AN INVESTIGATION OF THE TEACHING-LEARNING PROCESS BASED ON MULTIPLE INTELLIGENCE THEORY IN A HIGH SCHOOL BIOLOGY COURSE

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ARZU İRFAN PRESLEY

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Approval of the Graduate School of Natural and Applied Sciences

_____

Prof. Dr. Canan ÖZGEN
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

_____

Prof. Dr. Ömer GEBAN
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

_____

Prof. Dr. Petek AŞKAR
Supervisor

Examining Committee Members

Prof. Dr. Hüseyin Avni ÖKTEM (METU, BIO) _____

Prof. Dr. Petek AŞKAR(HACETTEPE UNV., CEIT) _____

Prof. Dr. Ömer GEBAN (METU, SSME) _____

Assoc. Prof. Dr. Ceren TEKKAYA (METU, ELE) _____

Assist. Prof. Dr. Jale ÇAKIROĞLU (METU, ELE) _____

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Name, Last name : Arzu İrfan, Presley

Signature :

ABSTRACT

AN INVESTIGATION OF THE TEACHING-LEARNING PROCESS
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Presley, Arzu İrfan

Ph.D., Department of Secondary Science and Mathematics Education
Supervisor : Prof. Dr. Petek Aşkar

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This study sought to investigate the effects of multiple intelligences based instruction (MIBI) and learning styles on ninth graders' attitudes toward biology, biology achievement, and overall multiple intelligences.

This experimental research was conducted in the second term of 2002-2003 educational year in Ereğli high school. The sample involved in the study consisted of 64 students from the two different ninth grade classes taught by the same teacher. One class was assigned as the experimental group in which students were exposed to MIBI, whereas the other class was assigned as the control group in which students were exposed to traditional instruction in the unit of diversity and classification of living organisms.

The data were obtained from attitudes toward biology scale, unit achievement test, multiple intelligences and Kolb's learning style inventories, interviews with the students and the teacher, and observations in the experimental classroom during the treatment.

Multivariate Analysis of Covariance was used for the quantitative data obtained from measuring tools. Results indicated that there was a significant effect

of MIBI on students' attitudes toward biology and biology achievement, but there was not any significant effect of MIBI on students' overall multiple intelligences. In addition, there was not any significant effect of the students' learning styles on their attitudes toward biology, biology achievement, or overall multiple intelligences. Moreover, interpretations of the interviews with the students and the teacher, and the observations of the experimental classroom indicated that MIBI had positive contributions on teaching and learning process.

Keywords: Multiple Intelligences Theory, Kolb's Learning Styles, Science Education, Biology Education, Diversity and Classification of Living Organisms

ÖZ

LİSE BİYOLOJİ DERSİNDE ÇOKLU ZEKA TEORİSİNE DAYALI ÖĞRETME - ÖĞRENME SÜRECİNİN İNCELENMESİ

Presley, Arzu İrfan

Doktora, Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümü

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Bu çalışma çoklu zeka temelli öğretimin ve öğrenme stillerinin dokuzuncu sınıf öğrencilerinin biyolojiye karşı tutumları, biyoloji dersindeki başarıları, ve çoklu zekalarının bütününe etkisini incelemek amacıyla gerçekleştirilmiştir.

Bu deneysel çalışma 2002-2003 eğitim-öğretim yılının 2. döneminde Ereğli Lisesinde uygulanmıştır. Çalışmanın örneklemini aynı öğretmenin girdiği iki ayrı dokuzuncu sınıfın 64 öğrencisi oluşturmuştur. "Canlıların çeşitliliği ve sınıflandırılması" ünitesini bu iki sınıftan deney gurubunda yer alan öğrenciler, çoklu zeka temelli öğretimle işlerken, kontrol gurubunda yer alan öğrenciler geleneksel öğretime göre işlemişlerdir.

Veriler biyolojiye karşı tutum ölçeği, ünite başarı testi, çoklu zeka ve öğrenme stilleri envanteri, öğrenciler ve öğretmenle gerçekleştirilen görüşmeler, ve deney gurubunun derslerinin gözlem sonuçlarından elde edilmiştir.

Ölçme araçlarından elde edilen veriler MANCOVA ile analiz edilmiştir. İstatistiksel sonuçlar, öğrencilerin ön başarıları ve ön zekaları kontrol altında tutulduğunda, çoklu zekaya dayalı işlenişin öğrencilerin biyoloji dersine yönelik tutumları ve biyoloji dersindeki başarıları üzerinde anlamlı olumlu bir etkisi olduğunu ancak öğrencilerin çoklu zekalarının bütününü etkilemediğini

göstermektedir. Ek olarak, öğrencilerin öğrenme stillerinin öğrencilerin biyoloji dersine yönelik tutum, biyoloji dersindeki başarı, ve çoklu zekalarının bütünü üzerinde hiçbir anlamlı etkiye sahip olmadığı tespit edilmiştir. Öğrenciler ve öğretmenle yapılan görüşmeler ve ders içi gözlemler çoklu zeka temelli eğitimin öğretme-öğrenme sürecine olumlu katkıları olduğunu göstermektedir.

Anahtar Kelimeler: Çoklu Zeka Teorisi, Kolb' un Öğrenme Stilleri, Fen Eğitimi, Biyoloji Eğitimi, Canlıların Çeşitliliği ve Sınıflandırılması

To my Parents

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And

To my husband

Kenneth Lee Presley

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LIST OF SYMBOLS

MI:	Multiple Intelligences
MIBI:	Multiple Intelligences Based Instruction
TI :	Traditional Instruction
LS:	Learning Styles
PLS:	Preferred Learning Style
ATBS:	Attitude Towards Biology Scale
AT:	"Diversity and Classication of Living Organisms" Unit Achievement Test
LSI:	Learning Style Inventory
MII:	Multiple Intelligences Inventory
PRE-ATT:	Prior Attitude score
PRE-ATBS:	Attitude Toward Biology Scale utilized as a pre-test
PRE-ACH:	Prior Achievement Score
PRE-AT:	"Diversity and Classication of Living Organisms" Unit Test utilized as a pre-test
PRE-MIS:	Prior Overall Multiple Intelligences Score
PRE-MII:	Multiple Intelligences Inventory utilized as a pretest
POST-ATT:	Attitude Score after the treatment
POST-ATBS:	Attitude Toward Biology Scale utilized as a post-test
POST-ACH:	Achievement Score after the treatment
POST-AT:	"Diversity and Classication of Living Organisms" Unit Test utilized as a pro-test
POST-MIS:	Overall MI Score after the treatment
POST-MII:	Multiple Intelligences Inventory utilized as a post-test
CG:	Control group
MIBG:	Multiple Intelligences Based Group
MANCOVA:	Multivariate Analysis of Covariance

ANCOVA:	Analysis of Covariance
CE:	Concrete Experience
RO:	Reflective Observation
AC:	Abstract Conceptualization
AE:	Active Experimentation
ACLS:	Accomodator Learning Style
ASLS:	Assimilator Learning Style
DLS:	Diverger Learning Style
ASLS:	Assimilator Learning Style
CLS:	Converger Learning Style
B/KI:	Bodily/Kinesthetic Intelligence
S/II:	Social/Interpersonal Intelligence
II:	Intrapersonal ıntelligence
L/MI:	Logical/Mathematical Intelligence
M/RI:	Musical/Rhytmic Intelligence
V/LI:	Verbal/Linguistic Intelligence
NI:	Naturalist Intelligence
IV :	Internal Validity

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CHAPTER 1

INTRODUCTION

As science helps people to understand the world, technology helps people to shape the world. Because of the high technological changes during the last few decades, there has been great attention directed to science education. In order to compete in the modern world in which life has been enhanced by the products of science and technology, science education needs to be one of the highest priorities of any society (Bybee, 2002; Howe & Jones, 1998; Phoenix, 2000).

Several programs that support the development of science education in secondary and higher institutions of learning have been launched. While these increased programs signal more interest in increasing the levels of science and technology development, the results have rarely met expectations. It is a sad but true fact that patterns of achievement measured by examination results are unsatisfactory in most countries, and scientific literacy is low in the general population (Baker & Piburn, 1997; Caillods, Göttelmann & Lewin, 1996; Gabel, 1994; Phoenix, 2000). Results from the Third International Mathematics and Science Study (TIMSS) also indicate the lack of achievement by Turkish students in scientific courses (Martin et. al., 2000).

In the past the advocates of education reform usually focused on the teacher's education as the starting point for correction and change in science education (Anderson & Mitchener, 1994). Keeping abreast with science research still remains a challenge for all science teachers (Van, 2000). Teachers have a key role for successful learning in the classrooms. They are the ones with the most contact with students. They are the ones who make the most important decisions about materials and methods. They are the ones who are almost always asked to upgrade their qualifications through continuing college and in-service education. The question of how to be an effective teacher has been a main topic of discussion

for educational researchers (Marsland, 2000). As stated by Horowitz (1996), "Becoming an effective science teacher does not happen overnight, it is a process that should last throughout a professional career." There are so many ways to teach that it would be wrong to suggest any one single rigid approach. Today it is known that the critical question is not only "How does the teacher teach?", but also "How do the students learn?" Because teaching and learning occur in a culture where the actions of the teacher and students are inextricably linked, researchers have attempted to discover relationships between what teachers do and how students learn (Howe & Jones, 1998; Tobin, Tippins & Gailard, 1994).

If teachers view science as simply a collection of facts and theories to be communicated to and mastered by students, then students will develop a very limited perspective about the meaning of science (Harlen, 1992). For many years, it has been recognized that science teachers should enable students to think like scientists and understand the nature of science instead of just teaching about the things that scientists know and have found out (Roberts, 2001). Although teachers want their students to like science and realize its usefulness, it is widely recognized that many students do not like science. According to them, science is boring and more nonsense than useful (Penick, 1995). Many ask "What does this have to do with my life?" Any course or curriculum that makes students have such kind of feelings and questions is a failure (Baker & Piburn, 1997). A teacher lecturing in front of the class while the students are listening is only stimulating to a few students. These types of lecture-delivered science courses turn most of the students into passive receivers of information (Penick, 1995; Townsend, Boca & Owens, 2003). Moreover, although research in science education has demonstrated that textbook-based instruction dominates most science classrooms (Finley, 1991, as cited in Dillon, O' Brien & Moje, 1994), it has been found out that this type of instruction is inadequate for meeting the goals of science education. Although students are aware of what they need to succeed in school, they are not often aware of what they need to succeed in life. New concepts go in their brain and then go the other way. Teaching science should not be the transmission of knowledge from teacher to student. As cited in Bybee (2002), one of the findings from "The National Research Council report How People Learn: Brain, Mind, Experience and School",

students come to the classroom with preconceptions about how the world works. If their preconceptions or experiences are not engaged, they may not grasp the new concepts that are taught or they may learn them merely for the purpose of a test score. After class, many may revert to their preconceptions when back in the real world (Veenema & Gardner, 1996). The reason for this problem is most teachers believe that all children learn in similar ways and are exposed to similar everyday experiences and phenomea (Freyberg & Osborne, 1985). As mentioned in Turkish National Science Curriculum (TNSC, 2001), teachers should focus on the preconceptions, experiences, and background of the students for the construction of new information.

Biology is the branch of Science which is interested in living organisms and their environment. The main aims of biology education in the Turkish National Biology Curriculum (TNBC, 1998) can be summarized as follows: The students should (1) develop a contemporary outlook on biology subjects, (2) develop an understanding of human beings as living organisms and their place in nature, (3) realize underlying similarities and differences among living things, (4) respect and realize the importance of all living things, (5) have an attitude of inquiry and curiosity, and (6) plan scientific investigations, the formulation of questions, and the design of experiments.

Research about biology education in Turkey reveals that teachers are inadequate to perform the aims of biology (Yaman & Soran, 2000). Since the students think that the only way to learn biological concepts is to memorize, they are lacking in terms of success. Even though much research has been done to improve biology education, most traditional biology courses are boring and colorless based primarily on the teacher's lecturing (Tranter, 2004). Too many biology teachers are aware of the fact that their students lack enthusiasm and are bored by a subject that is so intrinsically interesting. Some teachers believe that no matter what they do, they will have students who are lazy or are not able to learn biology well. Some of these teachers believe they are doing what they are supposed to do because they also have a group of hardworking students who are interested and actively participating in the same classroom with the so called lazy students. What is the main difference between these two groups of students? Are the

hardworking students smarter or more intelligent whereas the others are dull? According to Howard Gardner's Multiple Intelligences (MI) theory, there is more than one or two ways to be smart, and each individual is smart in many ways. The MI theory spans the range from verbal/linguistic and logical/mathematical intelligences, the usual foci of the educational system, to musical, kinesthetic, visual, naturalist, intrapersonal and interpersonal (at least eight) intelligences (Veenema & Gardner, 1996). Traditionally, Turkish education has also been directed to verbal/linguistic and logical/mathematical intelligences. Those who succeed in traditional classes, the favorite of the teachers, are mostly endowed with the linguistic and logical intelligences. Although Turkish biology teachers think because they use the observations, laboratory studies during their lessons, there is no reason for their students to have difficulties in learning, the students think they hardly learn biology (Yaman & Soran, 2000). According to the MI theory, individuals differ from one another in the forms of their relative strengths. These intelligences constitute the ways in which individuals take in information, retain and manipulate that information, and demonstrate their understandings. These separate intelligences develop at different times and in different ways in different individuals. The ways in which intelligences combine and blend are as varied as the faces and personalities of individuals. All of the intelligences work in concert, not in isolation. Since each individual is different from other, there is little sense to treat every one in a one-size-fits-all manner intelligences (Veenema & Gardner, 1996). One of the main reasons some of the students fail to succeed is teachers make students learn in ways that are quite different from the ways they learn in the real world (Gallager, Stepien, Sher & Workman, 1995). Teachers should realize that each child concentrates, processes, absorbs, and remembers new and difficult information in various ways. If they learn in various ways and if there are many ways to be smart, then there must be many ways to teach. Therefore, teaching in more ways will result in reaching more students. The main points that teachers and students should get from the MI theory are that all people are different and learn differently, and that we should respect, value, and nurture that diversity (Edwards, 1996). The TNSC was changed in 2001, and now focuses on diversity in the classroom. It is noted that: teachers are supposed to (1) know that the learning styles

and the learning speed of students may differ, (2) prepare different types of learning materials and activities, (3) be sure the teaching-learning strategy is suitable for all of the students in the classroom, (4) motivate the students for engaging in different types of activities (TNSC, 2001). Moreover, new Turkish National Primary and Secondary school curriculum including different types of activities, learning materials based on active learning and the needs of children are being prepared by the educators, consultants and the teachers enrolled in the project of Presidency of Teaching and Instruction Committee.

As teachers, it is important to provide students with varied learning experiences that will improve their current areas of strengths while challenging them to improve their abilities in weaker areas. Through a working knowledge of our students' learning styles and "intelligences", it will be easier to tailor lessons and activities expanding our students' strengths. This way, the number of students having fun, enjoying, and achieving in any kind of course will increase. As a biology educator, the purpose of this dissertation is to provide effective implications of multiple intelligences based instruction (MIBI) for high school biology courses.

1.1 Significance of the study

Many of the current seminars and symposiums held in Turkey about secondary school science and mathematics education indicate the replacement of teacher-centered education with student-centered education. Student-centered education needs appropriate teaching instructions instead of traditional instruction. MIBI is one of the student-centered instructions used at different educational levels in Turkey and abroad. This theory, and especially the activities from it, will meet the current needs of the students, and put the current theory into practice at the high school level.

Another significance of this study is the unit "Diversity and classification of living organisms", MIBI was applied. The fact that we are living beings whose livelihood depends upon an understanding of our external relations to other living beings and of the internal processes of living organisms causes biology to take on an important role in our daily lives. Every living organism is the center of a correlation for a multitude of biological relationships (Harvey, 1907, as cited in

Oliver & Nichols, 1998). It is known that maintaining diversity is one of the major pathways to sustainability. Although much of this biodiversity education has been through the science courses in schools at various stages, the term biodiversity is still an ill-defined concept (Gayford, 2000; Walls, Weelie & Geesteranus, 1997). Most students memorize the information, but they are unable to relate what they learn to their environment. Understanding this unit, students will be aware of the diversity and classification of the living organisms in the world, be more sensitive to the differences and similarities of those and have a different perspective about the role of them in our daily lives. Moreover, this unit will be a bridge for students when they are studying the next unit "Ecology", and it will make it easier for them to comprehend the relationships among living organisms. On the other hand, this unit is related to the “mitosis” and “meiosis” studied at the previous unit, Cell because “meiosis” is not only important for the perpetuation of a species; but also necessary for the formation of new species.

The most important aspect of this study is to provide evidence of the need for application of the MI theory in order to increase the quality of high school biology education. This study is also important in terms of the MI theory offering educators the chance to realize each student's potential within his/her own conditions, abilities, interests and development without making comparisons between the student's peers and allowing the students to learn in different ways.

1.2 Objectives of the Study

The objectives of this study are:

- to develop lesson plans including multiple intelligences activities in the unit of “Diversity and classification of living organisms” for the ninth grade biology course,
- to implement Multiple Intelligences theory,
- to investigate the effectiveness of Multiple Intelligences theory on ninth grade students’ attitudes toward biology, biology achievement, and overall multiple intelligences,

- to investigate the effectiveness of learning styles on ninth grade students' attitudes toward biology, biology achievement, and overall multiple intelligences,
- to investigate the relationship between the multiple intelligences and the learning styles,
- to investigate the effectiveness of Multiple Intelligences theory on ninth grade students' learning experiences,
- to investigate the effectiveness of Multiple Intelligences theory on biology teacher's teaching experiences.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter includes the history of views on intelligence, Gardner's theory of multiple intelligences, Gardner's multiple intelligences, the key points of Gardner's theory, and reflections on multiple intelligences and educational applications of Multiple Intelligences theory.

2.1 The History of Views on Intelligence

There have been many studies conducted to better understand the nature of intelligence. What is the exact definition of intelligence? Is it measurable? How can it be measured? Is it a sign of achievement in schools? Is it fixed? Is it affected by the environment or is it innate? Is it unitary or multifaceted? These are only a few of the many questions that have interested researchers.

In the late 1700s phrenology of Franz Joseph Gall (as cited in Gardner, 1983) had a great popularity in Europe and United States. The key idea of phrenology was that human skulls are different from another, and these differences affect the size and the shape of the brain. It was postulated that by examining the skull configurations of a person, an expert could determine the degree of intelligence of that person. Pierre Paul Broca, in the 1860s, added to Gall's information that there was a relationship between cognitive impairment and damage to specific portions of the brain. His work led the way to further study relating specific portions of the brain to specific cognitive functions.

Francis Galton (cousin of Charles Darwin), cited in Gardner and Hatch (1990), was perhaps the first psychologically oriented scientist who tried to measure the intellect directly. He postulated that intelligence was quantifiable and normally distributed. He developed statistical methods that made it possible to rank human beings in terms of their physical and intellectual powers and to correlate such

measures with one another. He tested head size and reaction time but found no correlations.

Then after in the early 1900s Alfred Binet, cited in Gardner (1993) was asked by Parisian educational leaders to assist in determining which students would succeed and which would not in elementary school. Binet and his team carried out the work that led to the first intelligence tests and the construct of intelligence quotient, or "IQ" (Gardner, 1993). Hence, the IQ concept of intelligence as being a single factor "g" became dominant. Used first clinically for "at risk" Parisian elementary school children, the intelligence test became "normed" on Californian middle-class children and was administered quite widely. This occurred largely in part to the efforts of Lewis Terman (cited in Gardner, 1998), who defined intelligence as the ability to carry on abstract thinking at Stanford University. The Stanford-Binet Scale, developed by Terman, became widely used in schools for grouping students by ability level and moreover predicting their future educational success. The original purpose of Binet-Simon Intelligence Scale was not to rank the students, but to provide a valuable curriculum planning tool (Marsland, 2000). As it turned out, this instrument could yield intellectual strength results in an hour and place a precise numerical value on that strength. By the 1920s and 1930s, intelligence tests had widely spread not only in America society but also in many other parts of the world. Though Binet never intended to reify intelligence, and though he did not maintain intelligence was a unitary trait the fact that his test results could be summarized by a single score fostered visions of intelligence as a unitary attribute situated in the heads of individuals. Just as individuals differed in height and weight, or in introversion or integrity, so, too, they differed from one another in how smart they were. Most likely these differences existed from early in life and they probably could not be altered very much. Because it was believed that intellectual strengths were largely inherited, there were few efforts to alter psychometric intelligence or to embrace Binet's original mission of using data about measured intelligence as a means of aiding students (Gardner, 1993).

By the 1990s, educators used many other tests such as Scholastic Aptitude Test. Although these tests are not called intelligence tests, they closely resemble standardized intelligent tests and correlate with them.

Charles Spearman (1927) analyzed the relations among experimental intelligence tests using factor analysis. As he observed correlations among performance on a variety of intellectual tasks, he found out that a person who does well on an intelligence test, also performs well on a variety of intellectual tasks (vocabulary, mathematical and spatial/visual skills). Thus, he proposed that intelligence consists of “two factors”, a general ability or “g” factor and a cluster of specific factors “s”. According to the two-factor theory of intelligence, the most important information about a person's intellectual ability is an estimate of their "g". Although this theory views intelligence as having more than one dimension, the position is taken that general ability underlies intelligent behavior. Therefore Spearman is known as the representer of the general-factor theory of intelligence (Spearman, 1927).

David Wechsler realized that an adequate definition of intelligence must be broader and have validity. Wechsler considered Spearman's two factor theory of “g” and many “s” s to be simplistic. He understood intelligence to be more of an effect, rather than a cause. Wechsler's definition of intelligence as "the global capacity to act purposefully, to think rationally, and to deal effectively with his environment" included the idea that intelligence is not a single capacity but a multifaceted aggregate. Wechsler also felt that the Binet scales were too verbally loaded for use with adults, so he designed an instrument with sub-tests to measure both verbal and nonverbal abilities. The Wechsler tests are based on ten or eleven verbal and performance subtests (Fancher, 1985).

While intelligence was initially perceived as a unitary concept, a debate started about whether the concept could legimitaly be broken into components. Such researchers, as Louis Leon Thurstone and J.P. Guilford, argued that intelligence was a composition of various independent factors (Gardner, 1998). Thurstone, cited in Morgan (1996), suggested that the human organism was far too complex for intellectual activity to be determined solely by a single human factor. He found several primary mental abilities. These abilities were those the individual uses in order to survive and succeed in society. He found this using factor analysis, like Spearman, but Thurstone took factor analysis a step further and rotated the factors. These factors included (1) *spatial*, spatial visualizations as well as ability to

mentally transform spatial figures, (2) *perceptual speed*, quickness in perceiving visual details, anomalies, similarities, etc., (3) *numerical*, the ability to quickly and accurately carry out mathematical operations, (4) *logical*, skill in a variety of inductive, deductive, and arithmetic reasoning tasks, (5) *verbal comprehension*, vocabulary, reading, comprehension, verbal analogies, etc, (6) *associative memory,* rote memory; (7) *word fluency*, the ability to quickly generate and manipulate a large number of words with specific characteristics, as in anagrams or rhyming tests. These factors made Thurstone's approach the first multi-factor approach to intelligence. Moreover, according to Guilford, intelligence was too complicated to be subsumed by a few primary mental abilities and "g" factor. He created the "Structure of Intellect", a model that identified more than 180 elementary abilities. His research findings suggested that each individual could be described by a profile rather than measuring a single score (Paik, 1998).

Howard Gardner also has constituted the view that intelligence is a pluralistic phenomenon, rather than a static structure with a single type of intelligence. In his theory of "Multiple Intelligences", human cognitive competence is believed to be better described in terms of a set of talents, abilities or mental skills, which is called as "intelligences". He developed a pluralized way of intellect. In his own words, intelligence is the "ability to solve problems or fashion products that are of consequence in a particular cultural setting or community" (Gardner, 1993, p.15). One of the reasons he has developed a theory with multiple intelligences is he felt that the current psychometric tests only examined the linguistic, logical, and some aspects of spatial intelligence, whereas the other dimensions such as athleticism, musical talent, and social awareness were not included (Paik, 1998). His theory has a biological basis. His studies with brains of people with disabilities revealed that there was damage in specific areas, in comparison to those who did not have a disability. In his initial studies, Gardner found seven different areas of the brain, and so his theory consisted of seven different intelligences, each related to a specific portion of the human brain (Li in Paik, 1998). Then after, he introduced two new intelligences (naturalist intelligence and existential intelligence). He concluded that intelligence was not fixed or static at birth. It can be learned, taught, enhanced, and it is multidimensional.

Fluid and crystallized intelligence are factors of intelligence test scores described by Raymond Cattell in his 1987 book, *Intelligence: Its Structure, Growth, and Action*. According to him, fluid intelligence is a simple, innate, general ability, which stays fairly constant throughout life. This intelligence is highly similar to Spearman's original concept of "g". Crystallized intelligence, on the other hand, is more dynamic and usually described as being dependent on learning, while fluid intelligence is independent of past experiences (Cattell, 1987).

Current research also indicates that intelligence is not a static structure but an open dynamic system that can continue to develop throughout life. Here are some of the current researchers who believe the modification of intelligence:

Through his work and studies, Reuven Feuerstein, an Israeli psychologist and educator, has developed a theory of the "Modifiability of Intelligence". The educational approach of this theory focuses on the quality of interaction between the teacher and the learner, which is called as "Mediated Learning Experiences" by him. He has successfully demonstrated that intelligence can be modified, expanded, and developed through systematic and planned enrichment (Feuerstein, 1998, as cited in Hine, 1998).

Marian Diamond, a neurophysiologist at the University of California has discovered that the human brain can change and improve with use. Diamond's theory, the "Plasticity of the Brain", implies that environmental conditions, interpersonal stimulation, and the way in which individuals think and behave actually change the body, brain and intelligence (Diamond, 1998, as cited in Hine, 1998).

Another indication of the current research about intelligence is that intelligence is pluralistic, and is broken into components. Robert Sternberg believes successful intelligence is far more important than academic intelligence measured by traditional IQ tests. These IQ tests assess the analytical and verbal skills, and not the creativity and practical knowledge that are critical for being successful in real life. Because of this belief, he developed tests to measure the creative and practical sides of the mind. In his view intelligence is the translation of underlying skills and abilities into routines that lead to highly competent everyday performance on the job, in personal relationships, and in other aspects of a person's daily lives

(Sternberg, 1996). At this point both Gardner and Sternberg agree on rejecting the focus of a single scholastic intelligence that is measured by a certain kind of short-answer test.

In Sternberg's "triarchic theory" intelligence is described as: (1) *the internal world of the individual*. Information-processing components of metacognitive, performance, and knowledge-acquisition components; (2) *the external world of the individual*. The individual's ability to adopt to and shape his or her environments, or select new ones; and (3) *the experience of the individual in the world*. The individual's ability to formulate new ideas, cope with novelty and unfamiliar tasks, and atomize information processing) (Gardner, 1993).

Another researcher who argues that the view of human IQ-idolizing is far too narrow ignoring a crucial range of abilities that matter immensely in terms of how well we do in life is Daniel Goleman. In his book *Emotional Intelligence* (1995) which based on the MI theory, he points out emotional intelligence as being the strongest indicator of human success. He shows the factors at work when people of high IQ's have difficulties and those of modest IQ's do quite well. These factors point to emotional intelligence as a different way of being smart. This intelligence includes self-awareness and impulse control, persistence, strong eagerness and self-motivation, empathy, and the ability to love and be loved by friends, partners, and family members. According to him, emotions play a much greater role in thought, decision making, and individual success than is commonly acknowledged. People who possess high emotional intelligence are the people who truly succeed in work as well as play. These people build flourishing careers and lasting, meaningful relationships.

2.2 Gardner's Theory of Multiple Intelligences

Harward psychologist Howard Gardner developed the theory of multiple intelligences and publicized it in his 1983 book, *Frames of Mind: The Theory of Multiple Intelligences*. Gardner believes "….understanding and knowledge is not something between two ears. It is something an individual performs which demonstrates the knowledge". What he is interested in is the intelligence that accomplishes a goal (cited in Schmidt, 1994). Gardner defines human intelligences

as abilities to solve problems, find or create new problems, and when appropriate, create products valued in a particular cultural setting (Chapman & Freeman, 1996; Checkley, 1997). This definition of intelligence makes it obvious that, according to the MI theory, the concept of intelligence has much more meaning than just being a score on an IQ test, and that there may be many ways to be smart (Kagan & Kagan, 1998). He claims that each individual has multiple intelligences which are all equally valuable. His evidence identifies the intelligences based on different areas he examined, including: studies of prodigies, gifted individuals, brain damaged patients, idiot savants, normal children, normal adults, experts in different fields, individuals from diverse cultures, and studies of the evolution of cognition (Gardner, 1983; Kezar, 2001). The MI theory attempts to discover a limited number of intelligences which alone or together are important in a human being's life. There are many candidates for "intelligences" that met Gardner's definition. Gardner uses eight criteria to select those intelligences. They are:

Potential isolation by brain damage. For example, injury to the Broca's area of the brain will result in the loss of patient's ability to verbally communicate using proper syntax. Nevertheless, this injury will not remove the person's understanding of correct grammar and word usage.

The existence of idiot savants, prodigies, and other exceptional individuals. For example, autistic children or youngsters with learning disabilities provide a confirmation by negation of a certain intelligence.

An identifiable core operation or set of operations. Musical intelligence, for instance, consists of a person's sensitivity to melody, harmony, rhythm, timbre and musical structure.

A distinctive developmental history, along with a definable set of expert "end-state" performances. Gardner believes that it will be necessary to identify developmental history of the intelligence and analysis of its susceptibility to modification and training. For example, expert athletes, poets, naturalists, and salespersons demonstrate performance characteristics.

An evolutionary history and evolutionary plausibility. Gardner states that the roots of current intelligences go back millions of years in the history of not only

Homo sapiens but also other species. Bird songs or primate social organizations are examples of other species using the roots of intelligence.

Support from experimental psychological tasks. Tests can indicate which intelligences are related to one another and which are discrete.

Support from psychometric findings. Batteries of tests can reveal which intelligences reflect the same underlying factors and which do not.

Susceptibility to encoding in a symbol system. Codes such as language, maps, numbers, and facial expressions capture components of the various intelligences.

As mentioned by Gardner, candidate intelligence can be considered as a genuine intelligence if it meets a few of the criteria given above (Gardner, 1983; 1999; Hoerr, 1997; 2000; Kagan & Kagan, 1998; O'Brien & Burnett, 2000).

2.3 Gardner's Multiple Intelligences

Initially, after testing numerous criteria, Gardner defined seven intelligences in the early 1980s. These seven intelligences that are of equal importance in human beings have been termed as verbal/linguistic intelligence, logical/mathematical intelligence, visual/spatial intelligence, musical intelligence, bodily/kinesthetic intelligence, social/interpersonal intelligence, and intrapersonal intelligence (Gardner, 1983). As Gardner first raised the specter of multiple intelligences, he said that if the notion of the pluralization of intelligences was accepted, there was no reason to think that intelligences would be limited to seven. If there were seven intelligences, he pointed out, certainly there could be more. Feeling that it was likely that more would be identified, he revisited the task of identifying intelligences and identified the eighth intelligence of naturalist intelligence which met the established criteria in 1995 (Hoerr, 1997).

These eight intelligences may be grouped in three major areas. Four of the eight, logical/mathematical, visual/spatial, bodily/kinesthetic, and naturalist may be placed in "object-related". Verbal/linguistic and musical may be placed in the "object-free" area. The remaining two of social/interpersonal and intrapersonal may be placed in "person-related" forms of intelligence. Object related capacities are controlled and shaped by the objects individuals encounter and interact in their

environments. On the other hand, the "object-free" intelligences are not shaped by the physical world, but are dependent upon language and musical systems (auditory systems). The third category, “person-related”, reflects a powerful set of counterbalances. The heart of social and interpersonal intelligences is the lives of the people (Campbell, Campbell & Dickonson, 1996; Chapman & Freeman, 1996; Lazear, 2000).

2.3.1 Object-related Intelligences

Logical/Mathematical Intelligence incorporates both scientific and mathematical abilities. It is the ability to think critically, determine relations such as cause-effect and if.....then relations, produce hypotheses, analyze objects and situations for their components, make connections between pieces of information, calculate, use abstract symbols such as numbers, geometric shapes, and discover using algorithms and logical sequences (Chapman & Freeman,1996; Kagan & Kagan, 1998; Saban, 2002; Yavuz, 2004). People such as mathematicians, engineers, accountants, computer programmers, researchers, astronomers, mystery writers, judges and scientists may demonstrate a high degree of logical/mathematical intelligence (Chapman & Freeman, 1996; Kagan & Kagan, 1998).

Visual/Spatial Intelligence is the capacity to think using pictures, images, shapes and color. Individuals high in this intelligence perceive the visual world accurately, and can recreate one’s visual experiences. Even a blind person may be perfectly spatially competent by creating mental maps of an environment or recognizing objects by touching. People such as chess masters, geometricians, painters, photographers, sculptors, decorators, explorers, sailors, engineers, surgeons, sculptors, painters, cartographers, and architects typically exhibit strengths in the visual/spatial intelligence.

Bodily/Kinesthetic Intelligence is the ability to express oneself with the bodily motions, facial and hand gestures, and control the mind and body coordination effectively. People such as actors/actresses, dancers, boxers, fitness enthusiasts, jugglers, magicians, surgeons, typists, swimmers, acrobats, athletes,

instrumentalists and artisans may have a great deal of bodily/kinesthetic intelligence.

Naturalist Intelligence is the ability to identify, take care of, and enjoy the land, sea, and the sky. It is also the ability to recognize and classify plants, animals, and other parts of the natural environment such as clouds, rocks and to use this ability productively such as in hunting, in farming, in biological science (Campbell, 1997; Durie, 1997; Hoerr, 1997; Wilson, 1998).

As Gardner believes in the past people needed to be able to recognize carnivorous animals, poisonous snakes, and flavorful mushrooms. But today, the ability, evolved to deal with natural kinds of elements, has been applied to deal with the world of man-made objects such as distinguishing among cars, sneakers, or sounds of different engines (Campbell, 1997; Durie, 1997). All types of scientists such as sailors, navigators, animal trainers, astronomers, biologists, botanists, doctors, ecologists, environmentalists, herbalists, naturalists, oceanographers, ornithologists, park rangers, landscape artists, zookeepers, and veterinarians may exhibit a high degree of naturalistic intelligence.

2.3.2 Object-free Intelligences

Verbal/Linguistic Intelligence is the ability to read, write, listen, and speak with sensitivity to the sounds, rhythms, and meanings of words. It is also the manipulation, formulation, and selection with sensitivity to the different functions of language, and its potential to excite, convince, stimulate, convey information, and simply to please. In short, it is the capacity to use language (Chapman & Freeman, 1996; Morgan, 1996). Sounds and rhythms in this domain are also found in "Musical Intelligence". People exhibiting this intelligence include poets, authors, attorneys, publishers, playwrights, orators, novelists, reporters, talk-show hosts, comedians, journalists, politicians, lecturers, sales people and teachers (Chapman & Freeman, 1996; Kagan & Kagan, 1998; Morgan, 1996).

Musical Intelligence is the ability to use the core set of musical elements of pitch, rhythm, and timbre. People such as singers, composers, instrumentalists, song writers, conductors, and those who enjoy, understand, and appreciate music and/or the elements of music may exhibit developed musical intelligence.

2.3.3 Person-related Intelligences

Social/Interpersonal Intelligence is the talent for understanding others, noticing and making distinctions among individuals and moods, temperaments, motivations and intentions. Examined in its simple form, this intelligence entails the capacity of the young child to detect and discriminate the various moods of adults around him or her. In an advanced form, it permits a skilled adult to understand the intentions of others even when those intentions have been hidden. Examples of those with higher-than-average interpersonal capabilities include politicians, religious leaders, teachers, nurses, social consultants, sociologists, and social reformers.

Intrapersonal Intelligence is the ability to understand one's own strengths, weaknesses, desires, intentions and feelings. It is also the ability to comprehend one's own range of emotions, label them, form an accurate model of oneself, and to use that model to operate effectively in life. At a basic level, intrapersonal intelligence is the capacity to distinguish feelings of pleasure from emotional pain, and on the basis of such discrimination to become more involved in or to withdraw from the situation. At the most advanced level, it is the capacity to detect and symbolize complex and high differentiated sets of feelings. Among this group are therapists, sages, psychologist/psychiatrists, some novelists, poets, political leaders, and philosophers.

2.4 The Key Points of Gardner's Theory

As seen above there are many ways to be intelligent within each category. These multiple intelligences can be nurtured and strengthened, or ignored and weakened. Moreover, the MI theory claims that each person possesses all eight intelligences in varying amounts for solving problems and creating products valued in a particular cultural setting. Although these intelligences are separated from each other and located in different areas of the brain, they can either work independently or concurrently. Thus, they typically complement each other as individuals develop skills or solve problems. A musician, for example, needs not only musical intelligence but also the bodily kinesthetic intelligence to manipulate the keys on a

saxophone or slip the bow across the strings of a violin (Raeburn, 1999). As Gardner states, the autonomy of these intelligences may be invisible because they typically work in harmony in ordinary life, so each person's intellectual composition is different from another (Armstrong, 1994a).

2.5 Reflections on Multiple Intelligences

Since the time Gardner has constructed a new view of intelligences in his book, *Frames of Mind*, so many "myths" have grown up about multiple intelligences. Some of the believed myths are given below:

One widely believed myth is that if there are seven or eight intelligences, one can (and perhaps should) create seven or eight tests to measure students' strengths in each of those areas. Gardner believes it is a perversion of the theory which is re-creating the sin of the single intelligence quotient and just multiplying it by a larger number. His concept of intelligences is an outgrowth of accumulating knowledge about the human brain and about human cultures, not the result of test scores. He is personally against assessment of intelligences unless such a measurement is used for a specific learning purpose-such as trying to find good entry points for a child in order to help her understand better (Checkley, 1997; Gardner, 1995).

Another myth is that intelligence is the same as a domain or a discipline. Gardner admits he was not as careful as he should have been in distinguishing intelligences from other concepts. Hence he reiterates his definition of intelligence as a new kind of construct, and distinguishes it from a domain which he describes as a culturally relevant organized set of activities characterized by a symbol system and a set of operations. Just as a domain may require more than one intelligence, intelligence also can be deployed in many domains. For example, the domain of musical performance involves bodily/kinesthetic and social/interpersonal as well as musical intelligences whereas a particular intelligence, like visual/spatial intelligence, can be put to work in a myriad of domains, ranging from sculpture to sailing to neuroanatomical investigations (Gardner, 1993; 1995).

One myth that Gardner personally finds irritating is that intelligences are the same thing as "learning styles," "cognitive styles," or "working styles." The concept

of style designates a general approach that an individual can apply equally to all conceivable contents. Such an example would be the claim that a particular learning style is used to approach everything that an individual does. If a person is organized, he or she is supposed to be organized about everything. Work in Project Spectrum casts doubt on the notion that such styles are generic. In contrast to the learning styles, multiple intelligences claim that a person responds individually in different ways to different kinds of content (Checkley, 1997; Gardner, 1993; 1995).

Another myth is the MI theory is not empirical, and a variant of this myth alleges that the MI theory is empirical but has been disapproved. Gardner staunchly defends the empiricism of the theory by referring to the numerous laboratory and field data that contributed to its development and the ongoing re-conceptualization of the theory based on new scientific data.

The MI theory is incompatible with g (general intelligence), with hereditarian accounts, or with environmental accounts of the nature and causes of intelligence. Gardner accepts the existence of g and its scientific place in intelligence theory, but he is more interested in its explanatory importance outside the relatively narrow environment of schooling. According to him, evidence for g is provided almost entirely by tests of linguistic and logical intelligence that are valuable skills in a school system. In addition, he criticizes the pencil-and-paper tests which require the memorization of digits and the memorization of letters and often return correlated results. Believing that these tasks require different intelligences, he offers to ask subjects to memorize a biology achievement test and a mathematical proof. His prediction is there will be low correlations. In short, the MI theory questions not the existence but the province and explanatory power of g. Over the last fifteen years, many studies have been conducted and empirical evidence continues to mount support for the theory. Certainly the theory may be falsified, but the evidence suggests that multiple intelligences exist within each individual (Gardner, 1993; Hoerr, 2000). By the same token; the MI theory is neutral on the question of heritability of specific intelligences. Instead this theory is most concerned with the interaction between genetics and the environment in understanding intelligence (Gardner, 1993).

The notion that the MI theory expands the definition of intelligence beyond utility and thus vitiates the usefulness, as well as the usual connotation of the terms (Sternberg, 1983) is another myth that produces a strong reaction from Gardner. He argues passionately that the narrow definition of intelligence being equal to scholastic performance is simply too constrictive. He agrees with the ones criticizing intelligences are not intelligences at all, but are really what people commonly refer to as gifts or talents, but wants verbal/linguistic and logical/mathematical ability also labeled as talents, rather than being elevated for no particular reason. According to him, calling some "talent" and some "intelligence" displays the bias of the cultures, so he suggests calling them all "talents" or all "intelligences". Just as societies change, so do evaluation of skills. Linguistic memory is prized because books are widely available. Perhaps, if computers handle everything related with linguistic and mathematical skills, societies may evolve into one where artistic skills are the most highly valued (Gardner, 1993; 1995). Gardner also believes that although Sternberg's effort to develop new measures of intelligence can help broaden the view about human capacities, those kinds are too close to the linguistic and logical items that have traditionally dominated intelligence testing (Gardner, 1999).

Another myth underscored by Gardner is the single approved educational approach based on the MI theory. Teaching all concepts of subjects using all of the intelligences is a waste of time and effort. Gardner says that teachers do not have to use each of the intelligences for teaching.

As cited in Raeburn (1999), acknowledging that there are some traditionalists, who see the MI theory as an excuse for lowering standards, Gardner says he has focused on genuine learning and has been insistent on high standards.

As Osborg (1995) mentioned, the MI theory labels students as winners and losers. Gardner's response is nowhere this kind of labeling or ranking is recommended (Gardner, 1995). He believes neglecting a child's full intellectual profile through focusing on only high or low intelligence is misapplication of the MI theory (Gardner, 1999).

2. 6 Educational Applications of Multiple Intelligences Theory

When Howard Gardner, proposed a new definition of intelligence in *Frames of Mind: The Theory of Multiple Intelligences* in 1983, he did not intend to address the application of the MI theory in educational settings. Although Gardner's expectation was psychologists would be interested with the MI theory, his theory especially took great attention of educators, teachers and school administrators. Campbell and Campbell (1999) stated the great need for this theory. "Because during preservice and in-service education, teachers rarely consider the nature of the human learning potential they are mandated to develop. This gap in our professional knowledge base is akin to doctors being trained without studying the human body." As soon as the MI theory took root in the educational settings, Gardner has found himself involved with the practical application of the theory in schools. In addition to writing many more books and articles on the MI theory, he has served as a consultant to a variety of school districts. This has resulted in many school staff applying the MI theory, while some educators have even built MI schools. Three of the reasons for teachers' acceptance of MI are:

(1) *The theory's contribution to the educators' knowledge base and beliefs about the human mind*. Gardner's intelligence definition initiates broader understanding of intellectual diversity and makes the teachers accept the thought that all students can learn. It enables people to look for the positive instead of the negative, and creates a positive school culture of respect and belief among the teachers and the students. (2) *MI's implications for professional practice*. First of all, MI offers guidance for the teachers for improving learning. Secondly, it suggests enriched educational opportunities for all students. (3) *The impact of MI programs on student academic achievement*. MI teachers help all students to experience success by intentionally seeking strengths in every student, and by personalizing everything in order to reach every student. MI also provides a new lens for teachers to perceive their students while students are expected to find ways to represent their knowledge. Students are more involved in their studies, and are not perceived as defective. This distinction ensures they do not have any excuses for not being successful. The students also perceive themselves as talented, since

MI makes them discover hidden talents about themselves (Campbell & Campbell, 1999).

The current MI movement includes many books, articles, seminars, symposiums, and web sites about the theory and practice of MI in different educational settings in all over the world.

The subparts of this section include some of the educational projects related to the MI theory, educational applications of MI in the world and in Turkey.

2.6.1 Projects Related to Multiple Intelligences Theory

There have been some major projects at different educational levels to which the MI theory have been applied. Four of the big projects explained in *Multiple Intelligences: The Theory in Practice* (Gardner, 1993) are discussed below.

Project Zero's *Project Spectrum* was a collaborative research project which offered an alternative approach to assessment and curriculum development for the preschool and early primary years. Gardner and his colleagues, David Feldman, Mara Kreshewsky and others created a rich environment, called spectrum class in 1984. They started the project with the assumption that each child had a distinctive profile with different abilities and spectrums of intelligence.

First the researchers identified a number of core capabilities in each of the seven intelligences; but rather than looking at intelligences in pure form, they looked at the domains of accomplishment of the culture through those forms taken up by children. The purpose of the project was to determine profiles of intelligences and working styles of young children. Since spectrum researchers realized that intelligences could not be measured in the abstract; the children were surrounded each day by rich and engaging materials that stimulated the use of a wide range of intelligences in their spectrum classroom. Over the course of a year or more spent in this environment, the children had ample opportunity to learn in various ways.

At the end of the year, the research team summarized the information gathered about each child in a brief essay called a Spectrum Report. This report described strengths and weaknesses of each child and offered specific recommendations about what to do at home, in school, or in the wider community to build on strengths as well as to bolster areas of weakness. Moreover, they

prepared a Parent Activities Manual with suggestions for activities in the different domains addressed by Spectrum with the idea that each child is unique.

The analyses given below were based on data collected during the 1986-87 and 1987-88 school years. There were two preschool classrooms, at the Eliot-Pearson Children's School at Tufts University in Medford, Massachusetts, enrolled in the project. The 1986-87 class was limited to thirteen four-year-olds, chiefly from a relatively homogenous, white, middle and upper income population. The mean age of these subjects were fifty-two months at the beginning of the school year. The 1987-88 class was compromised of twenty children, also from a white, middle and upper income population. The mean age of this class was fifty-three months at the beginning of the school year. Eight of the fifteen Spectrum activities were included in the 1986-87 analysis where as ten of them were included in 1987-88 analysis.

The research team's primary questions were:

(1) Do young children have domain-specific as well as more general strengths?

(2) Is there any correlation between performances in different activities?

(3) Does a child's strength in one domain facilitate or hinder performance in other domains? (Gardner, 1993; p. 94).

For the first question they considered that a child had strength in one standard deviation or more above the mean on the spectrum measures and had weakness in one standard deviation or more below the mean. As a result, they found that every child exhibited at least one strength and one weakness relative to him or herself.

For the second question, they created a matrix of correlations between pairs of ten activities used in the 1987-88 sample. The results showed that there was very little correlation between the activities, and reinforcing the opinion that the spectrum measures no overlapping capabilities in different content areas.

For the third question, the results indicated that a child's strength in one area might facilitate performance in another.

Another project explained by Gardner (1993) is *The Project Approach in the Key School Setting*. This project was first administered to a K-6 elementary school in downtown Indianapolis in 1987. Every student at the Key School participated

each day in a “pod”, where he or she worked with peers of different ages and a competent teacher to master a craft or discipline of interest. There were a dozen of pods, from architecture to gardening, from cooking to make money. An outside specialist, usually a parent, came to the school once a week to talk about the current theme. These themes included topics such as, swage disposal, forestry...etc. As part of the school requirements, students executed three new projects related to the theme; either quite broad or more focused each year. After students presented their projects to their friends, describing the purpose, problems and future implications of the project, they answered questions raised by classmates and by the teacher. All of the project presentations were videotaped and each student accumulated a video portfolio showing their development during the course. Believing in the importance of the projects (and student portfolios), they focused on five separate dimensions of the projects to be assessed. Those dimensions included:

Individual profile. This profile includes the student’s disposition toward work such as taking risks, preserving...etc., as well as the student’s intellectual tendencies of the seven intelligences.

Mastery of facts, skills and concepts. A student may select the facts, skills, and concepts they want to include in a project from their school work.

Quality of work. The aspects of quality are innovation, imagination, and aesthetic judgment and technique.

Communication. The student needs to communicate his findings skillfully to his peers and the teachers.

Reflection. Teachers and students can review work together, find the relation with the past work, conceive of it in terms of longer-term goals, working styles, and so on.

Naturally, the quality of the projects takes an important role, but the researchers were also interested in other main facets. One was the student’s own strengths, limitations, idiosyncrasies, and overall cognitive profile. The second was cooperation with classmates, teachers, and outside experts as well as the use of other kinds of resources, such as libraries or computer data bases. It was also stated that if students were to conceptualize, carry out, and present their projects effectively, they needed to be “scaffolded” in the various parts of this activity. As a

summary, Key School gave students opportunity to pursue their interest through activities, projects and group work exercising their intelligences in a natural way.

The Practical Intelligence For School (PIFS) was another project mentioned by Gardner (1993). In this project researchers tried to explore the question, "What is the best way to aid students in adjusting to and mastering a specific setting like school with the assumption that success depends on more than traditional academic intelligence?". And then in their view, students needed to learn how to understand, apply, and integrate both academic knowledge regarding the subject domains and practical knowledge about themselves. They also needed to learn and understand the academic tasks and the school system at large. In order to inspect the relationship of academic success to the environmental adaptation, selection and enrichment, with its theoretical roots in Gardner's theory of multiple intelligences and Sternberg's triarchic theory of intelligence, the project developed a set of lessons that helped students to build these skills in the context of the regular curriculum.

Hence initially PIFS required knowledge in three main areas: (1) one's own intellectual profile, learning styles and strategies, representing intrapersonal intelligence; (2) the structure and learning of academic tasks, representing the academic intelligences and combination of intelligences in particular domains; and (3) the school, reflecting interpersonal intelligence.

The PIFS curriculum targeted the sixth and seventh grades, a time when students made the difficult transition from elementary to middle school. Students were asked to carry out projects and activities, which made them more responsible for themselves. In order to determine what the students themselves understood about their roles as students, they conducted a series of in-depth interviews with 50 fifth and sixth from a variety of socioeconomic backgrounds in five schools in Boston area. The interview topics were study habits, the evaluation process, subject matter differences, and the demands of academic tasks, the roles of teachers and administrators, peer interactions, and the nature of the school system. After analyzing the responses, researchers focused on three main points that divided the students into three categories of "high", "middle", or "low". These three points

were: (1) elaboration of responses, (2) awareness of strategies and resources, and (3) sense of self as learner. Below is an explanation of the three main points.

The first point is elaboration of responses. Low-profile students had limited vocabulary when they were expressing their preferences, strengths and weaknesses, academic tasks and comparing the courses. High profile students were good at offering reasons about their answers.

The second point is strategies and resources. Low profile students in this point suggested helplessness, passivity, and magical thinking. High profile students understood their strengths and weaknesses, and varied their approaches to different subjects accordingly.

The last point is called "self as learner". High profile students seemed to have a strong sense of themselves as learners. While most "lows" seemed to have a limited identity as learners, they usually revealed at least one area they had interest and usually felt capable in. These potential "hooks" might be used to exploit student strength in one domain for the improvement of other domains.

An unexpected similarity between the high-profile students and low-profile students was the limited understanding capacity. Most students defined subjects in terms of content. Rather than being a separate course, it is meant to be incorporated into regular subject matter instruction. The infusion approach can be thought of as a "metacurriculum" consisting of a set of infusion units intended to help students understand tasks, how to accomplish best.

The PIFS curriculum was used and evaluated in urban schools in the Boston and Tewksbury area of Massachusetts and in rural schools in Connecticut. It encompassed some standard study skills, but differed from other programs in two important ways. First, instead of offering general solutions, it helped students develop their own approaches to work. Second, rather than being a separate course, it was meant to be incorporated into regular subject matter instruction.

Building on the PIFS results, researchers and teachers went on to develop the Creative Intelligence for School curriculum. This project took PIFS a step further: Instead of helping students adapt themselves to school, the new effort helped students figure out how to adapt school to their own interests and talents in the ways they approach projects and other assignments.

The last project mentioned by Gardner (1993) was the *Arts PROPEL*, a five-year, collaborative effort involving Harvard Project Zero, the Educational Testing Service (ETS), and the teachers and administrators of the Pittsburgh Public Schools. The main goal of this project was student-directed learning. Model programs combining instruction and assessment were developed for middle and high school students in three art forms: music, visual arts, and imaginative writing.

In an Arts PROPEL classroom, students approached the art form in three ways that gave the name of the project: (1) production-students were motivated to learn the basic skills and principles of the art form by integrating their ideas with music, words, or visual form; (2) perception-students studied works of art to understand the kinds of choices artists made and to see connections between their own and others' work; (3) reflection-students assessed their work according to their personal goals and standards of excellence in the field. Combining these three issues with the MI theory, the Arts PROPEL project was a new approach in arts curriculum and assessment principally at the high school level.

Two other projects associated with the MI theory are the *Adult Multiple Intelligences* and the *Schools Using Multiple Intelligences Theory* (SUMIT) Project.

Adult Multiple Intelligences Study was a five-year, January 1996-January 2001, collaboration between Project Zero and World Education, Inc. It investigated and supported the work of adult literacy educators in developing innovative instructional strategies, curriculums, and assessments based on the MI theory.

The MI theory, which emphasizes the positive ways that people acquire knowledge and interacts with the world, has been especially valuable to teachers working with adult students who had experienced repeated difficulties in learning. Since the MI theory was often applied to children and young adults, research was started in 1996 to help cast some light on adult learning strengths and abilities. Nine teachers and their approximately 120 students from Massachusetts, Maine, Rhode Island, Vermont, and Connecticut programs enrolled in the study. Two coordinators with expertise in MI also worked with the teachers. The study examined how the MI theory supported and enhanced learner centered instruction and assessment in adult basic education (ABE), English for speakers of other languages (ESOL), and adult secondary education programs (ASE). The goal of the project was not to

assess a learner's or practitioner's intelligence, but to help people learn about themselves and realize their own strengths.

The teachers and project coordinators used qualitative research methods with a particular emphasis on action research. Teachers were engaged as co-researchers who not only generated data but participated in its analysis. In addition, teachers in this particular study involved their students in the research by talking to them about the theory and introducing MI teaching activities.

One of the findings of the study revealed that the teachers using MI-inspired reflection strategies gained more knowledge about their students as individuals and in particular they learned what techniques would be best suited to teaching each individual student.

The teachers reported the classroom using MI was less teacher-centered and more learner-centered. The activities were especially meaningful to the students' lives, and therefore the students enjoyed and learned from them all the more. One of the teachers mentioned about the high engagement of her students in the activities, often working enthusiastically beyond their break time. Perhaps more importantly, it also helped students able to see their own strengths and the strengths of each other. The authors found that self learning was indeed a useful means of improving the students' self-efficacy. It increases their control over their own learning. Much like the skill of authenticity, such a technique tends to make students happy, boost their sense of their own intelligence abilities and learn *how to learn*. That achievement is something that will continue to benefit them throughout their lives (Kallenbach & Viens, 2002).

Project SUMIT was a three-year project, which began in January 1997. The purpose of the research was to identify, document, and promote effective implementations of MI. These are applications of the theory that teachers or principals associate with increases in student achievement test scores, quality of student work, attendance, behavior, and/or parent participation. With this information, it was planed to create and distribute resources and products that would support educators' efforts to apply MI in sound ways.

At the start point of the project, during the late winter and spring of 1997, SUMIT staff identified schools that had been using MI for three or more years and

that associated the use of the theory with improved outcomes for students. They conducted phone interviews with the principals and teachers at 41 schools and administers from three school districts. In these interviews, educators described how they integrated MI into their curriculum, assessment, professional development, and other organizational practices. They also described the outcomes of implementing MI in their schools. In addition many schools sent materials that highlighted their application of MI and outcomes related to it.

After the determination of the criteria, they visited some of the schools, interviewed teachers and students about MI, documented school activities using photographs, audiotapes and videotapes.

Across the schools that they studied, MI is regarded as the prominent influence in improved test scores, improved discipline, improved parent participation, and improved learning differences of the students. The frequency of the improvement of students with learning differences in the schools with MI was found to be 78%, whereas the improvement of students with learning differences in the schools with out MI was only found to be 2% (Gardner, 1999).

2.6.2 Applications of Multiple Intelligences Theory at Different Educational Levels in Different Parts of the World

Since the time Howard Gardner introduced the MI theory in 1983, there has been so much research for the implementation of that theory at different educational levels. Many teachers, mostly elementary school teachers have changed their teaching practices and have developed novel methods for its implementation. Although some of the middle school teachers also have begun to use MI in their teaching, acceptance of the theory by high school teachers and college lecturers is rare.

During the 1989-1990 school year, Campbell carried out an action research project to explore student reactions to the MI based instructional model in his third grade classroom of 27 students in Marysville, WA. After the preparation of lesson plans with respect to MI, he reconstructed his classroom to accommodate the centers in different areas with each area related to one of the intelligences. A portion of each school day, approximately 2 -1/2 hours, was devoted to spending

time in groups of three or four at each center learning regarding the day's theme in seven different ways. The students learned each subject artistically, mathematically, musically, linguistically, kinesthetically, interpersonally and independently (Campbell, 1989). Analyzing the collected data and observations, following results were revealed: (1) the students developed increased independence, responsibility and self-direction over the course of the year. They became skilled at developing their own projects, gathering the necessary resources and materials, and making well-planned presentations of all kinds. (2) Students previously identified as having behavioral problems made significant improvement in their behavior. By mid-year, they were making important contributions to their groups. And by year's end, several students who had not previously displayed leadership abilities took the lead with their groups. (3) Cooperative learning skills improved in all students. Students became highly skilled at listening, helping each other, and sharing leadership in different activities. They learned not only to respect each other but also to appreciate the unique abilities of their classmates. (4) Students became more skilled at working effectively. The ability to work multimodally in student presentations increased throughout the school year with students using a minimum of three to five intelligence areas in their classroom reports. (5) The more kinesthetic students particularly benefited from the active process of moving from center to center every fifteen to twenty minutes. (6) Parents reported frequently that behavior improved at home, more positive attitudes about school were exhibited, and attendance was increased. (7) Academic achievement of the students increased. Students who had previously been unsuccessful in school became high achievers in different areas. Daily work with music and movement in content areas helped students retain information. At the end of the year, all students were able to remember several songs created as early as September which contained specific academic information.

The results indicated increased multimodal skills, improved behavior, attitude, and achievement of the students. In addition to these, the role of the teacher changed as the year progressed, becoming less directive and more facilitative, more diversified, less of a taskmaster and more of a resource person and guide. The teacher started working with his students rather than working for them. He was

satisfied in their enthusiasm, began to see growth and development within himself. He became more creative and diverse in planning the class activities. He learned to write songs and sing, and his ability to draw and paint improved (Campbell, 1990).

As mentioned by La Farge (1994), Briacliff School, in Shoreham, New York, is one of the schools inspired by Gardner's concept of MI and finding new ways of teaching that will not leave any of the students behind, but will give them opportunities foster their potential. Marge Misiano teaches a combined kindergarten and first-grade class in this school. Once La Farge had visited her class, he observed her and art teacher, Ruth Kisch, co-teaching a project about how houses were built. The class was divided into two groups. One group was gathered around Misiano and discussed a collection of materials that had been brought in by a local builder. The materials that were brought in were two-by-fours, plasterboard, nails of different sizes, insulation, vinyl siding, and shingles. The discussion was centered on which materials would be inside of a house, outside of a house, and which materials would be seen when the house was completed and which would not. The other group was clustered in a corner of the room with Kisch. She showed them a photograph and a drawing of a house and asked them to identify the same features in both the photos and the drawing. The items that were to be identified were doors, windows, shutters, and a porch. She then explained what an architectural floor plan was, and showed them one of a house. A few minutes later, they turned to another floor plan, which she had drawn on a sheet of white paper and laid out on the carpet. She then asked the children to build a block building by following the floor plan-a challenging task. When it was complete, the children sat down to draw it making their version of the architectural drawing that they had studied at the beginning of the class. La Farge states that working within the strengths of a child, a teacher will realize that as the students experience success in easier areas, they will also attempt to try more complex activities.

Hoerr (1994) determined the implementation of the MI theory in New School in the City of St. Louis. After studying Howard Gardner's book, *Frames of Mind* for almost two years, the teachers working at this school implemented the theory under the direction of Tom Hoerr. The curriculum in New City School emphasizes that all skills and talents of the students have to be focused on in order

to prepare them for the future (Weber, 1992). Concentrating on the students' strengths rather than their weaknesses, teachers were able to reinforce the different strengths and talents of the students and nurture them. Drawing, designing, and creating model buildings with legos, drinking straws, or discarded machine parts were the strongest talents of the students. By creating learning centers and by engaging students in enjoyable or rich activities through out the curriculum, weaknesses were nurtured instead of being neglected. The students also developed self-esteem, creativity, critical thinking, and independence to succeed in a changing society.

Beckman (1996) studied the application of the MI when presenting each concept to her 2/3 classroom at the Miller Research Center on the campus of Edinboro University of Pennsylvania. She prepared lesson plans about the concepts in the curriculum concerning these several intelligences, and she constructed seven areas where materials were available to extend student learning through a variety of activities within a specific intelligence.

The *Verbal/Linguistic center* had word games, many books and dictionaries, a picture file, and an abundance of teacher made packets including manipulatives and activities in the area of spelling, comprehension, discrimination, and phonology.

The *Logical/Mathematical center* consisted of science experiments, math manipulatives, legos, gears, and teacher- made packets with activities related to math and science concepts.

The *Music center* had several records and a record player. It also had a tape player and a keyboard where children could play familiar songs, compose music on paper, or pick out a mystery tune which was also marked on the keyboard keys.

The *Bodily/Kinesthetic center* was right next to the music center where children could easily move to. It also had puppets and dress-up clothes for dramatic play.

The *Intrapersonal center* was a quiet corner with a set of non-working earphones and reading carrel, where students could work alone.

The *Social/Interpersonal center* consisted of games such as chess and mastermind, and again, teacher-made folder games and packets, which students could play together.

The *Spatial (art) center* had multicolored construction paper, paints, glue, markers, colored chalk, scissors, beads, yarn, clay, and weaving boards.

"Celebration of Learning" was the time when students showed what they had learned at the end of the unit. The students were free to choose how they would demonstrate their newfound knowledge. They could choose from such things as making a model, creating a mural, a dance, a song or rap, an experiment, a picture display, a video, a report, give a talk, or just about any other activity they chose. What they decided to do and how they accomplished the goal was recorded by the teacher.

Beckman reported that by using the MI theory, teachers can develop and adapt their way of presenting different topics to different children. The beauty of incorporating Howard Gardner's seven intelligences into this classroom was that it allowed all children to learn through their strengths, share their expertise and provide opportunities for meaningful learning.

Udvari (1996) designed a study that examined strategies used by classroom teachers to teach students with severe multiple disabilities (limited speeches, cognition, and physical abilities) in elementary classrooms. A student's inability was not considered an inherent problem of the individual. Instead, the presence of this student appeared to support the belief that all children can learn and the goal to facilitate that process is a worthy one.

Each week a teaching team consisting of two general educators, two special educators, a paraprofessional and a speech and language therapist designed 10 learning centers associated with an instructional theme for a first and second grade multi-age classroom of 40 students. Using the topic of rain forests, centers were engineered that expressly fostered the use of multiple intelligences. The basic structure of these activity centers facilitated the involvement of a wide range of learners, even those students that had severe multiple disabilities. Four of the ten centers are presented below:

A *survey center* was created which fostered verbal/linguistic, logical/mathematical, kinesthetic and interpersonal intelligences. Students used this center to record the responses of classmates when asked the question "what food from the rain forest do you like the most?" The surveyor provided actual samples of pineapple, avocado, coconut and nuts to the respondents before asking the question The child completing the survey recorded each response, graphed the results and analyzed the data to determine the most popular choice.

Rainforest music was played at the *dance center* which fostered musical, bodily/kinesthetic, interpersonal intelligences. The center was furnished with audio tapes representing the music of the indigenous people of the rain forests and a variety of traditional musical instruments (e.g. drums, rain sticks, etc.). Written information was also provided to explain the purpose behind the use of music and dance in native ceremonies. Students listened to the tapes alone or in small groups and then created their own compositions in music and dance. After the music was composed, the students recorded their own performances on audiotape and created a purpose for the exhibition (e.g. celebrating the end of the school year).

A *Trail mix recipe center* fostered bodily/kinesthetic, logical/mathematical intelligences. Students were provided with a written recipe with additional picture clues to make a tropical rain forest trail mix. Ingredients were dried banana chips, peanuts, chocolate chips and grated coconut. The recipe indicated the quantity of each food item needed. Students used counting or measuring skills to accurately follow the picture or written recipe. After preparing the trail mix, students created their own recipe cards to be used at home. This required students to make a hand written recipe and recall from memory the order and amount of each ingredient. Counting, measurement, following a sequence, and recalling the series of steps promoted the use of logical/mathematical intelligence. Kinesthetic avenues were emphasized by the manipulation of the ingredients and by the actual making and tasting of the finished product.

A *Rainforest wordbook* focused on visual/spatial, verbal/linguistic, intrapersonal and interpersonal intelligences: Students were provided with a variety of picture cards depicting endangered animals found in the rainforest. The name of the animal and a short description accompanied the picture. Written directions at

this center guided students to select three cards and construct a book by drawing the animal, writing the appropriate word, and generating a sentence. To promote intrapersonal reflection, students were challenged to describe ways endangered species could be protected.

Each of the seven forms of intelligence was represented in the four centers described. Children were encouraged to pre-select activity centers at the beginning of the unit, which typically resulted in students gravitating to activities that matched their strongest modalities. Throughout the week the instructors guided students into centers that would promote the use of less developed areas of intelligence. It was concluded that this kind of educational environment responded to the needs of a wide range of learners.

The MI theory, as well as dimensions of learning, became part of Trappe, Maryland elementary school's plan for change. The first part of the plan was to teach students about the theory of MI. Because Greenhawk worked with almost all the children, he took the lead allowing the children to assess and test their own intelligences through surveys and other activities. The classroom teachers then asked their students to think about which intelligences they were using during different activities. Students not only began referring to their own intelligences, but to those of their classmates. Most importantly, students were able to retain more knowledge. Once the teachers saw the results, they began to include different intelligences in each of their lessons. In general, students became more self-directed and seemed more confident in trying out new skills. Some discovered abilities they never knew they had. In one year, scores on the Maryland School Performance Assessment rose by 20 %. The teachers realized when students took a traditional pencil-and-paper test; they were using a variety of strategies to complete it. Even students whom they did not consider strong readers or writers were able to use the strategies that were taught to write good answers. In five years time, students began to see themselves as individuals with a variety of talents they could use in their learning. Moreover, parents who five years ago initially thought "Yes, this MI stuff is great, but when do you stop doing the fun stuff and begin teaching my child the basics?" realized that innovation does not necessarily mean moving away from the basics (Greenhawk, 1997).

A survey of Vialle (1997) also showed that the MI theory is used in educational settings in Australia, especially among preschool and primary schools. Cook Primary School in a sleepy suburb in Canberra, Australia's capital was closed because of its low enrollment figures. After implementation of MI in this school, student enrollment has soared. Moreover, now a great number of new students come from outside the area. Sacred Heart is another school using the MI theory in Cabramatta, the bustling, industrial western suburb of Sydney. Although the students of this school come from predominantly low socioeconomic and non-English-speaking backgrounds, they reach their full potential and impress other students with their high achievement. In order to investigate how Australian teachers implement the MI theory, Vialla observed classrooms in 30 schools and interviewed with 150 teachers across the country. The results revealed that teachers use two main basic approaches. In the first approach, teaching to intelligence, teachers are responsible for developing each child's intelligence. In the second approach, teaching through intelligences, teachers are responsible for developing students' skills in particular disciplines by providing learning activities through a number of intelligences. The best teachers seem to use a combination of these two approaches. The most significant outcome Vialle noticed at the schools she observed was; there was a shift from teacher centered education to learner centered education. The theory also gave students broader opportunity for the demonstration of their understandings and helped teachers shift assessment and evaluation from a narrowly based process to a broader one. Moreover, it let teachers to be aware of each student's interests, abilities, and learning styles and the ability to individualize the curriculum accordingly. As teachers agreed, MI made them far more effective practitioners and their students to be better learners.

Sweeney (1998) implemented the project in an urban, inner city elementary school. The sample participants consisted of 19 kindergarten students. The use of a MI framework allowed the researcher to set up a series of learning centers in the classroom. The research practitioner correlated observable classroom behaviors and the results of the inventory in the areas of linguistics (reading and language abilities), logical/mathematical (logical and mathematics skills), interpersonal (social skills) and intrapersonal (self knowledge skills). Inventory results showed

those students receiving low scores or non-dominance in the skills/intelligence areas were most likely to have difficulties with academics.

As part of UNICEF, Ellison and Rothenberger spent three weeks in Bangladesh where their task was to introduce the latest research on brain-based learning and multiple intelligences to teachers. Bangladesh is a densely populated country with one of the lowest per capita incomes in the world. Even with such great poverty, the Bangladesh government is still focused on improving education for all. The schools had essentially no budget for materials or even furniture, and children had to sit on the floor. The authors helped the teachers focus on the positive, and pointed out that sitting on the floor made it easy to regroup the children depending on the focus of the lessons. They encouraged the teachers to use the unpainted and bare walls as a place to display the children's art. They urged them to continually make connections before they taught, such as having the children draw a series of pictures about growing rice before reading the related story. They taught the teachers how to make paper dice for playing simple games using addition, subtractions, and multiplication. They also showed the teachers how to create picture-word concentration games that reinforced vocabulary and sequence games that illustrated the months of the year or the steps in growing rice. They involved the teachers in a number of self-reflective strategies designed to engage the students. One such strategy involved using their fingers to create a scale of 1 to 5, and ask the children to show their feelings and understandings on a given topic. Although clearly Bangladeshi classrooms were not as "rich" as classrooms in the United States, teachers, supported by their government, were willing to be creative in enriching learning environments for their children. Today in Bangladesh, more children are attending school, are actively engaged while they are in school, and are enjoying their learning experiences (Ellison & Rothenberger, 1999).

Campbell worked with the Tibetan Children's Village (TCV) staff and the students. TCV was first established in India, where majority of Tibetans have settled since the 1960's. Today over 2400 children are being educated there. The school itself lacks many of the resources taken for granted in western schools. Moreover, professional development of the teachers was limited by geography and financial means. As Campbell realized, each family chants together before

breakfast. Schools too begin with chanting. The heroes of TCV students were not musicians, movie stars, athletes or leaders, but saints and moral exemplars from the Buddhist religion. The education from early childhood through Grade 12 was quite traditional. Instruction was based on teachers lecturing, students taking notes, and the use of regular exams, but the curriculum was still primarily based on the Buddhist philosophy, lessons in writing focused on personal awareness and spiritual growth. Math and science were also affected by the Buddhist ideals, and seen as bodies of knowledge to understand the world. Even the artwork of students was the reflection of the imagery and beauty of the spiritual world they experienced. Campbell also stated the great willingness, attendance, engagement of the teachers to improve themselves professionally. First, they expanded their instructional repertoire with the simulation of MI lessons, singing dramatizing events, building models, collaborating on projects, creating charts, posters, diagrams and graphs. Then they worked on lesson plans and curriculum design. Finally, they discovered they could measure student learning not only with standardized tests but also with more performance-based assessments such as project presentations, demonstrations, exhibitions and performances using the arts. After the applications of MI in this culture, it was revealed that even in a homogenous culture, each student may learn in a unique way. By providing variety in education settings students may be more academically successful. Interestingly, the teachers also realized their own unique differences, and discovered they could use these differences for the optimization of teaching procedures and to support their colleagues. In short, the implications of MI for western teachers were equally apparent and relevant to the Tibetan teachers (Campbell, 1999).

In 1999, Hassan and Maluf applied MI based approach in early childhood years in a Middle Eastern culture. A total of 228 preschool children enrolled in International College School were chosen for this study. The school consisted of two branches, one in Beirut which is the capital of Lebanon, and the other which is located in a more suburban area. The control group consisted of 78 Kindergarten students in the suburb branch, whereas the experimental group consisted of 150 Kindergarten students in the Beirut branch. Both of the groups followed the school curriculum, while the experimental group was also administered the activities and

games, designed with respect to the *Project Spectrum Preschool Assessment Handbook*. The Lebanese kindergarten students revealed distinct profiles of intelligences, however, no significant difference was found between the two groups with respect to their achievement as measured by teacher ratings at the end of the year. As Hassan and Maluf explained, this may be due to the fact that these ratings might be subjective measurement. It would have been better to use standardized measures for this study. This study suggests that the development of different intelligences can be fostered from as early as the preschool years, through a learning environment based on learner-centered. Helping teachers to understand individual differences and multiple intelligences, the implementation of the MI theory resulted in the use of a variety of teaching methods and enriched learning environment and experiences.

Dr. Lefebrve, who had implemented the MI theory in his Psychology 101 class, administered a test developed by one of his colleagues in order to determine in which areas his students were best adapted. The assignments reflected the quality and the quantity of these learning options. Results from the first year of the two-year pilot study with 76 students indicated that students wanted various options in verifying their intelligence. After being encouraged by their professor, the students showed an increased interest in using different methods of learning. Their motivation to learn the academic material and the amount of time spent studying outside the classroom increased. This increase of effort and desire was based on their intrinsic motivation developed by the opportunity to be creative and their natural love of learning. Dr. Diaz reported that several of his students came and told him that he gave them an opportunity that no other teacher had given them (Kline, 1995).

Brougher (1997) reported about one of her graduate education classes that resembled an elementary classroom. The magazines, scissors, glue, paper, markers, construction paper, and crayons were all scattered on the tables. Students illustrated twelve different concepts about how the brain works with background music while the teacher moved from one group to another as a guide. She also gave examples about how she applied the MI theory with respect to the seven intelligences in her classes. For verbal/ linguistic intelligence, students worked in groups to write a

letter to the editor of a local newspaper that published comparison test results of a state wide standardized test taken by various schools. The teacher observed that the students made insightful comments and discussed the style, concepts and ideas that should be included in their letters. For logical/mathematical intelligence, they analyzed popular films, songs, and works of art for content- specific themes and patterns. For musical/rhythmic intelligence, she used music to energize, calm, or focus her students when she sensed that they were getting tired or stressed. Music that had words related to the subject was also a novelty to introduce a new topic or stimulate discussion. For intrapersonal intelligence, they wrote reflectively while listening to quiet music. “Ordinary Miracles”, a song from the CD, Barbara: The Concert is an example given by her. For visual/spatial intelligence, the students worked in groups to develop mind maps that explained the meaning and relationship of important concepts pertaining to material they had recently read. These small groups were also used for the interpersonal intelligence. With all of these activities related with the MI theory, Brougher found out that teaching adults can be much more enjoyable and productive.

Gibson and Govendo (1999) focused on the application of the MI theory to the following elements of the middle school classroom social community: the physical and social environment, classroom customs and routines, transitions, and social skills at the middle school level. Offering alternative interventions using an MI approach for students experiencing difficulty in the classroom, they claim that teachers can create an environment that facilitates both social and academic growth.

Recognizing that each student is talented in different ways, Emig (1997) decided to expand her teaching and assessment strategies according to multiple intelligences principles in her social science classes at Pennsylvania high school. To evaluate her work and her students’ progress, she developed a form called the MI Inventory. She discovered that students who were using their areas of strength to learn felt more competent, confident, and enjoyed learning new information. They participated more fully and retained more information because they could more easily see connections.

Dr. Shearer is a developmental psychologist. In his private practice he counsels adults, adolescents, and families to improve educational and vocational

achievement and personal satisfaction. He conducts workshops for teachers and school administrators interested in the MI theory. Eight high school teachers and over 165 of their students in Northeast Ohio were involved in a year long study conducted by him. The main purpose of the study was to determine the effect of a Multiple Intelligences Developmental Assessment Scales (MIDAS) on classroom instruction and self-directed learning. After the application of MIDAS, the students did all the activities in the *Stepping Stones* interactive workbook in order to increase their intrapersonal understanding and awareness of MI in academic learning and everyday practices. The teachers were supposed to evaluate these activities and give feedback to the students regarding their profiles. Findings of this study were: (1) Teachers have a great role guiding students in use of their intellectual strengths to do better in school. So they need to find alternative ways for creating lessons that reflect more than what is in the text book and try to connect with the personality of the class. (2) Because MIDAS focused on the students' strengths, they felt themselves better and had confidence to find out the actual tools they already had for being successful. Some of the main points behind the use of MI include, not "labeling" people by their preferred intelligences, and encouraging individuals to develop less preferred intelligences. (3) At-risk students and adults who had not experienced career success,| benefited from recognizing that they were intelligent and that they could identify careers that match their strengths (Shearer, 1999).

Meyer (1998) mainly used the Naturalist Intelligence in one of her science lessons in order to improve data collection and observation skills. She believes that by observing outside of the classroom, students can see those same patterns in nature and understand the connections. Her six grade students did quadrates and brainstormed a list of items that they might find in their quadrates just before leaving the classroom. In the field, on a data sheet they tallied, counted, recorded and drew what they saw in their quadrates. When they returned to the classroom, they shared their findings with their classmates. They compared their findings with their predictions and made comments. There were some students who were interested with the reasons why some appeared in the same place. Afterwards, they recorded the total classroom data of at least one object from everyone's quadrate. Meyer also suggested some extensions for this lesson that teacher could choose at

this point. Some of those suggestions are construction of a pictograph of the data, writing mathematical problems using the data collected, writing a story of how one item, selected from the quadrate, got onto that area, research on an object discovered. What she chose was giving them several prompts to reflect in their field studies: Today we....., I saw..... One thing I thought I was curious was....., I learned...., I think.....In her opinion students of all levels need these types of experiences.

The purpose of the master's project applied by Erb (1996) was to increase the students' responsibility for their own learning in biology in order to increase academic output and decrease the occurrence of inappropriate behavior. The target population was sophomore high school students. The high school was located in a stable, urban blue-collar community in northern Illinois. Data collected by the surveys was designed to determine the causes for the students' lack of responsibility, and data collected by the teacher, student, and social records were applied for the documentation of the problems of academic output and inappropriate behavior. The main reason behind the lack of responsibility of the students turned out to be a lack of intrinsic motivation and interest in science. After the implementation of the MI theory and cooperative learning, the post data revealed that there was an increase in the students' responsibility for their own learning through an increase in academic output and a decrease in students' responsibility for their own learning through an increase in academic output and a decrease in the frequency of occurrence of inappropriate behavior.

Bellanca (1998) mentions about a biology teacher in a large, college-directed suburban high school using the MI theory. Two views of this teacher, expressed at different times are given below:

> When I teach biology, my job is to cover the content. To get all the material required in our curriculum covered, I use two strategies. In class, I lecture or show films to get the material across. In the lab, I work through the lab book with the students. The labs correspond with the text chapters. I use pop quizzes, chapter tests, lab book grades, and a semester final to decide a student's grade for the semester.

> When I teach biology, my job is to interest students in the value of this science. This is much more than giving them information to spit back out on a test or quiz. I have to help them to understand how all the information fits together and why it is important. I also have to help them get as excited about biology as I am. In class, I use a variety of methods. First, I teach them how to gather the right information from a variety of sources. These can include some lectures, some films, targeted-reading from the text, or online resource materials. I also structure all-class and cooperative-group discussions so that they can relate the specific topics to the "big Picture". Finally, I use the lab to engage them in applying the new information. I use the lab book as a start for the students to investigate applications outside the classroom. I use pop quizzes and tests to check what they know about the material. But I also observe and grade how they do lab work, defend their findings, execute outside-of-class projects, contribute to the discussions, and complete the final exam. Unless I actively engage their minds in doing biology, I believe that I have shortchanged their opportunity to understand and to enjoy the subject.

Reading these two views of the teacher, it is easy to see how MI using has changed his beliefs and practices. Another example illustrating how beliefs about learning affect teaching practices is the implementation of the MI theory in the first grader class "Science curriculum content: Simple Machines". Instead of using text-based approach and memorization as in previous years, the teacher assigned pairs of students (interpersonal) to create an invented animal composed of several simple machines (logical/mathematical). As an example, the teacher showed the dinosaur she made by herself (visual/spatial) and pointed out how each machine was used. When the projects were completed, each pair of students made a presentation about their animals and group work. The results of this example conclude that MI provides all children with the opportunity to become active, engaged, and successful learners.

Another example is the research study designed by Goodnough (2000). The main purpose of this study was to explore the MI theory and how this theory makes teaching and learning science more meaningful. The study reports on the experiences of Goodnough and four additional teachers, two elementary teachers, one junior high teacher, and one high school teacher, as they participated in a collaborative action research project. The inquiry was a qualitative case study that aimed to understand the perspectives of those directly involved. This was achieved by using multiple methods to collect data such as, audio taping action research meetings, field notes, semi structured interviews, journal writing, and concept mapping. All data was analyzed on an ongoing basis.

Many positive outcomes resulted from the study in areas such as curriculum development, teacher development, and student learning in science. Through the process of action research, research participants became more reflective about their practice and thus enhanced their pedagogical content knowledge in science. Students became more engaged in learning science, gained a greater understanding of how they learn, and experienced a science curriculum that was more relevant and personalized. In addition, the action research process provided a feasible and effective forum for both curriculum development and professional development.

Dave, a private high school science teacher, explored the MI theory within the context of the action research group formed by Goodnough (2001) in December 1998. During this project, he worked with his 13 ninth-grade students in a small class. Three of the thirteen students were classified as English as a Second Language (ESL) students, and received support outside the traditional classroom. He used the MI theory as a framework to make decisions about how he would structure learning experiences for his students in a science unit on space and astronomy. Over the duration of the study, the action research group held 12 meetings with each meeting lasting between 120 to 150 minutes in duration. All meetings were audio taped and later transcribed and analyzed. Semi structured interviews were conducted with each participant at the beginning and end of the action research project. In addition, informal conversational interviews occurred after the action research meetings, after classroom teaching sessions, and after regular school hours. Transcribed interviews and recreated notes based on informal

interviews were sources of data that revealed the participants' developing views and beliefs about the MI theory, science teaching and learning, and action research. All participants recorded their thoughts, ideas, questions, and concerns in journals and responded to a survey. Student learning and teacher knowledge are the two major themes used for the discussion of the outcomes. According to Dave, the quality of learning experience by the students was enhanced. When asked on a questionnaire whether or not using MI had made them better learners, 85% of the class responded in the affirmative. As well, in response to another questionnaire statement asking whether they learned more easily using a variety of multiple intelligences, 85% of the students either agreed or strongly agreed. He believed that his students displayed higher levels of participation and enjoyed learning science more in his class than in their regular science classes. In his opinion, participation in this unit had a significant impact on the learning of his ESL students. In comparing the students' performance in the space and astronomy unit and in the previous cells and reproduction unit, there was not a substantial increase in achievement levels. However, in comparing student performance on other forms of assessment in both units, the overall MI class averages reflected a much broader range. In addition to these cognitive and affective outcomes, he believed that, students when exploring "space and astronomy" unit, benefited from engaging in metacognition. Using MI during this science unit also made Dave's strong and weak points as being a teacher and totally changed his approach to teaching and the way that he conducted the class. He created a more student-centered curriculum by building on his current instructional repertoire to include more of the multiple intelligences. He became more cognizant of and sensitive to his students' varied learning needs. He afforded his students opportunities to engage in self-reflection not only on how they were learning (the intelligences used), but on how successful they were in using a particular intelligence and on whether or not they liked using that intelligence.

Another study conducted by Marsland (2000) evaluated twelve studies on teacher effectiveness in order to investigate the role of MI. The analysis revealed great differences between the intelligences and their representation in teacher effectiveness research. A great imbalance occurred at the two ends of the spectrum. Personal intelligences were evaluated in 11 of the 12 studies while the naturalistic

intelligence was evaluated 1 out of 12. Other intelligences represented in order are, verbal/linguistic (6 out of 12) , bodily (5 out of 12), mathematical (4 out of 12) , and musical intelligences (2 out of 12). Analysis of the findings led to the conclusion that using the MI theory is an appropriate method for assessing teacher effectiveness, because it gives a more holistic understanding of the dynamism of being an effective teacher. Teachers who are aware of the MI theory and recognize its benefits are better able to meet the individual needs of the students.

Guild and Chock-Eng (1998) gives the overlapping areas of three theories, multiple intelligences, learning styles, and brain-based education theory by comparing the three middle school seventh grade Language Arts/Social Studies teams.

At the first school, there was a mural in process about the Revolutionary war with some students building a bridge with a variety of materials. Project posters were taped to the back chalk-board outlining tasks for group members, and major questions. Some students were working together while others were working alone. A common thread was the frequent hands-on work of the students.

In the second school, there was an adjoining area where students were involved in a class meeting to discuss their plans for the work that they would be doing at the learning centers. There were small groups of students working with the materials, tasks, and instructions in a variety of learning centers. Some groups were listening to a taped story, some were writing journals, some were playing word games, and others were inspecting a portfolio of photographs and recording responses.

In the third school, the subject of the social studies course was the culture of China, and the ability to learn specific map skills. There were posters of China's different regions and national monuments at the back wall of the room, two maps of China, one in English and one in Chinese behind the teacher's desk. There was also a cart full of books and magazine articles about China and novels written by Chinese-American authors. Students were talking about an excerpt from Jade Snow Wong's *Fifth Chinese Daughter* and comparing it to an earlier story they read from *Tales of a Chinese Grandmother* by Frances Carpenter. Students sometimes worked in pairs or in small groups and other times in a fairly large group with a

teacher directing the activity. During these activities soothing music was played in the background.

The common points of three of these schools are: active involvement of the students in their learning, learning in a variety of ways, and curriculum related to the real world and interests of students.

As explained by Guild and Chock-Eng, multiple intelligences, learning styles, and brain-based education each have particular theoretical constructs, research bases, and applications. These fields are distinct and separate from one another in some ways, but the application of them in a classroom environment look quite similar:

- each of the theories focus on how students learn,
- each of them may be a catalyst for student learning,
- each of them are learner-centered,
- learners' needs and interests are important for the teachers,
- teachers not only pay attention to the student's academic life, but also to the cultural, physical, social, and emotional life of him/her,
- both the teacher and the student are reflective practitioners,
- teacher and the students promote respect for both the differences and similarities among people in the school,
- they practice working together in productive ways.

Lindvall (1995) described the program with which she employed the MI theory and individual learning style in order to increase time on task, increase retention of academic material, and decrease in distracting behaviors in classrooms. Seventeen 13th grade students were the samples of the study. The data was collected by a survey about students' learning preferences and teaching methods related to the seven intelligences, academic assessment, teacher observations, parent questionnaires, student questionnaires and interviews. The results indicated that focusing on the needs and preferences of the students, and making accommodation to confirm those needs in the classroom, encouraged students to become increasingly engaged in their learning. There was an increase on time on task and retention of academic materials and decrease on behavioral problems.

2.6.3 Application of Multiple Intelligences Theory in Turkey

Although there have not been any application of MI in Turkey till the late 1990s, the interests of the researchers, authors and teachers increase day by day. Arı College, METU College, Ayşeabla College, Ankara University College, Ceceli Schools, Altın Education Schools located in Ankara, Enka College, Istek Foundation Schools, and Yüzyıl Işıl Education Foundation Schools located in İstanbul, and Sanko College located in Antep are some of the names of the private schools implementing the theory. In order to apply the MI theory in public schools in Turkey, Ministry of National Education conducted in-service education programmes about the theory and its applications during 2003-2004 education year. Also there are some books written by the authors about the theory and its applications (Bümen, 2002; Saban, 2002; Selçuk & Kayılı , 2002; Selçuk, Kayılı & Okut, 2004; Yavuz, 2001; 2004) but the lesson plans included in these books are only at primary education level, first grade to eighth grade.

Coşkungönüllü (1998) conducted a study to investigate the effect of the MI theory on fifth graders' mathematics achievement. The effect of the MI theory on the fifth graders' attitude toward mathematics was also investigated. This experimental research was applied in the second term of 1997-1998 educational year in TED College. There were two randomly assigned groups, one experimental group, having mathematics lessons using MI and one control group with traditional methods. The treatment lasted for three weeks. After the treatment, the data was analyzed by using independent t-test. This data analysis revealed that there was a significant effect on the students' mathematics achievement using the MI theory, but there was no significant effect on students' attitude toward mathematics by using the MI theory. According to the interviews she made with the experimental group and the teacher about the implementation of the theory, both the students and their teacher had positive opinions about its use. Her interpretations from her observations are, students in experimental group were having fun, willing to participate, collaborating with each other and encouraging their friends, whereas in control group the students were bored, unwilling to participate, and were not exchanging their ideas.

Şahin (2001) conducted a study to investigate the effects of application of MI activities and multivariate materials on third grade students' social science achievement. This experimental research was applied during the second term of 1999-2000 academic year in Kışla primary school in Ereğli, Zonguldak. Pretest-posttest experimental and control group design, observations, and interviews with the teacher and the students in the experimental group were utilized in this study. The data analyses revealed that MI activities and multivariate materials used in the class had a significant positive effect on students' achievement. In addition, according to the observations and interviews made with the students, it was found out that the students' multiple intelligences were positively affected. Finally, interview made with the teacher showed that she had positive views on the application of MI activities and multivariate materials in her class.

Özdemir, Korkmaz and Kaptan (2002) aimed to investigate the effect of MI based science teaching on fourth grade students' higher order thinking skills. This experimental research was conducted in 2001-2002 spring term in Beytepe primary school in Çankaya district in Ankara. Experimental design was used. There was only one group of 32 students involved in this study. An achievement test, including sub dimensions, knowledge, comprehension, and problem solving was used. Paired t-test results revealed that posttest scores were significantly higher than the pretest scores of the students in all of the sub dimensions and total test scores.

Özdemir (2002) conducted a research in order to investigate the effects of instructional strategies based on the principles of the MI theory on fourth graders' understanding of diversity of living things. This experimental research was conducted in 2001-2002 educational year in Beytepe elementary school. Two classes each taught by different teachers were involved in the study. One of these classes was randomly assigned as the experimental group and the other as the control group. The classroom instruction of the groups lasted for four weeks. Science achievement test, Science attitude scale and Teele inventory of multiple intelligences (TIMI) were utilized as measurement instruments. The data was analyzed by using independent t-test. Results of statistical analysis revealed that there was a significant difference between the effect of the instructional strategies used according to the principles of the MI theory and that of traditionally designed

science instruction in the favor of the experimental group on understanding of science concepts and on retention of knowledge related with the unit of "Diversity of Living Things". On the other hand no effect in terms of students' general attitude toward science was found. The results of TIMI revealed that students' most dominant intelligences were logical mathematical and interpersonal before and after the treatment. Also by looking at the pretest and posttest scores of TIMI, the variations in the types of intelligences of students between the pretest of TIMI and posttest of TIMI were more obvious and higher in experimental group. For example, the musical intelligence of the students in experimental group was apparently higher after the treatment.

Bümen (1999) carried out a study in order to find out the difference between the MI theory and implementation supplied by reviewing strategies and traditional instruction methods in the unit of " Diversity and Human Rights" in citizenship and human rights lesson. The subjects of the study were 112 eighth grade students of İzmir private Tevfik Fikret high school. Test-retest design was used with control groups. Among five classes, two of them were chosen to be control groups and three of them were to be experimental groups. Achievement test and attitude scale were administered. The findings of the research are: (1) both methods had the same effect for the knowledge level achievement of students, (2) MI implementation supplied by reviewing strategies was more effective on the comprehension, application levels and total achievement of the students, (3) MI was more effective on students' attitude, (4) MI was more effective on students' retention of the knowledge. In short this study reveals that MI effects not only cognitive learning but also affective behaviors.

Akbaş (2004) carried out a study to investigate the effects of MI based instruction on sixth graders' science achievement, and their attitudes towards science. This experimental research was conducted over three weeks in 2002-2003 educational year at METU Ankara College primary school. There was one control and one experimental group instructed by the same teacher. The MANCOVA results indicated that using methods based on the MI theory had a significant positive effect on students' science achievement. However, use of the MI theory did

not have any significant effect on students' attitude towards science. The teacher expressed positive views about the implementation of the theory.

Kaya (2002) conducted a study to investigate the effect of the MI theory on seventh graders' science achievement, retention of their knowledge, attitude toward science and perceptions in the topic of atom and atomic structure. This research was carried out during four weeks in 2001-2002 fall semester. The two classes used were part of the Emniyetçiler primary school located in Yenimahalle, Ankara. The treatment in the control group lasted 4 hours, whereas the treatment in the experimental group lasted 5 hours. The statistical results and observations of the researcher indicated that the MI theory had positive effects on the students' achievement, retention of knowledge, attitude, and general perceptions of science and the learning of science.

Güneş (2002) carried out a study for the implementation of the MI theory in developing and teaching the concept of buoyancy to seventh graders. The study was conducted in 2000-2001 school year in a private school in Ankara. The researcher being the class teacher and three of her classes were involved in the study. The instruction consisted of two parts. The first part included activities that lasted for two weeks, and the second part included the students' presentations. By using the triangulation technique, research findings were compared. This triangulation consisted of the students' written documents, classroom observations and science attitude scale. She found that MI based instructional techniques changed the students' attitudes toward science positively. Especially the written documents showed that most of the students enjoyed lessons with multiple intelligences based instruction (MIBI). They found the lessons colorful, interesting and refreshingly different than their usual lessons. Not only did the MI theory affect the attitudes of the students, but it also positively affected the students' achievement, responsibility, self-reliance and independence.

Aşçı (2003) carried out a study to investigate the effect of MI based instruction on ninth graders' ecology achievement, attitudes toward ecology and multiple intelligences. The study was conducted in 2001-2002 educational year in Atatürk Anatolian high school, in Yenimahalle, Ankara. One teacher and her two classes, one randomly assigned as the experimental group and the other assigned as

the control group, were involved in the study. The treatment lasted two weeks. The data was analyzed by using MANCOVA. Results of statistical analyses indicated that MIBI had a significant and positive effect both on the students' achievement and overall MI. However, MIBI had no effect on the students' attitudes toward ecology.

Gürçay (2003) conducted a study in order to compare the effects of MIBI with traditional instruction on students' physics achievement, and their attitude toward physics. This research was conducted during the second semester of 2002-2003 educational year. Four classes of one teacher (two as experimental and two as control group) from two ninth grade high schools in Sincan were involved in this study. A total of eight classes from two separate schools were selected. Four of the experimental classes were exposed to MIBI, whereas other four of the control classes were exposed to traditional teaching method. Before the treatment, all of the groups were given the MI inventory, attitude toward the content "Coulomb's Law", and achievement test as pretests. By using pretest results of the MI inventory, students in experimental classes were grouped with respect to their strongest intelligences. Since the groups were labeled with colors, instead of the intelligence dimensions, students were unaware of their strongest intelligence dimensions. After being grouped, the students were given activities printed with respect to the group colors. There were four intelligence groups including verbal/linguistic, logical/mathematical, visual/spatial, and social/interpersonal. These activities were based on their major intelligence and supported with two or three intelligences. After the end of each activity, groups shared their results with their classmates and teacher summarized the topics with MI based examples. The treatment lasted for three weeks. Then the same tests were administered as posttests to both of the groups. MANCOVA statistics results revealed that MIBI had a significant effect on the students' achievement but there was no significant effect of MIBI on students' attitudes towards physics, when students' prior semester GPA, pretest scores of Attitude toward the content "Coulomb's Law" and pretest scores of achievement were controlled. According to the students' belief questionnaire about treatment, most of the students liked MI based lessons. Moreover they thought MI based lessons increased their interest toward physics and also increased their physics

achievement. According to the analyses of the observation of the classroom students were willing to learn and had fun in experimental classes.

A study designed by Ekici (2002) sought to find out the availability of the biology teachers' various teaching strategies for various intelligences of their students. This research included 80 biology teachers in Çankaya district, Ankara during 2002-2003 educational year. An inventory including 10 teaching strategies for each of the intelligences (totally 80 teaching strategies) was used. The frequencies, percentages gained from the data showed that the most preferred teaching strategies by the biology teachers were based on linguistic intelligence. These strategies included discussions, reading from textbooks, and taking notes.

In 2002, Acat studied the applicability of the MI theory in planning and regulation situations in Turkey. For the study, a post-test design of experimental research model without a control group was used. The qualitative data analysis revealed that the results should be categorized in two groups: positive and negative views. The positive views were: the MI theory helps to get rid of the monotonous atmosphere in the situations, contributes to the social, personal and academic improvement of the individual, provides support to the teacher for the improvement of communication in the classroom and using various teaching/learning activities, and results in active participation of the students. The negative views were: difficulty in making a connection between level, subject and intelligences domain. The higher the grade is, the harder it is to find activities for that level. Another negative view mentioned was the lack of time for the preparation of MI based lesson plans. This is due to the heavy lesson schedules in Turkey, overcrowded classrooms, and lack of materials in the Turkish education system.

2. 7 Summary of the Review of Literature

1. The concept of "human intelligence" has been viewed in different ways. Traditional view describes intelligence as being static, unitary, single, and quantifiable. Recent theories view intelligence as a dynamic system that can continue to develop throughout life, is pluralistic, and is broken into components. It is not something to achieve in schools, but rather something to achieve in real life.

2. Gardner defines intelligence as the abilities to solve problems, find or create new problems, and when appropriate create products valued in a particular cultural setting.

3. A candidate intelligence that meet Gardner's definition can be considered as a genuine intelligence if it meets a few of the criteria. These criteria are: Potential isolation by brain damage, the existence of idiot savants, prodigies, and other exceptional individuals, an identifiable core operation or set of operations, a distinctive developmental history, along with a definable set of expert "end-state" performances, an evolutionary history and evolutionary plausibility, support from experimental psychological tasks, support from psychometric findings, and susceptibility to encoding in a symbol system.

4. Gardner (1999) defined eight intelligences which established criteria. Logical/mathematical, visual/spatial, bodily/kinesthetic, and naturalist intelligences may be placed in "object-related", verbal/linguistic and musical intelligences may be placed in the "object-free" area, and social/interpersonal and intrapersonal may be placed in "person-related" forms of intelligence.

5. Since Gardner proposed a new definition of intelligence in his book, Frames of Mind, there have been so many myths about MI.

6. Multiple intelligences has been implemented into the whole curriculum across any discipline as a means to better teaching and learning. Although some of the middle school teachers also use MI in their teaching, acceptance of the theory by high school teachers and college lecturers is rarer than the lower grade teachers.

7. The literature review reveals that Mı help students to have increased self confidence, independence, interest, motivation, and responsibility. Hence, MIBI has an influence in students' positive attitudes (Bümen, 1999; Campbell, 1990; 1999; Ellison & Rothenberger, 1999; Erb, 1996; Gardner, 1995; Greenhawk, 1997; Güneş, 2002; Hoerr, 1994; Kallenbach &Viens, 2002; Kaya, 2002; Kline, 1995; Lindvall, 1995; Shearer, 1999; Şahin, 2001).

8. MIBI allows students to learn through their strengths, share their experiences (Beckman, 1996) and responds to the needs of a wide range of students by giving them the opportunity to learn in various ways (Gardner, 1993; Udvari, 1996). Learning how to learn students become better learners (Goodnough, 2000; Vialle,

1997), have higher academic achievement (Akbaş, 2004; Aşçı, 2003; Bümen, 1999; Campbell, 1990; Coşkungönüllü, 1998; Gardner, 1999; Güneş, 2002; Gürçay, 2003; Kaya, 2002; Özdemir, 2002; Özdemir et. al., 2002; Şahin, 2001) and retain more information (Emig, 1997; Erb, 1996; Greenhawk, 1997; Lindvall, 1995).

9. The Multiple Intelligences theory enhances learner centered education (Campbell, 1999; Goodnough, 2000; Kallenbach & Viens, 2002; Vialle, 1997) and provides all students with the opportunity to become active, engaged learners (Bellanca, 1998; Lindvall, 1995). Both the teachers and students are reflective practitioners in an MI classroom.

10. By engaging students in rich activities, weaknesses of the students are nurtured instead of being neglected (Hoerr, 1994). A significant positive effect of the Multiple Iintelligences theory on students' overall MI was also found by Aşçı (2003).

11. In an Multiple Intelligences classroom the role of the teachers change becoming more facilitative and guide (Campbell, 1990). The Multiple Intelligences theory lets the teacher be aware of each student's interests, abilities and learning styles, and individualize the education accordingly (Goodnough, 2000; Kallenbach &Viens, 2002).

As a results, these summary results show us the applicability of multiple intelligences based instruction and positive contributions of the Multiple Intelligences theory in all over the world. Differently from these results, Acat's study indicates that there are also negative views about the applicability of the Multiple Intelligences theory in planning and regulation situations in Turkey. These are: the higher the grade is, the harder it is to find activities for that level, overcrowded classrooms, and lack of materials in the Turkish education system. The study applied by Erb also revealed that the most prefererred teaching strategies by biology teachers in Turkey are based on linguististic intelligence including, discussions, reading from text books, and taking notes. Hence, this research aimed to develop MI lesson plans, determine the applicability of the theory and effects of MIBI on teaching learning process.

CHAPTER 3

PROBLEMS AND MAIN HYPOTHESES

This chapter includes the main problem, sub problems and the hypotheses of the research.

3.1 Main Problem

What is the effect of Multiple Intelligences theory on teaching-learning process at the high school biology course in the unit of the diversity and classification of living organisms?

3.2 Sub Problems

1) Is there a significant difference between the ninth grade students exposed to multiple intelligences based instruction and those exposed to traditional instruction with respect to the attitudes towards biology, biology achievement and overall multiple intelligences?

2) Is there a significant difference among students in terms of learning styles with respect to the attitudes towards biology, biology achievement and overall multiple intelligences?

3) Is there any significant interaction between treatment and learning styles with respect to the attitudes towards biology, biology achievement and overall multiple intelligences?

4) Is there any significant relationship between dimensions of intelligence and learning styles?

5) Is multiple intelligences based instruction effective on students' learning experiences?

6) Is multiple intelligences based instruction effective on teacher's teaching experiences?

3.3 Hypotheses

1) There is a significant effect of multiple intelligences based instruction on the population means of the collective dependent variables of ninth grade students' attitudes towards biology, biology achievement and multiple intelligences posttest scores when the effects of their attitudes towards biology, biology achievement and overall multiple intelligences pretest scores are controlled.

2) There is a significant effect of learning styles on the population means of the collective dependent variables of ninth grade students' attitudes towards biology, biology achievement and multiple intelligences posttest scores when the effects of their attitudes towards biology, biology achievement and overall multiple intelligences pretest scores are controlled.

3) There is a significant interaction effect of multiple intelligences based instruction and learning styles on the population means of the collective dependent variables of ninth grade students' attitudes towards biology, biology achievement and overall multiple intelligences posttest scores when the effects of their attitudes towards biology, biology achievement and overall multiple intelligences pretest scores are controlled.

4) There is a significant correlation among eight types of intelligences and the learning styles.

5) There is an effect of multiple intelligences based instruction on students' learning experiences.

6) There is an effect of multiple intelligences based instruction on teacher's teaching experiences.

CHAPTER 4

METHOD

This chapter consists of the problem, description of the variables, characteristics of the participants enrolled in the study, data collection instruments, procedure, data analyses, assumptions and limitations of the study.

4.1 Problem

The problem of this dissertation was to investigate the teaching-learning process based on Multiple Intelligences theory at the high school biology course in the unit of the diversity and classification of living organisms.

4.2 Description of Variables

This part includes conceptual and operational definitions of the variables used in this study.

4.2.1 Conceptual Definitions of Variables

Learning Style- There are many different descriptions of individual learning styles. The baseline definition posed in *Learning in Adulthood: A Comprehensive Guide* says a learning style (LS) is "an individual's preferred and consistent set of behaviors or approaches to learning" (Greenagel, 2003). Claxton and Ralston (1978) define LS as an individual's "consistent way of responding to and using stimuli in the context of learning". According to Lawrence (1984), LS refers to an individual's habitual patterns of dealing with new information. Kocinski, cited in Heineman (1995), defines LS as the preferred way to learn and the way a person learns best. Keefe (1982) notes that learning styles are the cognitive, affective, and psychological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Oxford, Hollaway & Horton's (1992) description also includes these three domains.

Felder (1995) describes learning styles as “the ways in which an individual characteristically acquires, retains, and retrieves information”. As Dunn (1999) states, there is not any single learning style that is better or worse than any other.

Students have different characteristic strengths and preferences in the ways they take in and process information (Felder, 1996). Therefore, one method that is good for some students with certain characteristics may not be good for others with different characteristics. Some people may rely heavily on visual presentation; others may prefer spoken language; still others may respond better to hands-on activities (Reiff, 1992). Renzulli and Smith (1978) define LS as “the learner’s preferred mode of instruction” whereas Hunt (1979) says, “LS describes how a student learns, not what he has learned” (cited in Henson & Borthwick, 1984). Because LS is the preference of an individual to learn, it is better for teachers to try to match the LS of individuals with appropriate teaching strategies.

Intelligence- Intelligence is "the capacity to acquire and apply knowledge by means of thought and reason” (Walker, 2004).

Attitude- As Reece and Walker (1997, p.92) stated, **“**Attitudes have three components each of which may vary in intensity. *Knowledge* what the student knows, *emotion* what the student likes or dislikes about the subject, *action* what the student does to express feelings of like or dislike”.

Achievement- A dictionary definition of achievement encompasses elements which include “success”, “performance”, “accomplishment”, “competence” and “winning” in broad terms. In the Standards for test construction (APA, 1999) achievement is basically viewed as the competence a person has in an area of content.

4.2.2 Operational Definitions of Variables

Kolb’s Ways of Learning- There are four basic ways of learning defined by Kolb (1985):

Concrete experience. Kolb identifies an orientation toward concrete experience as dealing with immediate human situations in a personal way and being involved in experiences. The concrete experiencer has good relations with others

and has an open-minded approach to life. Feelings are important for people with a concrete experience.

Reflective observation. An orientation toward reflective observation deals with understanding the meaning of ideas and situations by carefully observing and impartially describing them. The reflective observer sees different perspectives and relies on his/her own beliefs and feelings. He/she is patient and thoughtful. Watching and listening are important for people with a reflective observation.

Abstract conceptualization. An orientation towards abstract conceptualization focuses on logic, ideas, and concepts. The abstract conceptualizer manipulates abstract symbols, makes systematic planning, and quantitative analysis. Thinking is important for people with an abstract conceptualization.

Active experimentation. An orientation toward active experimentation is based on influencing people and changing situations. The active experimenter likes to take risks to achieve his/her objectives. Those people learn by doing and practicing.

Kolb's Learning Styles- Kolb's four styles of learning are: converger, diverger, assimilator and accommodator (Kolb, 1985). These four learning styles are combinations of his two continuums of ways of learning, described above: concrete experience-reflective observation and abstract conceptualization-active experimentation.

The combinations of the two continuums result in the following learning styles:

Convergent learning style is a combination of abstract conceptualization and active experimentation. The main characteristics of this approach are problem solving, decision making, and the practical application of ideas. A converger prefers dealing with technical tasks and problems rather than social and interpersonal tasks. Learning by doing is important for the convergers.

Divergent learning style is a combination of concrete experience and reflective observation. Imaginative work, innovation, and awareness of meaning and values are the main characteristics of this approach. A diverger solves problems by viewing situations from different perspectives, generates new ideas, enjoys being with people, and tends to be feeling-oriented.

Assimilation learning style is a combination of abstract conceptualization and reflective observation. The greatest strength of this approach is the creation of theoretical models. Like a converger, an assimilator is less interested with people and interpersonal tasks and more interested with items and abstract concepts. Different from a converger, what an assimilator requires is a good clear explanation rather than practical opportunity.

Accomodatetive learning style is composed of concrete experience and active experimentation. The action oriented accommodator carries out plans and tasks, does things, takes risks, and gets involved in new experiences. They rely heavily on other people for information rather than on their own analytic ability.

In this study Kolb's Learning Style Inventory (LSI) (see Appendix A) was used in order to determine the preferred learning styles of the students.

Multiple Intelligences- Gardner (1983, 1995) challenged the unitary concept of intelligence and proposed that people possess seven or more fairly autonomous intelligences including, verbal/linguistic intelligence, logical/mathematical intelligence, visual/spatial intelligence, musical intelligence, bodily/kinesthetic intelligence, social/interpersonal intelligence, intrapersonal intelligence, and naturalist intelligence. In this study the Multiple Intelligences Inventory (MII) (see appendix B) was used in order to investigate the students' Multiple Intelligences.

Overall Multiple Intelligences- In this study, students' total score from the Multiple Intelligences Inventory (MII) was named as the overall multiple intelligences. As stated by Campbell (1992, p.197) different types of intelligence are synergistic: when one changes, others may be affected. Therefore, in this research, it was assumed that if a student's one dimension of intelligence was improved, the MI score would also be increased.

Ninth grade students' Dominant Intelligence- Students' area of multiple intelligences which is well developed is known as dominant intelligence. Students' dominant intelligence in this study was determined with MII.

Ninth grade students' Attitude Towards Biology- In this study the ninth grade students' attitude towards biology is measured by Attitude toward Biology Scale (ATBS) (see Appendix C).

Ninth grade students' Biology Achievement- Students' scores were measured by a multiple choice achievement test (AT) (see Appendix D) on the content of "Diversity and classification of living organisms."

4.3 Study participants

The target population of the study consisted of all of the ninth grade public high school students in Ereğli, Zonguldak. There are two public high schools named as Hacı Kadri Yılmaz high school and Ereğli high school in Ereğli. The accessible population was determined as all ninth grade students in Ereğli high school. The total number of ninth grade classrooms and the total number of biology teachers in this school were 9 and 4, respectively. Having a class size of approximately 30, the total number of ninth graders in this public high school was almost 270. This is the population for which the results of this study are generalized.

The subject of this study consisted of 64 ninth grade students from two classes of the same biology teacher in Ereğli high school. She was the only biology teacher in this school who accepted to use Multiple intelligences based lesson plans developed by the researcher and allowed the researcher to observe her biology classes.

Since the subjects were selected because they were easily accessible, convenience sampling was utilized. One of the two classes was randomly assigned as the experimental group (MIBG) and experienced the multiple intelligences based instruction (MIBI), and the other one was assigned as the control group (CG) and experienced the traditional instruction (TI). Number of students in each group was equal. Table 4.1 shows the subject characteristics of the study in terms of gender and treatment.

Table 4.1 Characteristics of the participants: Gender and treatment.

Gender	Groups			
	MIBG		CG	
	Frequency	Percent (%)	Frequency	Percent (%)
Male	17	53.12	15	46.88
Female	15	46.88	17	53.12

As seen in Table 4.1, 53.12% of the 32 experimental group students (N=17) were male and 46.88% (N=15) were female. The control group's gender distribution was the opposite of the experimental group with 53.12 % of the 32 control group students (N=17) of being female and 46.88 % (N=15) male.

Table 4.2 shows the characteristics of the students in terms of their dominant intelligences, Bodily/Kinesthetic Intelligence (B/KI), Social/Interpersonal Intelligence (S/II), Intrapersonal Intelligence (II), Logical/Mathematical Intelligence (L/MI), Musical Intelligence (M/RI), Verbal/Linguistic Intelligence (V/LI), Visual/Spatial Intelligence (V/SI) and Naturalist Intelligence (NI) and group just before the application of the study.

Table 4.2 Characteristics of the participants: Dominant Intelligences.

Dominant Intelligence	Group			
	MIBG		CG	
	Frequency	Percent (%)	Frequency	Percent (%)
B/KI	5	15.63	2	6.25
S/II	1	3.13	2	6.25
II	2	6.25	6	18.75
L/MI	-	-	-	-
M/RI	8	25.0	4	12.5
V/LI	4	12.5	2	6.25
V/SI	-	-	3	9.38
NI	12	37.5	13	40.63

As seen in Table 4.2, the percentages of B/KI, S/II, II, M/RI, V/LI and NI were 15.63%, 3.13%, 6.25%, 25.0%, 12.5%, and 37.5%, respectively in the experimental group. The percentages of B/KI, S/II, II, M/RI, V/LI, V/SI and NI were 6.25%, 6.25%, 18.75%, 12.5%, 6.25%, 9.38% and 40.63%, respectively in the control group, so it can be said that most of the students' dominant intelligence in both of the groups was naturalist intelligence. None of the students had a dominant intelligence of logical/mathematical intelligence in either of the groups. Moreover, there was not any student with a dominant visual/spatial intelligence in the experimental group.

4.4 Data Collection Instruments

The measuring tools used in this study are, Attitude towards Biology Scale (ATBS), Diversity and classification of living organisms unit achievement test (AT), Multiple Intelligences Inventory (MII), Learning Styles Inventory (LSI), a semi structured interview with the the experimental group students and the teacher, and the observations of the experimental classroom.

4.4.1 Attitude toward Biology Scale

Geban, Ertepınar, Yılmaz, Altun and Şahbaz (1994) developed this scale in order to measure student attitudes towards chemistry as a school subject. Çakır (2002) adopted this test (see Appendix C) to measure students' attitudes towards biology. The reliability of the scale containing 15 Likert type items (strongly agree, agree, undecided, disagree and strongly disagree) was found to be 0.83. Possible ATBS scores could range from 15 to 75. The completion time for students was approximately 5 minutes. In this research ATBS was utilized as a pre-test (PRE-ATBS) to investigate whether students' attitudes towards biology in both groups were the same or not at the beginning of the treatment and utilized also as a post-test (POST-ATBS) to investigate whether there was a significant difference between the students experienced MIBI and the students experienced traditional classroom techniques with respect to attitudes towards biology. Internal reliability of ATBS was calculated by using Cronbach Alpha. The values obtained for these reliability coefficients were 0.81 for the pretest and 0.87 for the posttest.

4.4.2 Diversity and classification of living organisms unit Achievement Test

First, in line with the objectives of the "Diversity and classification of living organisms" unit (Appendix E), 30 multiple choice items including four distracters and one correct alternative were prepared by the researcher. Views and opinions of two biology teachers and two instructors from the Secondary School of Science and Mathematics education were asked for face validity of the test. 20 multiple choice items were selected comparing similar questions corresponding to the same learning outcomes. Besides using feedback given by the teachers and the instructors, some of the items were reviewed and changes were made accordingly. The pilot test was

administered to a separate group of students in order to form this study's diversity and classification of living organisms unit achievement test (AT).

The mean of the AT, which is the average number of the items that were answered correctly, was 13.62 over 20. The variance of the test, which is an indication of the distribution of scores, was 12.25 meaning the scores were distributed in a wide range. The standard deviation, which is the square root of the variance, was 3.50. The scores were negatively skewed, indicating that there was a relative abundance of the scores at the left end of the distribution. The kurtosis number was positive. This means the distribution was peak. The minimum and maximum scores were 3 and 20, respectively. The median value, 14 was very close to the mean. That is, the distribution of scores was normal distributed. The Cronbach ά coefficient of the test was 0.70. As Kehoe (1995) mentioned, values of as low as 0.5 are satisfactory for short tests, though tests with over 50 items should yield values of 0.8 or higher (1.0 is the maximum). The standard error of measurement, which is an estimate of the standard deviation of the standard deviation of the error of measurement, was 1.91. Mean P, which is the average of the proportion of the correct responses across all the items, was 0.68. This is the average item difficulty for the overall test. The mean biserial, which is the average biserial correlations across all the items, was 0.53 indicating that discrimination between high and low achievers can be provided. Since the item discrimination coefficient, or equivalent, the point-biserial correlation between the item score and total score was higher than 0.2, indicating that students answering correctly tend to have higher scores, none of the items were eliminated. The AT is given in Appendix D.

The completion time for the students was approximately 25 minutes. Possible achievement scores could range from 0 to 20.

As validity evidence, correlations between the students' overall achievement from AT and their previous exam's scores ($r=0.62$, $p<0.01$) and final exam scores ($r=0.59$, $p<0.01$) of Biology courses were used.

AT was utilized as a pre-test (PRE-AT) to investigate whether students in both groups had the same level of achievement at the beginning of the treatment and utilized also as a post-test (POST-AT) to investigate whether there was a significant

difference between the students who experienced MIBI and the students that experienced traditional classroom techniques with respect to biology achievement of ninth graders.

In order to measure the reliability coefficient of this test, Reliability Analysis- scale (alpha) was used by SPSS-10. The values obtained as the reliability coefficients were 0.20 for the pretest and 0.75 for the posttest. The low reliability of the pretest may be because of the students who did not know the exact answer and tried to guess it.

4.4.3 Multiple Intelligences Inventory

Multiple Intelligences Inventory translated from English to Turkish by Oral (2001), was used in this research. At the initial phase of the study, MII was administered as a pre-test (PRE-MII) to the students in order to determine which of their intelligences were stronger and to determine their overall MI, and and also as a post-test (POST-MII) to investigate whether there was a significant difference between the students who experienced MIBI and the students that experienced traditional classroom techniques with respect to their overall intelligences.

. This inventory consists of 80 questions with 8 sub-dimensions (Appendix B). Each of the items of MII were rated on a 5-point Likert type response (strongly agree, agree undecided, disagree, and strongly disagree). Item numbers with respect to the intelligence dimensions are as follows:

- Items 4, 12, 21, 28, 37, 45, 53, 61, 69, 76 for Bodily/Kinesthetic intelligence,
- Items 7, 15, 23, 31, 39, 47, 55, 63, 71, 79 for Social/Interpersonal intelligence,
- Items 8, 16, 24, 32, 40, 48, 56, 64, 72, 80 for Intrapersonal intelligences,
- Items 2, 10, 19, 26, 34, 43, 50, 59, 67, 74 for Logical/Mathematical intelligence,
- Items 6, 14, 22, 30, 38, 46, 54, 62, 70, 77 for Musical intelligence,
- Items 1, 9, 18, 25, 33, 41, 49, 58, 65, 73 for Verbal/Linguistic intelligence,
- Items 3, 11, 20, 27, 35, 44, 52, 60, 68, 75 for Visual/Spatial intelligence
- Items 5, 13, 17, 29, 36, 42, 51, 57, 66, 78 for Naturalist intelligence.

The completion time was approximately 25 minutes. The possible overall MII scores could range from 80 to 400, whereas each of the sub dimensions of intelligence could range from 10 to 50.

The values obtained for the reliability coefficients were 0.91 for the pretest and 0.93 for the posttest. These results indicate a high reliability for MII.

Reliability estimates of the pretest with respect to the each of the intelligences are as follows: 0.47 for bodily/kinesthetic intelligence, 0.60 for social/interpersonal intelligence, 0.55 for intrapersonal intelligences, 0.64 for logical/mathematical intelligence, 0.75 for musical intelligence, 0.56 for verbal/linguistic intelligence, 0.66 for visual/spatial intelligence, and 0.68 for naturalist intelligence.

0.65 for bodily/kinesthetic intelligence, 0.63 for social/interpersonal intelligence, 0.67 for intrapersonal intelligence, 0.76 for both logical/mathematical and musical intelligences, 0.59 for verbal/linguistic intelligence, 0.61 for visual/spatial intelligence, and 0.62 for naturalist intelligence are the reliabilities that were found for the posttest with respect to the each of the intelligences.

4.4.4 Learning Style Inventory

The Learning Style Inventory that was developed by Kolb (1985) was used in order to determine which of the learning styles were preferred by the students at this study. LSI was adapted by Aşkar and Akkoyunlu (1993) into Turkish (see Appendix A). There are a total of 48 items divided into 4 subcategories, so each of the learning style has 12 items. Cronbach Alpha reliability for each of the learning style and the combinations of them were found to be as follows:

0.82 for Concrete Experience (CE), 0.73 for Reflective Observation (RO), 0.83 for Abstract Conceptualization (AC), 0.78 for Active Experimentation (AE), 0.88 for AC-CE and 0.81 for AE-RO.

The completion time was approximately 10 minutes. Each of the possible overall LS scores could range from 12 to 60. Total score of the LSI with the sum of those 4 style scores is 120.

By using Cronbach Alpha, the reliability coefficients were found to be 0.86 for CE, 0.79 for RO, 0.89 for AC, 0.82 for AE, 0.78 for AC-CE and 0.79 for AE-RO in this study.

4.4.5 Interview with the Experimental Group Students

A semi-structured interview was prepared by the researcher to determine the views and opinions of ninth grade students in experimental group who were exposed to the MIBI about the implementation and contributions of the MI theory. The interview questions are seen in Appendix F.

Each interview was approximately 30 minutes in duration. Interview schedules were developed prior to the interviews; however all of the questions on the interview schedule were not asked, and some exploratory questions that were not part of the interview guide was used to allow flexibility in the responses of the interviewees. All the interviews were audio taped.

4.4.6 Interview with the Biology Teacher

A pre-interview before the treatment was made with the teacher in order to investigate the prior experiences, achievement levels, learning styles of the students, teaching strategies and assessment used by the teacher, and the views of the teacher about the MI theory and its implementation. See Appendix G for the Interview questions with the teacher. The interview with the teacher lasted approximately 45 minutes.

4.4.7 Experimental Classroom Observation

All of lessons of the MIBG were videotaped to record and study the behavior as it normally occurred.. Since interactions between the teacher and students can best be studied through naturalistic observation, non participant observation was used. The important criterions, which were observed, are: the students' participation, student-student interaction, student-teacher interaction, motivation of the students and approaches of the teacher to the students.

4.5 Research Design

In order to determine the main effect of Multiple Intelligences Theory and prefered learning style type, and interaction effect of these two variables, factorial design was utilized in this study. Because factorial designs permit the investigation of additional independent variables and allow to study the interaction of an independent variable with one or more other variables (Fraenkel & Wallen, 1996).

Table 4.3 Research Design of the Study

Groups	Prefered Learning Style	Pretest	Treatment	Posttest
MIBG	Diverger Accomodator Assimilator Converger	PRE-ATBS PRE-AT PRE-MII	MIBI	POST- ATBS POST- AT POST- MII
CG	Diverger Accomodator Assimilator Converger	PRE-ATBS PRE-AT PRE-MII	TI	POST- ATBS POST- AT POST- MII

As seen in Table 4.3 the independent variable, treatment has two levels-MIBI (X1) and TI (X2). The moderator variable, prefered learning style has four levels-Diverger learning style (DLS) (Y1), accomodator learning style (ACLS) (Y2), assimilator learning style (ASLS) (Y3) and converger learning style (CLS) (Y4). The reason for calling these variables "moderate" variables is in this design how one of the variables might moderate the other is investigated.

To examine the main effects of Multiple Intelligences Theory and prefered learning Style on dependent variables, ATBS, AT and MII were administered to all of the subjects in the study before and after the treatment whereas LSI was administered to all of the subjects in the study after the treatment.

4.6 Procedure

This is both quantitative and qualitative research including statistical data analysis, and interviews and observations, which was applied in 2002-2003 spring semester in Kdz Ereğli. The qualitative method was used complementary to the quantitative method. There were two groups of ninth grade students; experimental group, which was instructed with Multiple intelligences teaching strategies and a control group, which was instructed with traditional classroom techniques.

The start point was a search of related literature and research study. "Multiple Intelligences theory", "Kolb's Learning Styles", "science education", "biology education", and "diversity and classification of living organisms" were

used as the key words. After determination of the key word list, Education Resources Information Center (ERIC), Ebscohost, YÖK database, and online sources were searched for information. Search engines used for the online sources were Metacrawler, Yahoo, and Google. Moreover, Hacettepe Eğitim Dergisi, Eğitim ve Bilim, Çağdaş Eğitim Dergisi, and Fen Bilimleri Eğitim Konferansları were searched systematically. After receiving a financial support for this study as a research Project by ZKU, all of the related documents were copied from METU library, and TUBITAK Ulakbim. Moreover, a dissertation *Exploring Multiple Intelligences Theory in the context of science education: An action research approach* (Goodnough, 2000) and *the book Multiple Intelligences: The theory in practice* (Gardner, 1993) were requested from abroad. Also the books, *Frames of Mind: The Theory of Multiple Intelligences* (Gardner, 1983), *Multiple assessments for Multiple Intelligences* (Bellanca, Chapman & Swartz, 1997), and *Active learning handbook* (Bellanca, 1997) that were taken from METU library and *Eğitim-Öğretimde Çoklu Zeka Teorisi ve Uygulamaları* (Yavuz, 2001) that was bought were read carefully for the implementation of the theory.

Next, all of the instruments, teaching-learning materials and the lesson plans that would be used for the study were prepared. The topics included in the lesson plans were about the structure and functions of nucleic acids of "Fundamental Components of Living Organisms" unit and Biological Diversity, Classification of Living Organisms, Viruses, 5 Kingdoms (Monera, Protista, Fungi, Plants and Animalia) of "Diversity and Classification of Living Organisms" unit. In order to prepare posters for the first weeks of the treatment, the researcher searched for articles and news about the diversity of living organisms from different sources, such as *Yeşil Atlas* (Appendix O), and Hürriyet online newspaper (Appendix P), various pictures of different types of animals, and cartoons from the internet.

Three experts examined these MI based lesson plans and gave feed back. What they examined were: whether the activities in these lesson plans were appropriate for the ninth graders' level, whether the activities covered the objectives of the unit, and whether the activities were really related to the intelligences given by the researcher. In addition, two biology teachers were asked about the appropriateness of these lesson plans for the ninth graders' biology course. The

lesson plans revised according to the opinions of the experts and the teachers are given in Appendix H.

Before the treatment, the teacher was informed about the Multiple intelligences, its applications in different educational settings, the differences of the students from each other, the lesson plans developed for the treatment and the materials constructed by the researcher, and how to implement these MI based lesson plans and materials to the experimental group. Moreover, she was given some Turkish sources, *Eğitim-Öğretimde Çoklu Zeka Teorisi ve Uygulamaları* (Yavuz, 2001), "Çoklu Zeka Uygulamaları" (Selçuk & Kayılı, 2002) written about the MI theory and its applications.

After the application of MI inventory and attitude toward biology scale for all of the students participated in the study, the lesson plans about the structure and functions of nucleic acids were implemented for the experimental group at the beginning of spring semester of 2002-2003 academic year as a pilot study for decreasing the novelty effect of the MI based instruction. This pilot study lasted for two weeks. The classroom instruction period was two 40-minutes sessions per week. During this period the activities based on eight types of intelligences were administered to the students. Some of these activities were: Listening to a story of a space-creature who was sent to earth in order to investigate the differences and similarities among living organisms, composing music by using only four musical notes, "do, re, mi and fa" and playing this music for their classmates by flute, analyzing the parts of a nucleic acid, construction of a nucleotide by cutting papers used as bases, P, and sugar, making a DNA molecule by using the models of the bases (A,T, G, C), sugar and phosphate working in groups, sharing their ideas with their friends about which type of nucleic acid they would like to be and explaining the reason.

A pre-interview was conducted with the teacher in order to determine the current situation of her students, teaching strategies she uses, learning styles of the students, and opinions of her about the implementation of the MI theory. Just before the instruction of the lesson plans about the "Diversity and classification of living organisms" unit, achievement test was utilized as a pretest for all of the students participated in the study in order to determine whether there was a prior

achievement difference between the two groups. The instruction of this unit lasted for over 5 weeks. Before the treatment, multiple intelligences inventory, diversity and classification of living organisms unit achievement test and attitude scale towards biology as pretests were administered to both of the groups.

During the treatment, since the researcher was also working, only the experimental group's lessons were observed. Although the researcher could not observe the control group, she was in contact with the teacher about how the lessons in the control group were instructed.

During the treatment, both of the groups had the same learning objectives by the same teacher. As the teacher stated regarding the control group she lectured, asked questions to the students about the topic, wrote on the blackboard, gave examples from daily life, sometimes let them take brief notes and posted there questions to be answered as homework and used the laboratory for the observation of protests. The students listened to their teacher, answered the questions, took notes, and used the microscope.

Differently from the control group, the experimental group had a biology classroom in which the desks were arranged at a U shape, the walls were decorated with the posters, news, articles, pictures, and cartoons about the topic of the day and the materials used by the teacher or made by the students were saved.

For the first lesson the teacher and the researcher decorated the pale walls in the experimental group with "News" poster including news about bacteria, viruses, protests (see Figure L.1.1); "Let's smile" poster including cartoons about living organisms(see Figure L.3.2); "Our side" poster including articles and stories about living organisms, and "10 million species" posters including pictures of various types of living organisms (see Figure L.3.1).

In this group, lesson plans included activities based on various types of intelligences. Group work, cooperative learning, discussing, and peer teaching were some of the activities about social/interpersonal intelligence. In the first lesson, the classroom was divided into three heterogeneous groups; each of them consisting of 11, 10 and 11 students, respectively. The first group was asked to search for plants, the second group was asked to search for invertebrate animals, and the third group was asked to search for vertebrate animals. Moreover, an outline including what to

do during group work was distributed to all of the students (see Appendix K.12). They would make a group organization plan, gather their resources and would be ready for the presentation 3 weeks later. They would also have their writings, pictures, articles, cartoons, classifications about their topic posted on the walls. This was the main group work which enhanced the social/interpersonal intelligence of the students. They studied together, learned to listen to each other, helped each other, and shared leadership in different types of activities. For example; one of the group members wrote a poem, another group member composed it. Some of the group members took pictures of the plants or animals and others classified those pictures (see Appendix M.3.3 and Appendix M.3.4). Then after everyone decorated the walls with what they had prepared (see Figure L.3.11). Students also did some classroom activities and homework in groups ranging from 3 to 6 students. The arrangement of the desks had an important role for students to share their thoughts easily. They found out the biological and economical importance of the plants, filled in the classification units table with the animal names given, assessed the performance of their friends in listener-speaker-observer activity, reacted to the teacher when she said: "Today I feel myself too tired. Although I am very hungry, I do not want to cook when I go to home. Oh...speaking of which, I have already remembered the soup I had cooked four days ago. Yep, it was really delicious. I had really forgotten that it had been on the table since the day I cooked. Thanks God now I feel myself better now. I have something to eat when I go home" and explained what might happen to the teacher, if she would drink it.

Listening, reading, speaking, writing, communicating, debating, discussing, and playing word games were some of the activities used to engage the verbal/linguistic intelligence in the MI based classroom. For example, the students made connections between the concepts they already knew and the new unit in the "Listening-speaker-observer" activity, gave a name of a living organism starting from the letter that the teacher asked during the "From A to Z" activity, wrote a play about the investigation of viruses, prepared a word puzzle about the bacteria (see Appendix M.1.2), listened to the story of the "Little horse mackerel" and classified the invertebrate animals in this story, and wrote articles about the ecological, biological importance of the living organisms.

Classifying, differentiating, solving logic problems, experimenting, predicting, organizing, questioning, and finding the similarities and differences were some of the activities used in order to involve logical/mathematical intelligence. For example, students made a general classification of the living organisms that were named by their friends during "From A to Z" activity, differentiated the analog or homolog organs for the "Find the rule" activity, showed how one classification unit involved the other by the "Venn-diagram" activity, showed the common and different characteristics of the organisms studied (such as viruses & bacteria, fungi & plants, flowering plants & non flowering plants) on "Venn-diagrams", They guessed why the balloon got bigger during the "Let's revive the yeasts", classified the animals with respect to classification units on "classification units tables", classified the plants on the classification boards pasted on the board, walls.

Acting, cutting, pasting, moving for a purpose, making models, role-playing were used in order to include bodily/kinesthetic intelligence. For example, for "stand up" activity students were divided into 7 groups, named as "non-flowering plants", "open-seeded plants", "closed-seeded plants", "monocotyledons", "dicotyledons", "non flowering plants with veins", and "without veins" and when the teacher announced a characteristics, the group members having that characteristics stood up. Other examples for bodily/kinesthetic intelligence are, students cut seven pieces of papers from smaller size to bigger, each containing the other in order to show the classification units' relation with each other, cut the virus reproduction pictures which were in incorrect order and pasted them in correct order, made models (virus, bacteria model), role-played in the investigation of viruses, pasted the animal and plant pictures on the classification boards on the walls.

Singing, learning through lyrics, composing melodies or lyrics, listening to music, using rhythms were the activities to engage the musical intelligence in the classroom. The students learned the classification units by using the rhythm of an advertisement known as "direct drive", sang the song of "we are the viruses" with the melody of an advertisement known as "we are undergraduate students",

composed lyrics about the bacteria named as “The little bacteria” and invertebrate animals named as “the caterpillar”

Decorating, building models, using colors, visualizing, illustrating, drawing, reading pictures were the activities used for visual/spatial intelligence. For example, students made a comparison about the classification units by looking at the number of animal pictures, pasted on the “Classification Pyramid”, found out the error in the cartoons of “the joke of the earth worm to his friend” and “the tragedy of the caterpillar”, filled in the speaking balloons as they wished during the vertebrata cartoon activity, drew cartoons, drew bacteria pictures, drew what they saw under the microscope, took pictures of the plants and animals.

Collecting plants, insects, detailed observation, recognizing species, appreciating living organisms, analyzing similarities and differences, caring for plants, animals, and other organisms, protecting the environment, and classification were some of the skills that the teacher tried to improve of the students. They told the names of different species of dogs and brought river water, different types of cones, non flowering plants and invertebrate animals into the classroom. They had field trip, watched documentary films about the living organisms, gave examples about the classified plants and animals from nature, observed the invertebrate animal models and classified them, compared the gills of a fish and a mussel.

Working individually, expressing feelings, sharing experiences, and imagination were some of the activities used in order to involve intrapersonal intelligence. For example, they checked how well they understood the objectives of the lesson from the objectives list that was distributed to them, they expressed their own thoughts about whether they would wash themselves in the Ganj river as the Hindu people do, they talked about how they pick up the mushrooms, and filled in the KWL sheets with what they Knew, Wanted to learn before the topic of vertebrate animals, and what they Learned after the instruction of vertebrate animals.

During MIBI students enrolled in different types of activities related to eight types of intelligences. Needs and interests of them were taken into consideration. They were given opportunity to use and show their strengths. For example, at the end of the lesson about the viruses, students were encouraged to pre-select the

activity they would prepare for the next lesson about Bacteria (see Appendix K.6). The main purpose of this study was each student not only used their strong intelligences but also developed less-preferred intelligences.

The instruction lasted over 5 weeks, totally 11 hours in each of the groups. After the instruction, Multiple Intelligences Inventory, Attitude Scale toward Biology and Diversity and classification of living organisms unit achievement test as post tests and Learning Style Inventory were administered to both of the groups. There were also interviews with the students about the implications of MIBI on the teaching- learning process.

4.7 Analyses of Data

Both quantitative analysis including, MANCOVA, correlation and paired t-test, and qualitative analysis including content and descriptive analyses were used for data analyses.

4.7.1 Quantitative Analyses of Data

The data was collected from; Attitude scale toward biology, diversity and classification of living organisms unit achievement test , multiple intelligences inventory, and learning style inventory.

Data list, consisting of treatment (GROUP), preattitude (PRE-ATT), preachievement (PRE-ACH), premultiple intelligences overall score (PRE-MIS), prebodily/kinesthetic intelligence (PRE-B/KI), presocial/interpersonal intelligence (PRE-S/II), preintrapersonal intelligence (PRE-II), prelogical/mathematical intelligence (PRE-L/MI), premusical intelligence (PRE-M/RI), preverbal/linguistic intelligence (PRE-V/LI), previsual/spatial intelligence (PRE-V/SI), prenaturalist intelligence (PRE-NI), predominant intelligence (PDI), attitude (ATT), achievement (ACH), overall multiple intelligences (MI), B/KI, S/II, II, L/MI, M/RI, V/LI, V/SI, NI, MII, prefered learning style (PLS), concrete experience subtype of learning style (CE), Reflective Observation subtype of learning style (RO), Abstract Conceptualization subtype of learning style (AC), and Active Experimentation subtype of learning style (AE) were prepared by using SPSS in which columns

show variables and rows show students participating in the study. The statistical analyses were done by using SPSS.

4.7.1.1 Descriptive Statistics

The mean, standard deviation, skewness, kurtosis and the histograms were presented for the control and experimental groups.

4.7.1.2 Inferential Statistics

Multivariate Analysis of Variance (MANCOVA) was used for the data gained from ATBS, AT, LSI and MII scores in order to test the first three hypotheses of this study. MANCOVA is an extension of the Analysis of Covariance (ANCOVA). ANCOVA enables the researcher to adjust the posttest mean scores on the dependent variable for each group to compensate for the initial differences between the groups on the pretest which is called as covariate. The amount of the post test mean scores to be adjusted depends on the amount of the difference between the pretest means and the degree of relationship between the covariate and dependent variable. Differently from ANCOVA, MANCOVA incorporates two or more dependent variables in the same analyses; hence it permits a more powerful test of differences among means. Table 4.4 shows all variables and the variable set entry order that were used in this statistical analysis. As seen in Table 4.4, Set A including the covariates, PRE-ATT, PRE-ACH, and PRE-MIS was entered first. Set B including the treatment and preferred learning style was entered second in the analysis while Set A*B, covariate-independent variable (treatment and type of learning style) was entered third to determine covariate-independent variable interactions.

Table 4.4 MANCOVA Variable- Set Composition and Statistical Model Entry Order.

Variable Set	Entry Order	Variable Name
A (Covariates)	1st	X1= PRE-ATT X2= PRE-ACH X3= PRE-MIS
B (Independent Variables)	2nd	X4= GROUP X5= PLS

Table 4.4 (continued)

Variable Set	Entry Order	Variable Name
A*B (Covariates*Independent Variables)	3rd	X6= X1*X4 X7= X1*X5 X8= X2*X4 X9= X2*X5 X10=X3*X4 X11=X3*X5

This Set A*B must be statistically non significant for the MANCOVA model to be valid. After MANCOVA analysis, follow-up ANCOVAs were used for significant main effects.

Paired t-test was used for the data gained from the scores of each of the dimensions of MI in order to determine whether any dimensions of MI of the students were changed in MIBIG and CG, and the relationship among the eight intelligences and the learning styles was analyzed with Correlation by SPSS.

4.7.2 Qualitative Analyses of Data

The data was collected from the interviews with the experimental group students and biology teacher, and the observations of the experimental classroom.

The data gained from the interviews with the students was analyzed based on the descriptions stated in "Sosyal Bilimlerde Nitel Araştırma Yöntemleri" (Yıldırım & Şimşek, 1999). The steps that were followed are given below:

Data coding. Data coding was made according to the pre-codes determined by the researcher earlier. After the addition of other codes that were not involved in the pre-code list, the data was reviewed. Hence, the data was coded with respect to the total code list.

Generating categories. After determination of the common aspects of the codes gathered together, categories by this commonality were formed.

Organization and Definition of data by codes and categories. The data were organized and defined by using the quotes and presentation of the findings in order.

Comments and Discussion of the Findings. Relations among the findings were interpreted.

Descriptive analysis was used for the data collected from the interview with the teacher and the classroom observations.

4.8 Assumptions of the Study

1. Neither the researcher nor the teacher was biased during the study.
2. The teacher followed the instructions of the researcher.
3. Students in one group did not interact with the students in the other group.
4. The measuring instruments were administered under standard conditions.
5. The subjects of the study answered the items of the tests accurately and honestly.

4.9 Limitations of the Study

1. The results of this study are limited to 64 ninth graders in Ereğli high school in Ereğli, Zonguldak.
2. The study is limited to the unit of "Diversity and Classification of Living Organisms".
3. In this study Multiple choice diversity and classification of living organisms unit achievement test , based on verbal/linguistic and logical/mathematical intelligence, was used in order to meaure the achievement of the students. Therefore, the way the students' achievement was measured is limited with this achievement test .
4. The way the students' multiple intelligences were measured was based on multiple intelligences inventory, not their performances or activity preferences in the classroom.

CHAPTER 5

RESULTS

This chapter is divided into two sections; the first section presenting the quantitative analyses and the second section presenting the qualitative analyses.

5.1 Results of Quantitative Analysis

The results of the quantitative analysis include the descriptive, inferential statistics and the summary of the findings.

5.1.1 Descriptive Statistics

Mean, standard deviation, skewness, kurtosis, minimum and maximum scores related to the pretest and posttest scores on the ATBS, AT and MII, and LSI scores for the experimental and control groups are determined in this part.

Table 5.1 presents descriptive statistics related to the students' pretest and posttest scores on the Attitude towards Biology. The students' scores on the ATBS could range from 15 to 75 in which higher scores mean more positive attitudes toward biology, lower scores mean more negative attitudes toward biology. As seen from Table 5.1, the experimental group showed a mean increase of 3.41 from pretest to posttest whereas the control group showed a slightly mean decrease of 0.69 from pretest to posttest. According to Kunnan the values between –2 and +2 can be assumed as approximately normal for skewness and kurtosis (as cited in Aşçı, 2003). So skewness and kurtosis of the two groups given in Table 5.1 were accepted as normal for each of the pretests and the posttests. Table 5.1 also presents standard deviation, minimum and maximum values of the pretest and posttest scores on the ATBS for the experimental and control groups.

Table 5.1 Basic Descriptive Statistics related to pretest and posttest scores on the ATBS for the experimental and control groups.

	Scores on the ATBS			
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	55.22	54.53	58.78	62.19
Standard Deviation	8.15	7.59	6.92	6.16
Skewness	-0.26	-0.37	0.14	-0.51
Kurtosis	0.03	-0.14	-0.40	-0.18
Minimum Score	37	36	47	49
Maximum Score	73	68	75	72

Table 5.2 represents descriptive statistics related to the students' pretest and posttest scores on the students' scores on the diversity and classification of living organisms unit achievement test . The students' scores on the AT could range from 0 to 20 in which higher scores mean greater biology achievement. As shown in Table 5.2, both the control group and the experimental group showed a mean increase of 3.09 points and 5.85 points, respectively. It is seen that the experimental group students' achievement was higher than the control group students'. Table 5.2 also presents some other basic descriptive of participants like skewness, kurtosis, standard deviation, minimum and maximum values. As given in Table 5.2, skewness and kurtosis values between -0.44 and 0.25 could be accepted as approximately normal for each of the pretests and posttests.

Table 5.2 Basic Descriptive Statistics related to pretest and posttest scores on the AT for the experimental and control groups.

	Scores on the AT			
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	3.91	7	4.81	10.66
Standard Deviation	1.69	3.04	2.10	4.05
Skewness	-0.14	0.25	0.02	-0.02
Kurtosis	-0.25	-0.44	-0.41	-1.01
Minimum Score	0	2	1	4
Maximum Score	7	14	9	18

Table 5.3 presents descriptive statistics related to the pretest and posttest scores on the MII. The students' MII scores could range from 80 to 400 in which higher scores indicate greater level of intelligence. As seen from Table 5.3, there is a slightly mean decrease of 0.28 from pretest to posttest for control group's overall intelligence where there is a mean increase of 4.88 from pretest to posttest for experimental group's overall intelligence.

Table 5.3 Basic Descriptive Statistics related to pretest and posttest scores on the MII for the experimental and control groups.

	Scores on the MII			
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	253.75	253.47	268.78	273.66
Standard Deviation	41.29	37.24	30.82	37.01
Skewness	-0.04	-0.02	-0.01	-0.32
Kurtosis	-0.48	-0.91	-0.82	-0.10
Minimum Score	163	188	209	195
Maximum Score	341	320	324	345

Table 5.4 presents descriptive statistics related to the pretest and posttest scores on MII with respect to multiple Intelligences dimensions. The students' MI dimension scores on the MII could range from 10 to 50. For each of the intelligence dimensions higher scores indicate greater level of intelligence. Skewness and Kurtosis values for each intelligence dimension could be accepted as approximately normal for each pretests and posttests.

Table 5.4 Basic Descriptive Statistics Related to pretest and posttest scores on the MII with respect to 8 dimensions for the experimental and control groups.

Scores on the Bodily/Kinesthetic Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	32.44	31.81	35.84	35.03
Standard Deviation	5.55	6.28	4.69	5.53

Table 5.4 (continued)

Scores on the Bodily/Kinesthetic Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Skewness	-0.01	0.25	0.02	-0.23
Kurtosis	0.30	-0.30	-0.51	0.35
Minimum Score	20	20	26	21
Maximum Score	46	46	45	46

Scores on the Interpersonal Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	29.66	29.69	31.13	32.88
Standard Deviation	6.87	6.32	6.05	5.80
Skewness	0.06	-0.13	0.69	0.27
Kurtosis	0.25	-0.71	0.02	0.97
Minimum Score	16	17	21	19
Maximum Score	47	41	46	47

Scores on the Intrapersonal Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	32.34	32.63	33.22	33.31
Standard Deviation	6.20	6.17	4.78	5.64
Skewness	-0.37	-1.14	0.59	-0.34
Kurtosis	-0.89	1.23	0.25	0.12
Minimum Score	19	14	25	22
Maximum Score	42	41	46	45

Scores on the Logical/Mathematical Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	29.66	30.00	30.41	32.75
Standard Deviation	5.99	6.14	5.43	6.76
Skewness	0.07	-0.08	0.78	0.18
Kurtosis	-0.69	-0.47	0.91	0.23
Minimum Score	18	17	22	20
Maximum Score	41	42	46	50

Scores on the Musical Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	32.22	32.31	34.44	35.16
Standard Deviation	7.35	6.03	8.11	8.07
Skewness	-0.00	0.10	0.17	0.06
Kurtosis	-0.86	-0.14	-0.95	-0.92
Minimum Score	19	19	21	20
Maximum Score	46	44	50	50

Table 5.4 (continued)

Scores on the Verbal/linguistic Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	30.22	31.31	33.00	34.03
Standard Deviation	6.32	-0.54	-0,78	-0.25
Skewness	0.06	-0.54	-0.78	-0.25
Kurtosis	-0.22	-0.41	0.05	-0.34
Minimum Score	17	18	20	21
Maximum Score	40	39	40	44

Scores on the Visual /Spatial Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	37.72	31.16	33.41	33.06
Standard Deviation	6.95	5.07	5.85	6.40
Skewness	0.04	0.49	-0.45	-0.58
Kurtosis	-0.65	0.47	-0.50	-0.14
Minimum Score	18	20	21	18
Maximum Score	45	44	42	42

Scores on the Naturalistic Intelligence Dimension of MII				
	CG		MIBG	
	Pretest	Posttest	Pretest	Posttest
N	32	32	32	32
Mean	35.50	34.56	37.25	37.50
Standard Deviation	7.17	6.63	4.89	4.44
Skewness	-0.37	-0.24	-0.07	0.35
Kurtosis	-0.63	-0.31	-0.74	0.14
Minimum Score	21	19	27	29
Maximum Score	48	46	47	48

Table 5.5 represents descriptive statistics related to the pretest and posttest scores on LSI with respect to the ways of learning. The students' ways of learning scores on the LSI could range from 12 to 48. For each of the intelligence dimensions higher scores indicate greater level of intelligence. Skewness and Kurtosis values for each intelligence dimension could be accepted as approximately normal for each pretests and posttests.

Table 5.5 Basic Descriptive Statistics of the sub dimensions of Learning Styles for the experimental and control groups.

Scores on the Concrete Experience		
	CG	MIBG
N	32	32
Mean	25.91	29.91
Standard Deviation	7.66	8.76
Skewness	0.53	0.16
Kurtosis	-0.80	-0.92
Minimum Score	15	14
Maximum Score	41	46

Scores on the Reflective Observation		
	CG	MIBG
N	32	32
Mean	32.22	29.69
Standard Deviation	6.79	7.04
Skewness	-0.27	0.4
Kurtosis	-0.49	0.18
Minimum Score	18	18
Maximum Score	43	47

Scores on the Abstract Conceptualization		
	CG	MIBG
N	32	32
Mean	28.13	27.47
Standard Deviation	7.03	10.74
Skewness	-0.16	0.08
Kurtosis	-1.09	-1.11
Minimum Score	14	12
Maximum Score	40	46

Scores on the Active Experimentation		
	CG	MIBG
N	32	32
Mean	33.75	32.94
Standard Deviation	6.94	8.23
Skewness	0.08	0.02
Kurtosis	-0.55	-0.92
Minimum Score	19	19
Maximum Score	45	47

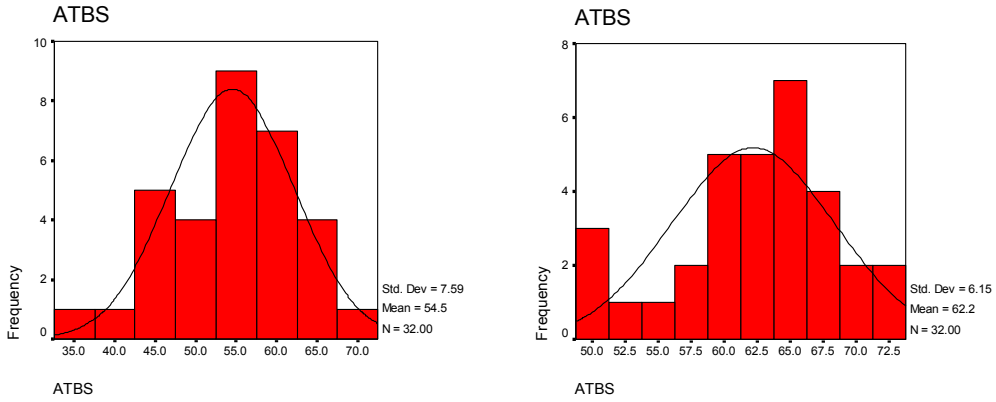
Table 5.6 shows the frequency and percentages of the learning styles of the students in terms of Convergent Learning style (CLS), Divergent Learning Style (DLS), Assimilation Learning Style (ASLS), and Accommodative Learning style (ACLS) in both of the groups. The percentages of DLS, ACLS, ASLS, and CLS were 37.5%, 28.13%, 21.88%, and 12.5% respectively in the experimental group.

The percentages of ASLS, DLS, ACLS, and CLS were 34.38%, 31.25%, 21.88%, and 12.5%, respectively in the control group. Hence, it can be said that the most preferred learning style in the experimental group was divergent learning style, whereas assimilation learning style was the mostly preferred style in control group. Convergent learning was the least preferred style in both of the groups.

Table 5.6 Frequency and Percentages of the Learning Styles for the experimental and control Groups.

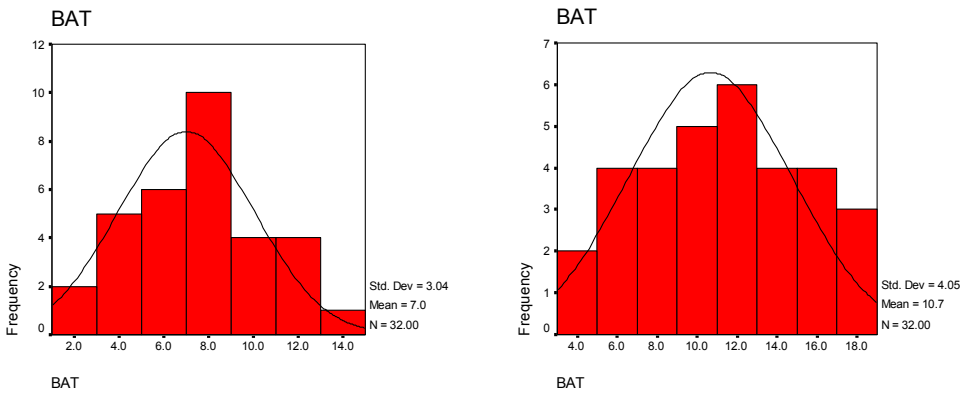
	Group			
	CG		MIBG	
Learning Style	Frequency	Percent	Frequency	Percent
CLS	4	12.5	4	12.5
DLS	10	31.25	12	37.5
ASLS	11	34.38	7	21.88
ACLS	7	21.88	9	28.13

Figure 5.1, Figure 5.2 and Figure 5.3 show the histograms with normal curves related to the POST-ATBS, POST-AT and POST-MII according to the experimental and control groups. The histograms seen in these figgures are an evidence for the normal distribution of the dependent variables.



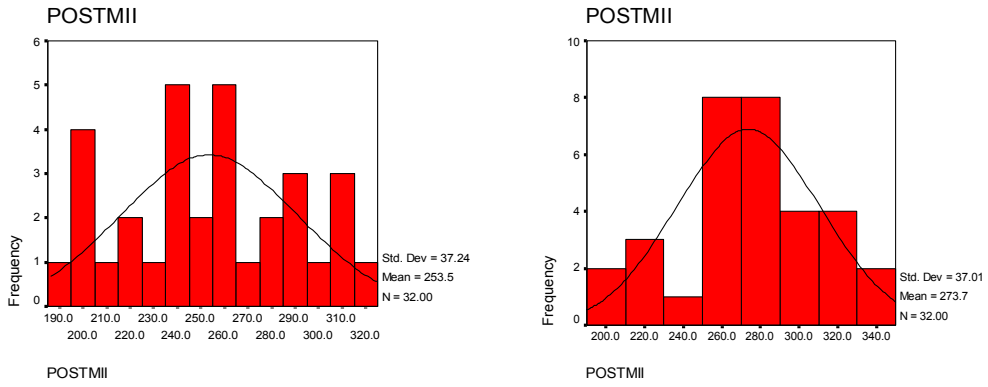
CG MIBG

Figure 5.1 Histograms of students' posttest scores for the ATBS for the control and experimental groups.



CG MIBG

Figure 5.2 Histograms of students' posttest scores for the AT for the control and experimental groups.



CG MIBG

Figure 5.3 Histograms of students' posttest scores for the MII for the control and experimental groups.

5.1.2 Inferential Statistics

This part of inferential statistics includes the determination of the covariates, the verification of Multivariate Analysis of Covariance (MANCOVA) assumptions, the statistical model of MANCOVA and the analysis of hypotheses.

5.1.2.1 Determination of Covariates

Three of the variables including PRE-ATT, PRE-ACH, and PRE-MIS were pre-determined as potential confounding factors of the study in order to statistically equalize the differences among the experimental and control groups. Because there should be a significant correlation between the covariates and the dependent variables, a correlation analysis was performed. The results of the correlation analysis and their significance levels are presented in Table 5.7. As seen in Table 5.7, since all of the variables in Set A were significantly correlated with at least one of the dependent variables of ATT, ACH, and MIS; they were determined as covariates for the following inferential analyses.

Table 5.7 Significicance test of Correlation between Covariates and Dependent Variables.

	Correlation Coefficients		
Covariates/DV	ATT	ACH	MIS
PRE-ATT	0.646**	0.281*	0.452**
PRE-ACH	0.044	0.177	0.248*
PRE-MIS	0.280*	0.238	0.730**

* Correlation is significant at the 0.05 level (2 tailed)
**Correlation is significant at the 0.01 level (2 tailed)

5.1.2.2 Assumptions of MANCOVA

Independency of observations, normality, homogeneity of regression, multicollinearity, and equality of variances are the five assumptions of MANCOVA.

For the independency of observations assumption, both the teacher and the researcher applied the tests to the students in experimental and control groups. It was observed that all the participants did the tests by themselves without being disturbed or interacting with others, so the observations were independent of one another.

Multivariate normality which the MANCOVA is based on implications that the sampling distributions of means of the each of the dependent variable in each

cell and all linear combinations are normally distributed (Tabachnick and Fidell, 2001). In order to test this normality assumption, the skewness and kurtosis values of the dependent variables given in descriptive statistics section were used. The skewness and kurtosis scores on the post test scores of ATBS, AT, and MII were in the acceptable range for normal distribution.

The regression between covariates and dependent variables in one group should be the same as the regression in other groups (Tabachnick & Fidell, 2001, p. 331). The more this assumption is violated, the more conservative MANCOVA becomes (the more likely it is to make Type I errors - accepting a false null hypothesis). In order to test the assumption that the relationship between covariate and the dependent variables must be equal for all groups (homogeneity of regression), three different sets were produced. Covariates were set into Set A, independent variables were set in to Set B and interaction terms of each of the covariates and each of the independent variables were set in to Set C. Then MRC was performed to test the significance of R^2 change using enter method for three dependent variables.

Table 5.8 represents the results of the MRC analysis of homogeneity of regression. As seen in Table 5.8 none of the Set Cs are significant. Therefore, homogeneity of regression assumption is satisfied for the MANCOVA model designed by the covariates PRE-ATT, PRE-ACH, and PRE-MIS.

Table 5.8 MRC Analysis of Homogeneity of Regression.

Model	Change Statistics				
ATT	R^2 Change	F Change	df1	df2	Sig.F Change
Set A	0.42	14.68	3	60	0.00
Set B	0.13	8.00	2	58	0.00
Set C	0.03	0.58	6	52	0.75
ACH					
Set A	0.12	2.83	3	60	0.05
Set B	0.14	5.36	2	58	0.01
Set C	0.08	1.02	6	52	0.43
MIS					
Set A	0.61	31.01	3	60	0.00
Set B	0.01	1.11	2	58	0.34
Set C	0.04	0.96	6	52	0.47

Multicollinearity is an unacceptably high level of intercorrelation among the independents, such that the effects of the independents cannot be separated. As a rule of thumb, intercorrelation among the independents above 0.8 signals a possible problem. To test multicollinearity assumption, correlations among covariates were examined. Table 5.9 indicates that there is no significant correlation higher than 0.8 between covariates. Therefore, this assumption was met.

Table 5.9 Correlations among covariates of the study.

Variables	PRE-ATT	PRE-ACH
PRE-ACH	0.06	
PRE-MIS	0.33**	0.12

** Correlation is significant at .01 level (2 tailed).

Box's M Test was used to check whether the covariate matrix was similar for each group (each cell in the factor design matrix). Table 5.10 shows Box's M is not significant (p=.49). This means the multivariate normality assumption was not violated. In other words, the observed covariance matrices of the dependent variables were equal across groups.

Table 5.10 Box Test of Equality of Covariance Matrices.

Box's M	55.22
F	0.99
df1	42
df2	1491
Sig.	0.49

In order to test the assumption of equality of variance, Levene's Test for Equality was used. As Table 5.11 indicates the error variances of the selected three dependent variables across groups were equal.

Table 5.11 Levene's Test for Equality of Error Variances.

	F	df1	df2	Sig.
ATT	0.93	7	56	0.49
ACH	1.13	7	56	0.36
MIS	1.16	7	56	0.34

As seen above, results of evaluation of each of the assumptions were satisfactory.

5.1.2.3 Multivariate Analysis of Covariance Model

ATT, ACH and MIS are the dependent variables of the study and PRE-ATT, PRE-ACH, and PRE-MIS are the covariates. Group membership with respect to the two groups (experimental and control groups) and PLS with respect to the four groups (diverger, accommodator, assimilator, and converger) were used as fixed factors of this study.

Table 5.12 presents the results of this MANCOVA Model. As it is seen from the table, rather than PRE-ACH, covariates have a significant portion in the model. The significancy of these covariates in this model is an evidence that the subjects of this study were adequately matched.

Table 5.12 Multivariate Test Results.

Source	Wilk's λ	Hypothesis df	Error df	Multivariate F	Sig.	Eta Squared	Observed power
PRE-ATT	0.65	3	51	9.27	0.00	0.35	0.99
PRE-ACH	0.87	3	51	2.51	0.07	0.13	0.59
PRE-MIS	0.55	3	51	13.81	0.00	0.45	1.000
GROUP	0.78	3	51	4.89	0.01	0.22	0.89
PLS	0.91	9	124.27	0.57	0.82	0.03	0.22
GROUP* PLS	0.85	9	124.27	0.96	0.48	0.05	0.37

*P<0.01 level

5.1.2.4 Null hypothesis I

There is no significant overall effect of treatment on the population means of the collective dependent variables of the post test scores of attitude toward biology, post test scores of biology achievement, and post test scores of multiple intelligences of ninth grade students when the effects of pre test scores of attitude toward biology, pretest scores of biology achievement and pretest scores of multiple intelligences have been controlled.

As seen in Table 5.12, this null hypothesis was rejected ($\lambda = 0.78$, $p = .01$). This means that there is significant mean difference between the posttest mean scores of ninth grade students exposed to MI based instruction and those exposed to traditional method on the population means of the collective dependent variables of the ATT, ACH and MIS.

"Effect size" is an important tool in judging effectiveness. Typically an effect size is expressed as a number between 0 and 1, with higher values referring to a finding of a large magnitude. One measure of effect size is eta-square, which is roughly equivalent to the R^2 used in multiple regression. As seen in Table 5.12, the eta squared of the observed treatment effect was found to be 0.22. This means 22% of the variance in this analysis was explained by the treatment.

Observed power in this model was found to be 0.89. This value indicates the high probability of detecting a significant effect when the effect truly exists in nature. In order to test the effect of the grouping factor on each dependent variable separately, a univariate analysis of covariance (ANCOVA) was conducted as follow-up tests to the MANCOVA. Table 5.13 indicates the results of the univariate ANCOVAs for each dependent variable.

5.1.2.5 Null Hypothesis 2

There is no significant overall effect of learning styles of ninth grade students on the population means of the collective dependent variables of post test scores of attitude toward biology, post test scores of biology achievement, and post test scores of multiple intelligences when the effects of pre test scores of attitude toward biology, pretest scores of biology achievement and pretest scores of multiple intelligences have been controlled.

As seen in Table5.12 this null hypothesis was accepted (λ= 0.91, p= .82). This means that there is not any significant mean difference between the posttest mean scores of ninth grade students with respect to their PLS on the population means of the collective dependent variables of the ATT, ACH and MIS.

5.1.2.6 Null Hypothesis 3

There is no significant interaction effect of the treatment and the learning styles on the population means of the collective dependent variables of post test scores of attitude toward biology, post test scores of biology achievement, and post test scores of multiple intelligences when the effects of pre test scores of attitude toward biology, pretest scores of biology achievement and pretest scores of multiple intelligences have been controlled.

As seen in Table 5.12 this hypothesis was not rejected (λ= 0.85, p=.48) meaning that GROUP and PLS of the students do not have any significant effect on ATT, ACH and MIS of the ninth grade students. If this interaction effect was significant then the effect of groups on dependent variables would not be interpreted without taking into consideration PLS. So it can be said that groups differ in collective dependent variables, regardless of PLS.

Table 5.13 Results of Univariate ANCOVAs.

Source	Dependent Variable	df	F	Sig.	Eta Squared	Observed Power
Corrected Model	ATT	10	7.86	0.00	0.60	1.00
	ACH	10	2.17	0.03	0.29	0.86
	MIS	10	9.34	0.00	0.64	1.00
Intercept	ATT	1	9.19	0.00	0.15	0.85
	ACH	1	0.13	0.72	0.00	0.06
	MIS	1	0.55	0.46	0.01	0.11
PRE-ATT	ATT	1	28.73	0.00	0.35	1.00
	ACH	1	0.88	0.35	0.02	0.15
	MIS	1	2.88	0.10	0.05	0.39
PRE-ACH	ATT	1	2.91	0.09	0.05	0.39
	ACH	1	0.04	0.84	0.00	0.06
	MIS	1	2.98	0.09	0.05	0.40
PRE-MIS	ATT	1	1.40	0.24	0.03	0.21
	ACH	1	0.56	0.46	0.01	0.11
	MIS	1	41.38	0.00	0.44	1.00

Table 5.13 (continued)

Source	Dependent Variable	df	F	Sig.	Eta Squared	Observed Power
GROUP	ATT	1	7.90	0.01	0.13	0.79
	ACH	1	9.30	0.00	0.15	0.85
	MIS	1	0.34	0.56	0.01	0.09
PLS	ATT	3	0.10	0.96	0.01	0.07
	ACH	3	0.45	0.72	0.03	0.13
	MIS	3	0.90	0.45	0.05	0.23
GROUP*PLS	ATT	3	2.05	0.12	0.10	0.50
	ACH	3	0.31	0.82	0.02	0.11
	MIS	3	0.33	0.80	0.02	0.11
Error	ATT	53				
	ACH	53				
	MIS	53				
Total	ATT	64				
	ACH	64				
	MIS	64				
Corrected Total	ATT	63				
	ACH	63				
	MIS	63				

5.1.2.7 Null Hypothesis 4

There is no significant difference between the posttest mean scores of ninth grade students exposed to multiple Intelligences based instruction and the students exposed to traditional classroom techniques on the population means of the post test scores of attitude toward biology when the effects of the pretest scores of attitude toward biology, pretest scores of achievement, and pretest scores of multiple intelligences have been controlled.

As seen in Table 5.13, this null hypothesis was rejected (p= .01). This means MI based instruction was effective in improving positive attitudes toward biology. The magnitude of the observed treatment effects (eta squared) and power for the ATT were 0.13 and 0.79, respectively. This means 13% of the variance in this analysis was explained by the treatment.

The value of 0.79 for power indicates the high probability of detecting a significant effect when the effect truly exists in nature.

5.1.2.8 Null Hypothesis 5

There is no significant difference between the posttest mean scores of ninth grade students exposed to multiple intelligences based instruction and the students exposed to traditional classroom techniques on the population means of the post test scores of diversity and classification of living organisms unit achievement when the effects of the pre test scores of attitude toward biology, pretest scores of achievement, and pretest scores of multiple intelligences have been controlled.

As seen in Table 5.13, this null hypothesis was rejected (p= .00). This means MI based instruction was effective in increasing the achievement of the students. The magnitude of the observed treatment effects (eta squared) and power for the posttest scores of AT was 0.15 and 0.85, respectively. This means 15% of the variance in this analysis was explained by the treatment. The value of 0.85 for power indicates high probability.

5.1.2.9 Null Hypothesis 6

There is no significant difference between the posttest mean scores of ninth grade students exposed to multiple intelligences based instruction and the students exposed to traditional classroom techniques on the population means of the post test scores of multiple intelligences when the effects of the pre test scores of attitude toward biology, pretest scores of achievement, and pretest scores of multiple intelligences have been controlled.

As seen in Table 5.13, this null hypothesis failed to reject (p=.56). This means MI based instruction was not effective in increasing the posttest scores of MI.

After the extraction of the effect of the covariate PRE-ATT on the dependent variable, ATT, estimated mean was calculated. These estimated means for ATT are given in Table 5.14.

Table 5.14 Estimated marginal means.

Dependent Variable	Treatment	Mean
ATT	MIBI	60.47
	TI	55.96

As it is seen in Table 5.14, the experimental group's mean was higher than the control group's mean. The mean differences between experimental and control groups on ATT, shown in Table 5.1 had been 7.66 before extracting the covariate effect from this dependent variable. After extracting the PRE-ATT covariate effect from the dependent variable, the mean difference between these two groups was 4.51.

Neither GROUP nor PLSs of the students had any effect on MIS. In order to test whether any of the intelligence dimensions of the ninth grade students' had any change, paired t-test analysis was conducted for the eight dimensions of MI in control and experimental groups.

Table 5.15 Paired t-test results for 8 dimensions of MI in CG.

	Paired differences					
	N	mean	SD	df	t	p
PRE-B/KI POST-B/KI	32	0.63	5.08	31	0.70	0.49
PRE-S/II POST- S/II	32	-0.03	5.78	31	0.03	0.98
PRE-II POST-II	32	-0.28	5.19	31	0.31	0.76
PRE-L/MI POST- L/MI	32	-0.34	5.30	31	0.37	0.72
PRE-M/RI POST- M/RI	32	-0.09	5.66	31	0.09	0.93
PRE-V/LI POST- V/LI	32	-1.09	5.21	31	1.19	0.24
PRE-V/SI POST- V/SI	32	0.56	5.46	31	0.58	0.56
PRE-NI POST-NI	32	0.94	6.85	31	0.77	0.45

As seen in Table 5.15, there is not any significant mean difference between any of the pre MI scores and post MI scores in the control group.

Table 5.16 Paired t-test results for 8 dimensions of MI in MIBG.

	Paired differences					
	N	mean	SD	df	t	p
PRE-B/KI POST-B/KI	32	0.81	4.90	31	0.94	0.356
PRE-S/II POST- S/II	32	-1.75	5.39	31	-1.84	0.08
PRE-II POST-II	32	-0.09	5.61	31	-0.09	0.93
PRE-L/MI POST- L/MI	32	-2.34	5.15	31	-2.58	0.02*
PRE-M/RI POST- M/RI	32	-0.72	5.28	31	-0.77	0.45
PRE-V/LI POST- V/LI	32	-1.03	4.37	31	-1.33	0.19
PRE-V/SI POST- V/SI	32	0.34	5.71	31	0.34	0.74
PRE-NI POST-NI	32	0.28	3.67	31	0.39	0.70

*significant at the 0.05 level

As seen in Table 5.16, the only significant difference seen is between pre-logical/mathematical intelligence and post logical/mathematical intelligence scores of the students. Correlations of the intelligences with the learning styles are given in Table 5.17.

Table 5.17 represents the correlation between the dimensions of intelligence and learning styles in both of the groups. As seen in Table 5.17, statistically there is not any significant relationship with the sub dimensions of intelligence and types of learning styles of the students enrolled in the control and experimental groups.

Table 5.17. Correlation between dimensions of intelligences and learning styles in control and experimental group.

	CG				MIBG			
Variables	DLS	ACLS	ASLS	CS	DLS	ACLS	ASLS	CS
B/KI	0.14	-0.27	0.27	-0.14	.00	.24	-.239	.000
S/II	-0.02	-0.05	0.05	0.02	-.02	.155	-.155	.015
II	-0.28	-0.13	0.13	0.28	.10	.120	-.120	-.101
L/MI	-0.14	-0.29	0.29	0.14	-.17	-.177	.177	.170
M/RI	0.10	-0.34	0.34	-0.10	-.10	-.055	.055	.100
V/LI	-0.03	-0.28	0.28	0.03	-.05	-.156	.156	.051
V/SI	0.20	-0.28	0.28	-0.20	.08	-.002	.002	-.079
NI	0.04	-0.17	0.17	-0.04	-.13	-.015	.015	.126

Since the diverger learning style is the sum of concrete experience and reflective observation, the accommodator learning style is the sum of reflective observation and active experimentation. The assimilator type learning style is the sum of abstract conceptualization and reflective observation and the converger type learning style is the sum of abstract conceptualization and active experimentation. A correlation analysis was used for determining whether there is any relation between the sub dimensions of intelligence and these subtypes of learning style. This correlation is given in Table 5.18.

Table 5.18 Correlation between dimensions of intelligence and subtypes of learning styles.

	CG				MIBG			
Variables	CE	RO	AC	AE	CE	RO	AC	AE
B/KI	-.122	.267	.057	-.18	.09	-.11	-.16	.21
S/II	.050	-.075	.13	-.12	.15	-.20	-.02	.04
II	-.117	-.127	.28	-.03	.30	-.25	.05	-.16
L/MI	-.011	-.112	.45*	-.33	.15	-.39*	.42*	-.39*
M/RI	-.069	.173	.23	-.32	-.04	-.07	.10	-.03
V/LI	-.125	.115	.22	-.20	.03	-.09	.21	-.23
V/SI	-.016	.203	.13	-.31	-.05	.16	-.10	.054
NI	-.070	.117	.09	-.13	-.08	-.05	.05	.066

*Correlation is significant at the 0.05 level (2-tailed).

As seen in Table 5.18, there was a positive correlation between logical/mathematical intelligence and the subtype learning style, abstract conceptualization in both control (r=0.45) and experimental group (r=0.42). Also

Table 5.18 indicates the negative correlations between logical/mathematical intelligence with reflective observation (r=-0.39) and between logical/mathematical intelligence with active experimentation (r=-0.39) in the experimental group. This means in the control group the ones with higher scores of logical/mathematical intelligence preferred abstract conceptualization learning style.

5.1.3 Summary of the Findings of the Quantitative Study

The results of the quantitative analyses can be summarized as follows:

1. The experimental group students experiencing multiple intelligences based instruction had significantly higher achievement when compared to the control group students.
2. The experimental group students experiencing multiple intelligences based instruction had significantly higher attitudes toward biology when compared to the control group students.
3. Multiple intelligences based instruction had no significant effect on the overall multiple intelligences of the students.
4. There was no significant difference in the mean of difference scores between students in terms of preferred learning style types with respect to the collective dependent variables of students' attitude, achievement, and overall multiple intelligences.
5. There was no significant interaction between treatment and preferred learning style types with respect to the collective dependent variables of students' attitude, achievement, and overall multiple intelligences.
6. There was not any mean difference between any of the pre and post MI scores in control group students experiencing traditional instruction.
7. Experimental group students experiencing multiple intelligences based instruction had higher logical/mathematical intelligence scores when compared to their prior logical/mathematical intelligence scores.
8. There was not any significant correlation between the learning styles and multiple Intelligences for the experimental group students experiencing multiple intelligences based instruction and the control group students experiencing traditional instruction.

9. There was a significant positive correlation with Abstract Conceptualization, the subtype of learning style and logical/mathematical Intelligence in both of the control and experimental groups.
10. There was a significant negative correlation with Reflective Observation, the subtype of Learning Style and Logical/mathematical Intelligence in the experimental group.
11. There was a significant negative correlation with Active Experimentation, the subtype of Learning Style and Logical/mathematical Intelligence in the experimental group.

5.2 Results of the Qualitative Research

In order to find out the effects of MIBI on students' learning experiences and teacher's teaching experiences, qualitative data was used. The qualitative data was obtained from the interviews done with the biology teacher and twelve students of her enrolled in MIBG, and the experimental classroom observations.

5.2.1 Results from the Interview with the Students

The students' original names were changed into the months of a year. Days of the week were used for the other students' names mentioned by these students. Hence none of the original names of the students enrolled in this study was used. During the interviews students were asked open ended questions about the MIBI, their learning style preferences and effects of MIBI in their biology course.The data obtained from the interviews with the students was analyzed by using content analysis which is one of the qualitative data analysis. The results gained may be categorized as: The differences between multiple intelligences classroom and regular classroom with respect to teaching-learning process, the physical appearance of the multiple intelligences classroom, teacher in the multiple intelligences classroom, and students enrolled in the multiple intelligences classroom.

5.2.1.1 The Differences between Multiple Intelligences Classroom and Regular Classroom with respect to Teaching-Learning Process

All of the students stated they preferred multiple intelligences based instruction to traditional instruction. They explained that the two methods were very different. The main differences revealed by the students were about the information sources and activities that enhanced their learning experience and teacher's teaching experience.

Most of the students referred to the textbooks as their sole source of information when they were making a comparison between MIBI and TI. "Not only were our biology course but also all of our courses based on the text books" said January. February explained the reason they were normally dependent on the text books, "Our teacher was giving us questions mostly covering the whole subject of the day and we were participating in the lessons by giving answers to those questions. These questions and answers of them were kind of a readiness for us for the lesson. We were finding the answers of the questions from our text books. We needn't use any different types of sources." She continued, "During this project I went to the library, searched from magazines, newspapers, other books and encyclopedias. I now believe that the textbook by itself is not enough for mastery learning". March is another student pointing out the text books as the main sources for them during the TI. In April's opinion, their lessons based on the traditional method were just a normal, ordinary course in which they were trying to memorize what the teacher was lecturing to them from their text books. May also stated, "We were in trouble about how we would memorize the subjects, concepts our teacher had lectured us". June mentioned, when he was answering the exam questions, he remembered the activities they did in the classroom. He stated, "Although those were written in our text books, it was hard for us to remember what was written there".

During the interviews, each of the students referred to different activities and the positive effects they had learning the material. They mentioned the creative and fun classroom activities they did which enabled them to understand and retain the information more easily when the MIBI was applied.

January mentioned how singing songs and composing helped them retain information while studying during the experiment. She even wanted to sing the "virus song" she created just after the interview. She really was very proud of her ability to remember the information and finding a way on her own that helped. "Not only we sang songs, but also took pictures, made research, prepared boards, read stories, interesting news, had group work" added January. She said, "Because we did different things everyday it was impossible to forget". In her opinion, MIBI was totally different in all aspects. June believes that MIBI helped them retain information and they learned better as a class. As he explained, "Differently from the TI, we classified the living organisms on the papers, on the board, pasted pictures of them, filled the worksheets given to us, worked as a group, made search, prepared our own files, used the microscope". He continued, "we saw the protests that we were used to see in our textbooks, under the microscope in real this time". He also mentioned that MIBI was more colorful and amusing. It encouraged and helped everybody participate. July also indicated that MIBI made the biology course much more amusing and understandable. She referred to the many activities that were used in class. She talked about the theatre, the stories, the puzzle, cutting and pasting pictures, making classifications on pieces of papers, cartoons on the board, and investigation as examples of the interesting activities they performed. "It was nice to play the game thinking ourselves as we were those plants and stood up with respect to the characteristics of us". April is another student who mentioned she had fun with the different activities such as writing lyrics, taking pictures and theatre. "I still remember the lyrics and all of the activities we did one by one"

The other common response was about the teacher lecturing and asking questions to the students and the students listening to her and answering the questions during the TI. There were also times that they were also asking the teacher the subjects about they did not know but August does not think that they learned well this way. According to her, since the class was not interested with the subjects in Biology course, the students were not participating. She reported that "I remember I was feeling myself uncomfortable at such kind of times". She believes that that they learned better with MIBI as a class. As she explained, "we prepared theatre, sang songs, wrote poets, worked as a group, drew pictures about the related

subjects. It was so nice". December is another student who did not think they learned well in the regular classroom. He said, "The only thing we were doing was just listening to the teacher". September also reported that they were listening to their teacher when she was lecturing. Sometimes they were asking questions or answering. During the implementation of the MI theory, they watched Cds, sang songs, role-played, collected pictures, composed, used classification tables, prepared information boards, and played games. October also stated how their previous biology course was boring. As he explained, the teacher was either lecturing or solving the problems and they were preparing 5 questions as homework for asking their friends during the instruction. He thinks MIBI including watching VCD, pasting the animal, plant and virus pictures, using the microscope, working as groups, bringing animals into the classroom environment, preparing those subjects helped them to learn more. He was remembering what they did in the classroom when he was studying at home. For example he still remembers the songs they sang. Agreeing with the fact that the teacher being a lecturer and the students being listeners, November indicated that there were so many students who were not listening to the teacher. She also added that they were answering the questions posted by the teacher so most of the time they were sitting at their desks during the regular lessons. According to her the lessons with MIBI were amusing. They were not the same. "Because we listened to music, watched VCD, did experiment, collected information, collect pictures. It was so beautiful". Along with her friends, March also noted that they were answering the teacher's questions. In her opinion, they became more active during the implementation of the MI theory. "We drew pictures, made models, wrote lyrics, had group work, which made us learn better" said March.

5.2.1.2 The Physical Appearance of the Multiple Intelligences Classroom

The students' observation about the appearance of their classroom was mostly about how colorful their classroom was.

January who pointed out that she loved the colors said their classroom was so nice that every part was full of colors: there were colorful flowers, animal pictures on the boards they prepared. She even remembered that they painted the

colorless dog into pink and black. As seeing the dog picture in her mind, her eyes shined, she smiled and with a lovely voice said how cute it looked. “It is impossible to express those feelings, I can say those feelings could only be lived. In short it was wonderful”, she continued.

May was a student who had positive feelings about multiple intelligences classroom in his words, “With this instruction it was like the sun had rised into our classroom. Everywhere was very colorful. I felt the spring in the classroom as well as we felt outside.”

February mentioned they decorated the classroom group by group. So the boards were colored with respect to the group’s subjects. There were posters, articles, pictures and cartoons they drew about the subjects related with the course. “I really liked the pictures on the walls” said January. Because everywhere in the classroom was full of those, she felt like they were entering into another room. “I realized we were doing something important. It was fun to be in that classroom.”, added February. April is another student who described the classroom as another room. In her opinion, their regular classroom was an ordinary classroom: colorless and faint. But the multiple intelligences classroom was a colorful, chirping and twittering class including the boards and the models. She said, “It was looking like a study room more than a classroom.” July’s opinions may be an expression to why April had thought their classroom was kind of a study room. “Not only were the walls, but also our blackboard also colorful. So seeing something related with the course around us, made us learn easier”.

The students had sit at their desks which were designed at the shape of “U”. There were three “U” shaped groups so the students had sat group by group. Although they were not as many as the ones who mentioned about the colors, a few students talked about the arrangement of the desks.

July is one of the students reporting the arrangement of the desks in their multiple intelligences class differently from the traditional class. April reported that since it was easy for them to share their thoughts with the group members, she felt herself as they were in a meeting saloon. June also mentioned how comfortable they felt themselves because of the new arrangement of the desks designed as groups.

5.2.1.3 Teacher in the Multiple intelligences Classroom

All of the students referred to their teacher lecturing, asking questions to them and answering their questions in front of the classroom in their previous biology course. March thinks because their authoritarian teacher was using the "grade notebook" for making them study, they were scared of her. April and July stated she was angry with the classroom if there were some students who did not listen to her when she was lecturing. "She was yelling us to be silent", continued July. Differently from the previous lessons, she was more docile and had calmed down during the application of the MI theory. As July mentioned, instead of lecturing and just asking questions, she activated them, "She was not asking as many questions as she had been doing before". March believes she was active because she had given them opportunity to select any activity they would like to do. All of the students talked about different types of activities they performed and liked. September also pointed out she became a good guide for them. She stated that they contacted to her not only in the classroom but also outside the classroom. "She just told us what to do and how", explained April. Agreeing with September and April, February also stated she helped them whenever they needed, self denying. She also stated how closer relations she had with them. "That is the main reason we felt ourselves comfortable", January expressed her feelings. July and August are the other students who mentioned about the close relation of teacher with them. She was dealing with them one by one. According to January and February, she behaved so special, so different to them that they felt themselves very special. January was thankful for her teacher for making them a "head crown" and have those nice feelings that they had never had before. "She never differentiated any of the students in the classroom", added February. As June mentioned, at the times he was not raising his hand, she was asking his opinion about the subject. Although she was trying to be sure everybody participated in her previous courses, it was hard because the students were not interested with the course.

5.2.1.4 Students Enrolled in the Multiple Intelligences Classroom

The interviews with the MIBG students revealed that MIBI had a positive effect on students' achievement, learning, participation, relationships with their friends, and psychomotor skills.

Achievement

All of the students mentioned they learned better with MIBI. Moreover when it was asked them mention the name of the unit that they learned best in their ninth grade biology course, they all gave the name of "diversity and classification of living organisms" unit. Some of the students highlighted that it was easier for them. For example, June still remembers the question about animal kingdom. "It was so easy for me to answer that exam question. I understood the subject so well that the probability I will answer a question about that subject in the university entrance exam would be high". January is another student stating she answered the exam questions about this unit easily. She even got 1-2 points more. Because it was easier to learn, July's grade was also higher than her first term grade. February also labeled herself more successful. "I was not a lazy student, I did not have poor marks before but I believe that I became more successful. As a lazy student may become a successful student, a hardworking student may become a more successful student" said February. In order to investigate whether their learning preferences were still the same, they were asked about their previous learning styles and current learning styles. So this part is divided into 2 parts including the students' pre-learning preferences and current learning preferences.

Learning preferences in the regular classroom

It was determined that most students referred to learning by reading the textbooks or what their teacher made them note at their biology classes when they were at home.

As September mentioned their teacher always wanted them to repeat. So she was repeating by reading and summarizing at home. She believed that she learned better when she was reading. October and March were also making repetition by reading as September was doing. June, August, May and November were the other

students who tried to learn by reading. April also stated she was mostly memorizing by reading at the place she sat. January started her talking about they were disagree with learning with memorizing. But as she continued, she stated that because just telling what remained in their minds in the classroom was not enough for them to learn, memorizing was a must". In her opinion they resembled a parrot memorizing the book. "I can say it was hard", added January. Agreeing with January and April about learning by memorizing, July focused they were dependent on their textbooks. Preparing questions from the text book was another way for her to learn.

February, October, November and May also were the students studying by preparing questions and answering those questions. April mentioned their teacher had told them it would be better for them if they prepared questions and answers of them. Though she believed it was better than memorizing, it was still as boring as memorizing. August's preference for studying was sometimes solving questions in the textbooks. As it is seen some of the students' learning preference was learning by thinking that they were studying by preparing questions and answering them.

November who was solving the tests at the back pages of the text book, mostly was telling to herself. Another student who mentioned she studied by herself was March. Differently from November, instead of telling to herself, she was testing herself by preparing an exam for herself. March said that their teacher thought that they would learn better if they tested themselves. So it was another advice of the teacher for the students to learn better.

Differently from the other students, February and September stated they learned better when they studied by writing. September was summarizing and February was studying by writing for all of her exams "but truth I had no willing for studying" added February. Because she was very bored of the biology course in which they were just listening to their teacher lecturing. She was in search of new seekings. She tried to have the exams with the information she learned by listening to her teacher but could not be successful. She also talked about she was asking the teacher the subjects that she could not exactly understood just before the exams.

Although August stated that their teacher had advised them to study by asking their friends, none of the students, rather than her did not mention that they were asking questions each other at their spare time.

Learning preferences in the multiple intelligences classroom

Although the students had mentioned that they learned by reading, writing, and thinking (solving problems and preparing and asking questions) just before the implementation of MIBI, during the MIBI in addition to these, they stated they learned by watching, doing, singing and feeling.

January believes that she learns better when she sees and lives. So it was easier for her to learn by watching and doing during the application of this study. The virus subject became so easy for her when she studied it by singing. She said, "I can say I even need not study much just before one night before the exam. It was like I was studying everyday". "It may sound funny to you but I even studied to literature course with music and got higher grade", smiled January.

Although it was so easy for them to forget if they did not repeat it, during the instruction of the MI theory May realized that he could understand biology so well. How he studied this time was trying to pasteurize what he read. Moreover his mind was kind of going to another world, feeling that he was a part of the subject during the biology lessons. Hence he believes that his retention level was higher.

December learns better when he sees and touches, so he thinks he learned best when he was watching VCD.

November is another student who thinks she learns better when she sees. She likes the pictures, and collects the pictures. Since she collected, pictures, and data, it was easier for her to learn. Another characteristic of her is she loves being in nature and watching living organisms around her. So *animal kingdom* was the subject she learned best. She also learned *fungi kingdom* very well because she had prior knowledge about the mushrooms in this kingdom. The reason for this is she was used to pick up mushrooms with her father.

According to September the way they learned was different from before. For example, she learned better when she drew pictures, studied by the melody and sometimes thought herself as being a scientist. Moreover there were times when she thought that she learned better when she was alone whereas there were times she learned better when she was studying with her friends.

Thinking the same with September about learning differently from before, July mentioned “This time when we were learning we were dependent on neither the text books nor the questions. We saw, made classifications, comparisons. We added something from ourselves. We acted, sang songs, solved puzzles, and pasted pictures of the animals and plants on the boards.” According to her learning by seeing was more comfortable and effective on learning and retention of the information.

April states she realized she could learn by seeing, doing, living and using her emotions. “I especially used my kinesthetic skills. Besides it was so much fun to deal with different things and have results.”

August said she sometimes learned the same way as she did before, but there were sometimes that she studied differently. Such as, filling in the worksheets that her teacher gave to them, solving the puzzles. “I sometimes tried to draw cartoons but of course I could not accomplish” smiled August. She mentioned she is used to watch documentary films so with the previous knowledge she had from those films, she also realized that she had so much information about the animals. “I felt like I had more prior knowledge than I guessed”.

October also stated that he learned the same way as he did before. Addition to his previous learning, he learned better by watching. It was nice for him to realize the connection between the outside world and the biology course.

Addition to his previous learning June liked studying from the files they prepared. For example, he learned better after he repeated ordering the binomial classification papers from species to kingdom at home.

March, May and February stated that they searched from different types of books. May picturized what he read from the books. February loved learning new information from other sources. “I know it is wrong but I was also reading about biology subjects at our other courses”. She started to not only searching from other sources but also taking the main points as notes. She said, “I had never taken notes by myself during the other lessons before”. She loved pasting pictures on the cardboards and taking notes on them by using colorful pens. She also believes that making practice was useful for increasing their retention level. “There is nothing like applying”, added February.

May, September, February and October also mentioned about learning in groups. May said they were making search as a group whereas February said the group members were coming altogether and discussing their subjects or homework before the Biology course for that day. She summarized her thoughts, “we started to learn systematically”.

Active participation

All of the students mentioned they were active during this unit. One of the reasons they were more active than before was, they had much more self confidence. What increased their self confidence was, they realized they learned easier by using their own strengths. The easier the subjects were to them, the more they participated during the courses. Here are the students’ opinions about their participation during the course:

January said, “I was silent and inactive until the time I took my friends’ attention with my strength on music. I even myself have never realized I had such kind of a strength. Before what music meant to me was only memorizing the notes”.

She said, “This MIBI made me say: I am this. This is me!”. Moreover she also mentioned how she took her friends’ attention as her participation to the course increased. They were saying, “Aha! Again January is talking”.

February is another student who realized she was good at writing poets which she had never tried before. “I was more active during this instruction. I really liked being able to do something. Because of my self confidence, I was comfortable on participation”. She also added, how special she felt herself when she was lecturing to her friends.

November stated that she was proud of herself when the teacher said she liked the cartoon she drew. She revealed that she was naturally shy and did not want to participate much, before. But MIBI made her participate more. “I raised my hand continuously”, said November. She continued, “I had self confidence that I could success. I even started to make plans in my mind about how I could do the best. I was not so before. I do not know why but I was too shy”.

April was also proud of herself realizing her strengths such as taking nice photos, and composing. She was glad to know that she was useful. “I said yea I

accomplished it". It was also nice for her to know that "she was there! as being an active member of her group". She also mentioned, "MIBI thought me to say: I am here!".

July said, "We students were the ones who were active, not our teacher". She also mentioned how singing songs sounded her bad at first because her voice was not that good but after starting to sing songs in the classroom with her friends, her self-confidence increased. Moreover she agreed with about being comfortable, "I was comfortable during this instruction, because learning better has increased my self confidence".

August also mentioned that they learned that they had different capabilities. Such as making models, writing lyrics. "I learned that I am better than I have been", said August.

Because December had previous knowledge and thought it was easier for him to learn, he raised his hand all the time. "I felt myself as I was hyperactive", said December. "I did not participate that much before", added December. Since June also thought he understood better, his participation level also increased. March said, "I had lack of confidence about participation with TI. I was scared what if my answer would be wrong. Then after I learned it was not a big deal to be wrong, I started to participate more".

July is the only student thinking that her participation was more before this instruction. "I participated more before, because the questions, the teacher asking us, were from the book, so it was easier for me to give answers of those questions which I had already memorized. During this instruction there was not any memorization".

January mentioned how responsibility is needed in MIBI. February said, "I had so much self-confidence that I was voluntary to have any type of responsibilities whether I could do or not. For example, I learned using the cam by myself." November also stated, "since you are supposed to have missions, you learn having responsibilities". August is another student who believes she became more responsible during the implication of the MI theory.

Speaking of the self-confidence, active participation and taking responsibilities, here are the opinions of the students about their leadership skills:

Most of the students mentioned about leadership skills of themselves during the implementation of the MI theory. May stated “In the previous biology course, I did not do the things that the others could not do. I was not so different from most of my friends but during the implication of the MI theory, there are times I felt myself as a leader. Such as, I felt myself as a leader when I was drawing the types of reproduction of the bacteria on the blackboard for my friends in the lesson”. He also underlined that at the times he had mastery learning, he felt himself as a biology teacher.

June also felt him as a leader when his friends were asking him questions. As he mentioned, during the times he was actively participating, his friends started to think “wow…..this boy knows well” and started to ask him questions. In April’s opinion, although solving the problems was making him feel as a leader in regular lessons, leadership feeling had not been as much as it has been with different types of strengths of her during the implementation of the MI theory. February also stated how she felt herself as being a person from the higher level. She also stated that being a leader does not mean being ahead of your friends. It was helping them for the motivation and guiding. The time November felt herself as a leader was when she had so much information about the subject invertebrate from different types of sources such as newspaper, encyclopedias, different books and brought so many pictures, cartoons. January is another student who believes multiple intelligences base instruction made her feel as a leader. “Before the implementation of the MI theory everybody was the leader of his/her own whereas I was the leader of my books. We had no idea about the leadership ship skills of ourselves and our friends.” This sentence of January means she not only felt herself as a leader but also realized the leadership skills of her friends”. Agreeing with January, September also stated the main leader of the classroom was February but they also were leaders time to time. Such as, since searching about the invertebrate was her job with her friend August, they had more information than the others in the classroom. According to her, because October collected the bugs, which she could never do by herself, he also was a leader. February was really good at writing lyrics. In short, “we completed each other”, said September. October also stated he was a leader in the classroom then he stopped and continued, “If we use the word of “leadership”, a

leader is only one person. But I can not say I was the only leader, we all understood". August also mentioned everybody was a leader at the subject they knew.

Attitudes

When talking about biology course with MIBI, all of the students mentioned the course was amusing. July believes that their biology course was full of fun with the different activities they did rather than being boring as it had been used to. November also agreed with July and said, "It was kind of a biology game not a biology course". When December also mentioned about the amusing games they played in the classroom, I asked to him whether they were childish. His answer was, "It is a game with the rules. The first rule is you have to have knowledge for playing that game. Such as you can not paste the animals into the right place, if you do not know whether it is in vertebrata phylum or not".

As mentioned by April, May and September, MIBI took their attention with the activities used. February also suggested the course should be enhanced with the activities in order to take students' attention and increase their enthusiasm as it was in their multiple intelligences based biology course. April said, "If something is applied over and over, we students get bored of it. So we need novelty, different types of activities in our courses". Because June learned better with the different types of activities used, he was more willing to participate. "I had lack of concentration especially close to the end of the previous lessons, but this time I did not want the lesson finish", added June. January mentioned she loved role-playing. "I have been dealing with theatre since I was in primary school. I am good at role-playing", January explained the reason the theatre activity took her attention. Moreover she had great pleasure because of the other different types of activities they did continuously. April also stated she never lost her enthusiasm during the biology course with MIBI. February also had a great enthusiasm to come to the multiple intelligences classroom. "I was looking forward to biology course dates. I did not want the term end, just because I did not want our multiple intelligences based biology course end", said February. One of her memories improves how this multiple intelligences based biology course was important to her. "I remember my

younger brother had thrown my file I was using in my biology course. I got so angry with him that we had an argument with him. I had to explain my parents how that file had a great importance in my life". She was so much interested with the lessons that she even was asking the teacher questions at break time. When I asked her, whether she had been doing that before or not she said she was used to but the number of questions she asked increased with this instruction. As October stated, because biology course based multiple intelligences was so amusing, he became more dependent to the course. It was not boring to him as it sounded before. So the more comfortable he felt, the more active he became. He also started to ask more questions during the biology lessons. December also referred to asking more questions during MIBI. Especially he was very curious when they had the balloon experiment with the yeasts. He also believes that multiple intelligences based instruction has changed his attitude toward nature. "A student in multiple intelligences classroom starts to love and conserve the living organisms", he said. July also mentioned that she started to like biology course more with an increasing interest towards living organisms, especially the plants. "It was nice to investigate the plants around us when we were walking on the road".

In Turkey, at tenth grade students make department preferences with respect to the jobs they would love to have. The departments include Turkish-Mathematics (TM), Turkish-Social (TS), Mathematics (M) and Science (S). February said, "If I had chosen Science, it would be just because of biology course with MIBI". January also stated how multiple intelligences based biology course was different for him when compared with the other courses. "It has had "a different meaning for me. If I would not be choosing T for the next year, I am so sure that I would like to be a biology teacher".

Interaction among students

Almost half of the students indicated that they helped each other. They helped to each other in different ways. Such as studying together, motivating and encouraging each other about the course and the participation.

January mentioned how she tried to help her friends like biology. As she explained, "I was making them study the songs I composed and try to understand

the lyrics and relation of those sentences with our subject". "I treated them as if they were my siblings rather than friends", added January. April and December stated the help of October. He helped April at the time she was preparing lyrics. February also referred to her friends helping her. Their subject was "invertebrate". Though she had thought that everybody would focus on their own subjects, even other groups' members April and March helped her so much whenever she had problems. March was her favorite friend to whom she asked questions. January also stated the interaction of different groups with each other. In her words, "We were both rival and friend groups with the other two groups. We were asking questions to each other".

March also mentioned that since she did the classifications and the Venn diagrams better than her friends, she helped them if they were in difficulty.

As they were divided into three groups, February had thought that it would be so hard for her to study with her group friends. Because her close friends were at other groups and she did not know the group members that well. Moreover she was selected as the group president. Hence she felt like she would have the whole responsibility, but she was wrong. What exactly she had done was only helping to her friends.

In her opinion her friends were too passive in all of the courses, "kind of invisible in the classroom". She told them how amusing this biology course would be if they participated. She also told it would be hard for them to understand just by watching without doing anything. During the times all of the group members of the other groups were participating, but only two-three from their group, she was feeling herself bad. Soon she arranged a meeting for the group members. This was especially for boys. Because according to her, girls were already responsible, "this is a general characteristic of the girls", said February. After then, other friends also started to participate. They even started telling subjects. She expressed her feelings as, "I was lost in amazement when I saw I motivated them". "We did this altogether" added February.

April also talked about how Monday motivated her for writing lyrics and the theatre. It was a nice feeling for her to realize that she could do it and shared it with her friends.

February also talked about one of her friends, August, who was living in a village. She was a good friend but she was very silent. She was too passive in the lessons. February says she can not say she never participated but it was so rare she did. She agreed that there were times she was talking but she was not that much efficient. She even was not talking with any of the friends in the classroom. She was sitting alone at the break times. When February became the group president, male friends offered her to be her assistant. She did not want to be. February encouraged her and she became active in the lessons. Moreover, she started to participate more in other courses, too. February thought to herself that she was good at encouraging her.

August also agreed with February that she helped her. She also stated she helped to her. “We learned our missing points from each other”, added August. January also agreed with August and stated that the most important part was being altogether. “We shared our thoughts”, said April.

February realized that she even started to talk with her friends that she had never talked before. Especially with her male friends. For example, although Tuesday and December were at different groups, they started to ask her questions. According to her the reason they asked her was she was active in biology course in this unit. This feeling increased her self- confidence. Helping her friends gave her pleasure. By time they became so good friends that they even started to call each other.

Students also talked about they started to know each other better. They realized other ways of their friends that they had never expected something from them before the instruction of this unit. Stating that she realized the strengths of some of her friends, January said that she started to think what they would be doing in the future.

All of the students interviewed with gave her name because of her compositions, lyrics and singing. Here are the own sentences of February for her close friend January: “January took my attention when she first played flute. She is a good friend of me and I am so sure that she would be angry with me if she had heard but I can say that she was not active in any of the courses before. She changed very much in biology course”.

The other students talked about are given below:

December and April had positive impacts on February with the virus models they made. Wednesday and May are the other students astonishing her in this unit. They had considered their role for the theatre so important that they had got the aprons from other teachers. Besides, December, Wednesday and May were too passive before this instruction. She also stated that she had never seen April and March so dominant in any of the courses. She also loved the cards April prepared. January stated, "April was kind of the photographer of the year with the alive colored flower pictures she took". October thought Thursday's bacteria reproduction model was a good model. August remembers the puzzle Friday prepared. Before this instruction, some of the students had no enthusiasm toward biology course. They were bored especially at the times the teacher was lecturing but with this instruction participation level of the students increased. November, June, Saturday and Monday are her friends who became active during MIBI. Agreeing with August, January's thoughts about the participation of her classroom friends are, "Everybody may not be perfect but I can say they were great. I really can not describe with the words. It can only be lived. It was kind of a legend. I do not want to exaggerate but it is the truth that, some of my friends who were so silent and reading from the book just because the teacher wanted them started to lecture sing songs during the biology course". She gave September as an example. Although she was too inactive before, she accompanied to all of the songs sang in the classroom. "Even though she was another group's member, she sang our group's song with us" said January. April also mentioned how everybody was more interested and had effort for doing something, for learning. For example, October was very silent before but he took role in the theatre. November also talked about one of her classroom friends whom she realized that he was trying to do something and participate. This student was Sunday who was hard to be labeled as a student. Before this instruction biology course had no meaning for him.

Another point January and March referred to was having responsibilities. January said she realized that she was not an individual in the classroom. They were a team as a classroom in which all of the members had responsibilities to each other. "The more you take responsibilities, the higher confidence you have" said

January. “Not only our self confidence but also confidence to each other increased”, added March. They started to listen to each other carefully. December said, his friends were correcting him if he was telling something wrong. So they were helping him to learn where he was wrong.

Psychomotor skills

Some of the students mentioned about the effect of MIBI on their bodily/ kinesthetical skills. April said that she realized she could do other things which improved their kinesthetic skills. Although September reported that she did not like playing with the pasteboards, MIBI would help them to improve these psychomotor skills of them. May mentioned what exactly he liked was making model and it was nice for January to learn how to use technological vehicles, such as cam in biology course. March also stated that some of naughty friends in the classroom who did not want to sit at their desks in regular lessons liked making models and playing the game “stand up” in multiple intelligences classroom.

5.2.2 Results from the Interview with the Teacher

A semi-structured interview was conducted just before the application of MI based instruction in April. This interview consisted of two parts. In the first part of the interview it was aimed to determine the prior experiences, prior achievement, learning styles, evaluation of the students, and teaching strategies, and methods used by the teacher. In the second part, it was aimed to determine the views of the teacher about the MI theory and its implications.

The first question of the first part was about the prior knowledge and experiences of the students about the unit “diversity and classification of the living organisms”.

The teacher said, “Most of the students come from the village and some of them work at the gardens their parents have. Hence they may have the general characteristics of some of the living organisms but they have no idea about systematic classification”.

Then the teacher was asked to answer their prior science courses including the diversity and classification of living organisms. She said “I assume they start to

learn everything from the beginning. Since the education system is based on rote memorization, they do not remember anything belonging to their prior education. I sometimes say them they had learned those when they were at secondary school but they say they have forgotten".

The next question was about the objectives of the teacher in this unit. Here are the objectives she mentioned: To make the description of the systematic classification, to comprehend the living organisms around us, to comprehend how those living organisms are classified, to learn the classification units starting from species to kingdom, group the living organisms in these units, and to describe the similarities and differences among the living organisms.

How the teacher teaches this unit was the fourth question. She said, "Although I want to use different strategies, instructions, techniques, I can not apply those because of the physical limitations and lack of opportunities. Hence I mostly lecture and ask questions to the students. But I can tell students do not learn well this way. Last week I wanted my students to make a cell model by using plastic bottle, and clays in order to make them realize the three dimension of the cell. They think the cell is very straight and flat. I can say they liked it. There are also times I narrate the subjects. It is not something planned before the lesson. The story occurs to my mind at the time I am lecturing. They enjoy listening to it. The problem is if I ask about that subject later on they tell me the story I told them, not the scientific concept they are supposed to learn"

Since she mentioned about the narrating, whether she had ever tried that during the unit of "diversity and classification of living organisms" till that time was asked her. She said, "The ninth grade students were used to have studies for Atatürk Commemoration and Youths and Sports Festival. Hence it was hard to find students at schools. When they were back since they were in a hurry for catching up I was just lecturing. This really upsets me. This is the first time that our students will not go to studies for the festival so I believe that I will really be able to teach this unit well this time".

The next question was about the evaluation of the students. "We four biology teachers in this school work cooperatively. We prepare common plans and written exams for our students. But I do not only use the written exams for the

evaluation, I also spend 5-10 minutes times for the oral exam. I ask questions to the students about the previous lesson. This way I can determine the missing points. I also have another style. I want students to prepare questions and answers of them from their text books. I gave tasks to some of the students in the classroom for checking. They tell me the ones who have not done their homework. I talk to those and motivate them to make their homework for the next time.

When she was asked the effectiveness of this method, her answer was, "In fact it is hard to differentiate the students at first, but I can do that in 1-2 months time period. Because they attempt to take their friends' homework. As I notice those, I talk to them and try to make them get used to do their homework by themselves. I can tell that the ones doing their homework regularly have higher grades"

The learning styles that the students are used to use was another main question that was asked to her. She started saying that, "They do not have so many books, sources except for their text books. Some of them have different types of books including multiple choices, but the number of those students in a classroom is not more than 10. Hence since they are dependent to their text books, they are not so well prepared for the courses. At first, they were used to summarize. I told them summarizing is not an effective way. Because what they were telling to me was, although they had presented the subject to their mother, or sister/brother, at the time they were having exam they could not answer the questions. The main reason why they could not succeed was although they knew the subject; they were not good at answering questions just because they did not understand the question. But as they started to prepare questions and the answers they were used to the types of the questions that might be asked to them. It was effective for them to prepare the questions by themselves after reading the chapter".

Whether they were studying by themselves for learning was a tag question asked to the teacher. She said they could study with their parents or siblings. The difference was before they were taking the book into their hands and memorizing. They even were not checking the tittles of the parts they were reading. But this way, answering to the questions was the main point instead of reading or telling.

Moreover, I advice them to watch the documentaries and read the biological research published in the newspapers and magazines.

The eighth question was asked to teacher in order to make her describe a lazy student. Here are her own sentences: “When we say a lazy student, what I mean is a student who is unprepared and uninterested for the lesson. This may be false but within the education system we are involved in, that’s how I see. A student who does not do her/his homework, does not study for the exams is a lazy student”. She continued, “I am aware of the fact that we do not take into considerations the needs and interests of our students in this education system. They tell this to us time to time. They talk us about the schools having computers, televisions in the classes. They say what we do is just lecturing and wanting all of those information back from them. They have complaints about not being able to learn without seeing”.

The next question was about the achievement of the students in other courses. The teacher said, because of the restoration of the building she did not have a detailed information about the students’ success in other courses but in general according to her the ones who were successful in biology were also successful in other courses.

The last question was the factors effecting the student achievement. In her opinion lack of physical conditions, opportunities were the main reasons. She finished her sentence by saying, “There are not any curious students left in our education system. Even if there are we are so close to lose them”.

The first question of the second part was about the views and opinions of the teacher about MI. She said “I have had no information about this theory before. I learned from you that there are at least eight types of intelligences defined by Gardner. The theory focuses on different ways, interests and learning styles every individual have. In fact every body should focus on that. In my opinion, teaching by using MI will provide an effective learning for the students. I sometimes share what I have learned and read about this theory with my friends. There are only a few of my friends who were really interested with this theory. The majority believes it is hard to change this education system we already have. They are closed to learn the current teaching learning theories. To me this is one of their major missing points”.

The second question asked to the teacher was about her expectations from MI. Her answer was “I exactly do not know what exactly I expect. I just wish we had better physical conditions in our school. I still feel myself uncomfortable because of the inefficiency of the physical needs. I am so sure that the theory will take attention of the students very much but I am afraid the implication of the theory will be limited with only this unit. Truth I want the learning to be permanent. I also wish I could apply the theory for the tenth and eleventh graders”.

Then last question was about the factors that might limit the implementation of the theory during the research. She said, “The main limitation will be because of the physical conditions. You will prepare special materials for the students for taking precautions but I will not be able to apply this environment for my students after this research will be finished. Moreover I know students will be supposed to make search but our students are not good at searching topics, subjects posted to them. They even do not know how to use the library. For example, once I had wanted them to search for meiosis division, they came back to me telling that they could not find. I mean everything should be ready for them; they are used to take everything from their teachers. I know they must be leaded for search but although we have computer laboratory at our school, it is not used because of lack of computer teacher. You may say they can read newspapers but it is hard for a student to read newspaper whose father does not buy newspaper. They even are in difficulty when they are buying university entrance exam preparation books. Another limitation may be the time. The courses in our school are all teacher-centered and there are times I need to repeat a topic, a subject, a concept over and over for being sure that they understand. Hence I believe that we also may have time problem for them to comprehend the information. The activities will take much time”.

5.2.3 Results from the Classroom Observations

Due to a restoration at the main Ereğli high school building during the second term of the 2002-2003 academic year, the students had to move to the Ereğli Imam Hatip high school building. This school had not received this many students in years, and the building itself had fallen into neglect. The classrooms were in poor condition because of the absence of students for such a long time period. This was

easily noticeable by the lack of paint and upkeep of the desks and walls. The size of the class was approximately 4X7m. There were big windows which let the sun come into classroom without the curtains. The students were supposed to have their lessons at this school building temporarily while the main high school was renovated.

During the MI based instruction, the class was divided into three groups; each of them consisting 11, 10 and 11 students, respectively. The desks in the classroom were arranged in a U shape. The first group of students sat at the left side of the U shape, the second group sat at the right, and third group sat at the bottom of the U shaped formation of desks. That way it would be easier for them to work in groups and share their thoughts with their friends. The empty unpainted walls were filled with the posters including current events, articles, the students' own compositions, pictures, and cartoons which were changed by the groups with respect to the subject of the day (see Figure L.3.11).

The teacher centered education changed into student centered education in this classroom environment during this research. It was observed that the role of the teacher being a lecturer evolved into a guide, motivator, and a facilitator (. It was observed during the first two weeks of the study, that there were five students who kept trying to take notes, but as the time passed, these a few students stopped taking down notes from the blackboard. The students spent most of their time with different classroom activities during the treatment. They willingly and actively participated in all of the activities. They seemed to enjoy what they were engaged in. There were times when the students worked alone as well as in groups. They looked comfortable in their biology lessons based on MIBI. Some of the activities they worked alone in are as follows:

- They typed the classification units on the colorful cards they prepared. When they were writing those units, some students were mumbling the rhymes they had already learned,
- After preparing their cards, they sorted them in order (see Figure L.5.2)
- They drew Venn diagrams for showing which of the classification unit involves the other (see Figure L.2.2),

- They wrote the parts of the viruses and the bacteria on the pictures about the reproduction of viruses (see Appendix M.3.1),
- They looked at the pictures, made comments and then sorted them in order (Figure L.2.3 and Appendix M.3.1),
- They drew what they saw under the microscope (see Figure L.3.13),
- They drew a daisy and a mushroom picture in to their notebooks,
- After listening to the teacher and their friend's small presentations, they used their stickers for making classification of the plants on the colorful papers given to them (see Figure L.5.9 and Figure L.8.2).
- They filled in the Venn diagrams about the plants (see Appendix M.2.1 and M.2.2),
- After listening to the story of "Little Horse Mackerel", they filled the classification papers with the name of the invertebrate organisms in the story,
- They wrote what they knew and would like to learn about the animal kingdom,
- They gave numbers to the groups from simple to complex (see Figure L.2.7 and Appendix M.8.4).

When they were working alone, the teacher ensured each student was completing the assignments (Figure N.2.1 and N.2.2). Although they were supposed to work alone, there were some students who preferred working with their peers sitting next to them. It was an advantage for the students to ask their friends for help in completing their missing parts or asking about the parts that they could not do. For example, some of the students who could not complete all of the classification groups on their own stickers were able to when assisted by their friends.

Other activities students worked in groups are:

- They chose the plants included in the groups that the teacher grouped them in (see Figure L.6.2),
- They listed the biological and ecological importance of the plants,
- They filled in the classification units tables with the names of the animals written,

- They observed the invertebrate animal models, classified them and filled in an observation report (see Figure L.2.6),
- They sorted animals from simple to complex and prepared information chains (see Appendix L.5.10).

The teacher's role during the group activities was very important. When the students were supposed to be engaged in a group activity, she was reminded them not to work individually, guided them to work in groups, share their thoughts with each other, and give decisions altogether as a group, not individually. She also checked whether all the group members were participating. Students seemed they were having fun to work with their peers. There was not any one student who was not involved in the group activities. Everyone participated and stayed focused on their tasks. They were sharing their thoughts and having discussions. They were giving their discussions as a group not individually. Some of them were checking what they were doing from their text books. If they had some problems that they could not solve within their group, they asked other groups for assistance. If they still were not sure, then they asked for the teacher's help. The teacher was available and provided assistance, but did not give them the exact answer. Instead, she guided them to find the answer on their own.

Their group works also worked well. All of the groups tried to do their best. They used multiple research sources, created pictures related to their topic, prepared different types of posters, wrote lyrics, sang songs, wrote poems, asked riddles for their classmates, watched CDs about their subjects, and had field trip. During the preparation period they showed what they had prepared to the teacher and asked for her feedback, they helped each other and studied together. At the end of 6 weeks, they had formed closer relationships within the groups. It was observed that the group members were ready for the presentation. They were extremely knowledgeable about their subjects that they correctly answered every single question posed by the teacher.

The students demonstrated personal responsibility during this research. They did whatever they were supposed to do. They were initiative and actively participating during MIBI. Several examples can be presented to support this observation:

- They had homework regarding the relationship of proteins, carbohydrates, nucleic acids, cell types, and cell division within living organisms. Since they had studied those concepts, the speaker-listener-observer activity worked well.
- Each of them brought the colorful cards cut in various sizes that they were supposed to do for the classification units in their biology classes.
- Each of them brought the other cards they cut in the shapes as the teacher had described.
- One created a play, and her friends acted out the parts (see Figure L.5.3 and L.5.4).
- Though they were not that skillful, they were willing to act in the play of the investigation of viruses. Moreover, four students had leaves on their pockets representing the tobacco plants in which the viruses were investigated, they used a pink box made of a cardboard as a Millipore filter, one of the "scientists" in the play used the projector as an electron microscope, and a virus model made by one of her friends as the virus that was investigated in the play (see Figure L.5.3).
- One wrote a composition about her feelings regarding a scientist who wants to exterminate all kinds of bacteria in the world. Three of her classmates' role played what she wrote. The scientist wore a white uniform; the bacteria talking to the scientist had masks on their eyes. The useful bacteria's mask was green whereas the harmful bacteria's mask was black (see Figure L.5.4).
- They made virus models (Appendix M.5.1),
- One of them made the conjugation model (Appendix M.5.2),
- One of them made an asexual reproduction model of the bacteria by using play dough,
- Two of them had drawn the shapes and the reproduction of the bacteria on the pasteboards (see Figure L.3.7) and made a small presentation about the reproduction for their friends on the blackboard (see Figure L.3.5 and L.3.6).

- They searched for the answers of the questions from different types of sources (Figure L.1.2). For example when trying to guess why the dinosaurs were vanished but not the bacteria, Anıl told his friends and the teacher about the reason based on what he had read ,
- They drew Venn diagrams for showing the similarities and differences between the viruses and bacteria (Figure L.2.4),
- They solved the puzzle their friends prepared at home (see Appendix M.1.2).
- They filled the blanks in the tree diagram sheet as homework (see Appendix M.3.2)
- They made the bread get moldy,
- They decorated the walls with the posters they prepared as a group work (Figure L.3.11),
- Group members were well prepared for the subject of their group (Appendix M.1.4, M.1.5, and M.2.3),
- Group members made small presentations about what the teacher wanted them to explain.
- They cut the animal pictures and pasted them into right places as homework (see Appendix M.8.4).

They seemed to lose track of the time during the lessons, and no students were looking at their watches in anticipation of the break time. Even when the class bell rang, the students did not attempt to leave. They were still interested in the subjects they were working on. For example, while trying to solve multiple choice questions about the bacteria, the bell rang for recess. The teacher let them go out, but the students spent the time trying to find the right answer on their own during the break. They liked the fact that they were understanding, learning and solving any kind of problems by explaining the reasons. One of the biology lessons had started 10 minutes later than normal because the exam the students had just taken prior to the lesson had taken more time. That day when the bell rang, the students behaved as if the bell did not ring. They continued working on Venn diagrams about the plants with great enthusiasm. In another biology lesson they were

observing the protests under the microscope. It was observed that when the bell rang, the students made a line for observing the Protests one more time instead of running toward the door to leave. During a lesson concerning an experiment about yeasts had ended, most of the students spent their break time looking, touching, and sharing their ideas and questions about the experiment with their teacher and friends. General observations about the students during the break times reveal that the students spent their time in the classroom were reading articles or the news on the posters, studying the pictures, and talking about their group work. While it was observed that certain students preferred certain activities over others, there was not a single student sitting at their desk alone.

The students also showed a great interest in helping each other. Some examples of how they helped each other are stated below:

- During the speaker-listener-observer activity, there was only one group including 3 students who were not well prepared. After finishing her group work, one member of another group went into that group and helped her friends to make the connections.
- One of the students said the order of the classification units to his friend when they were drawing Venn diagrams.
- One of the students showed her friends in her group how to write the names of the animals into the Venn diagrams they already had drawn
- Enjoying the observation of the protests under the microscope, one of the students drew what she saw into her notebook and showed her friends what they were supposed to see.
- When one of the group members, selected by the teacher, pasted the classification groups on to the pasteboards on the walls, she asked for help in pasting the pictures.
- When the groups were selecting the examples that were involved in their group, a student wanted her friend's help to go and look for a plant's picture on the blackboard because she could not decide whether it was in their group or not.

The students' enthusiasm also carried over into their participation levels and showed them asking different types of questions related with the topic of the day. Here are some of the questions they asked:

- When it was said that two different species can not reproduce, a student asked about the horse and the donkey.
- When the topic was the endospors, one of the students asked about the bacteria left on the window after cleaning.
- When the teacher mentioned an euglena had contractile vacuoles, one of the students asked whether all of the other one-celled protests had it. Because she thought that all were living in the ponds and needed to collect unwanted water from inside the cell and discharge it to the outside.
- Another student's question about the blue-green algae having multiple nuclei was which of the nuclei of a blue-green alga controlled the division of a cell.
- The experiment concerning the yeasts especially held the students attention. They were particularly fascinated with seeing the balloon get bigger. This caused them to ask so many questions. Some questions were about whether the balloon might explode, or lose air if they waited for a long time period, or how long the yeasts might be alive inside the balloon.
- One of the students talking about the poisonous jelly fish was curious whether it was actually a jelly fish.
- Another student's question was about why the ring worms do not die when they are cut.
- One of the group's grasshopper model had 7 legs. It was a production error. When they were observing the animal models; that group's members asked about the possibility of having one more leg in real life.
- When they were looking at the project pictures of the animals included in the arthropod class and comparing the insects and the spiders, one of the students asked the name of the animal that looked like a spider. The classroom was willing to share their thoughts with their friends. They all

were trying to guess the animal. At last some of the students using their text books found out that it resembled a tick.

The teacher seemed to enjoy the students' participation and questions. She would make remarks such as, "your friend asked a good question", but she preferred to let the students find the answers to the answers by themselves instead of answering them directly. When making summaries, she either asked questions to the students or made them complete the sentences about the previous lessons. The participation level of the students was extremely high. They were raising their hands or completing the teachers sentences in unison. This is a sign that the students were remembering the new concepts they had learned during the previous lessons. For example, when the teacher started her sentence saying, "There are 5 kingdoms. These are from simple to past....." the students completed her sentence together.

The teacher was good at giving instructions to the students about the activities and patient to allow enough time for them to finish their activities. As the students worked on their activities, she checked all of the groups or the students individually.

- She examined the drawings of the students about the daisy and the mushroom,
- She checked and made sure each student was writing about what they knew and what they wanted to learn about the animal kingdom.
- When the students were drawing what they saw under the microscope, she guided them to compare their drawings with the ones in their text books, and find out the names of the organisms that they saw under the microscope.

During the observation of the protests under the microscope, she also checked the preparatory in every 2-3 minutes in order to make sure that all the students saw the protests. Moreover, those students that said they could not see the protests very well were given more time and instruction by the teacher so they could see them more clearly. She gave clues to help the students when they had problems, performed an incorrect action, gave wrong answers, or could not give an answer. She was a good guide for the students during this research. As the groups or individual students finished their activities, she summarized those parts. During

these summations, she showed transparencies to the students, used the finished activities of the students as the summaries, or used the materials prepared by the researcher. Some of the examples are:

- As the students determined the order of the virus reproduction, she used one student's finished activity as a sample. She showed another student's finished activity that displayed the correct order, but was not pasted in a circular way. This meant that diagram did not show the viruses spreading out into the other bacteria cells (see Figure N.2.4).
- When they all finished pasting, she summarized the reproduction of a bacteriophage by using a sheet prepared by a student (see Figure N.4.1) .
- After the students filled the classification unit tables, she let them paste the animal pictures on the classification pyramid on the wall in front of the class (see Figure L.5.1).
- After the students wrote the plant classification groups on the stickers, she let the group members paste the classification groups they prepared on the cardboards at the right and left side of the blackboard in the correct order (see Figure L.3.10).
- After the students filled the Venn diagrams about the plants, she let them to tell the similarities and differences of each. She wrote what they said on the diagrams, and asked the students paste those Venn diagrams on the walls in order to allow the students to reference them whenever they needed.

She used all the materials taken into classroom by the students, such a virus model when summarizing the characteristics of the viruses (see Figure N.4.3). She listened to the lyrics carefully and checked whether the lyrics were totally correct biologically, and asked questions about the lyrics. She asked another student represent the conjugation model he made to his friends (see Figure L.5.5). She captured the attention of the students with the question "which colors of strings has your friend used for the representation of each of the bacteria's DNA?" She gave two of the students' posters in order to make them see closer when they were drawing on the blackboard (see Figure L.3.8). She also took an active role with the students when she became the speaker of the theatre play about the investigation of

viruses. She copied the bacteria puzzle created by one student, and wanted all of the students to solve the puzzle as homework. She showed the common fern that the group members had brought and asked questions about the brown dots on it, roots, stems and the leaf-like fronds. She also used the pine-cone, earthworm and the insects (Figure L.8.3) they brought into class. She used the ideas of the group members for the presentation of related subjects. She wanted the group members to approve the examples given by their class mates. She read their cartoons, listened to the poems they wrote, and used the spider map that was prepared by the second group members (see Figure N.5.1) and the classification poster related with the vertebrate animals that was prepared by the third group members (see Figure N.5.2). She made them post their posters on the walls and motivated the students to read each of them. She also learned the group names and checked their group files.

The teacher also used her emotions to express ideas and control the class. Although the class reading activity started immediately after a very energetic group study, the tone of the teacher's voice made all of the students keep quiet and listen to her carefully. When she finished reading the story, one of the students mentioned she felt like she would cry. The teacher seemed to be very pleased with the participation of the students.

The experiences and the prior knowledge of the students were also taken into consideration by the teacher. They talked about the gills of the mussel and the fish, different types of dog species, food poisoning, and their memories about jelly fish. They discussed the brown spots under the leaves of a common fern, the mushrooms they picked up, jelly fishes, and the worms living in apples. A student seemed to enjoy talking about the documentary he watched about the round warms. They enjoyed drawing a daisy and mushroom in their notebooks. They liked sharing their experiences with their friends and the teacher. Especially a student talking about how she picked up mushrooms with his father had never been so active till that time.

One interesting observation was made during a small presentation conducted by the first group. The third group tried to motivate their friends to raise their hands while the questions were being asked by the first group. It was nice that they tried to

be as active as the first group for that lesson. There was a nice rivalry between the groups.

The students were extremely interested during the lesson lectures and listened to their peers, other group members, and teacher very carefully.

- During the first lesson in the topic of classification, there was a sound coming from the outside the classroom. Thinking that it was a bird, the teacher asked how those birds might be classified. The class focused on the sound and altogether replied that it was a frog not a bird. Then the teacher corrected the sentence and asked how those frogs might be classified.
- Just after the virus song they sang, the teacher mentioned the viruses use their enzymes for entering into the cell. Some of the students had a conflict in their mind, because the virus song they just sang had the lyrics "we are the compulsory parasites which do not have enzyme systems". Hence they cried, "But they do not have enzymes".
- When the teacher was summarizing, the students listened impatiently and finished the teacher's sentences before she had finished summation. For example, after watching the VCD about the viruses, one of the students completed the teacher's sentence about the number of viruses in a bacteria cell. He was the one saying that there are 300 viruses in a bacteria cell.
- This happened especially during the times the teacher was talking about a group's subject. The group members, too impatient to wait for her, completed her sentences during the discussion.
- During one of the activities, the students were supposed to select the invertebrate organisms' names in the story of the little horse mackerel. Although the students were listening to the teacher carefully (see Figure L.1.5), the teacher realized that they missed some of the names. Hence, she offered to read the same part one more time. The students were glad for the offer and in unison said "Yes".

The students carefully watched and listened to the other groups' findings and the presentations of their friends and the teacher. After the small presentations of their classmates, the teacher would ask the other students questions about that

presentation and checked whether they had listened and understood. During those times the teacher seemed pleased to realize that they were listening carefully, and adding their own ideas about any missing parts. She was continually saying "well-done, very good" to the students as they participated. They easily found and corrected any incorrect parts. For example:

- When the groups were supposed to find the biological and ecological importance of the plants, the first group had found four, the second group had found three and the third group had found two usages. As the first group member counted down the different usages they had found, one of the students from a different group added one more category,
- When one of the students said the plants may be divided in to two parts; one with veins and one without veins, the students altogether corrected the order, and stated it should be reversed and go from simple to complex,
- During the "choose the plants included in your group" activity, the monocotyledon group focused on the leaves and assumed that the olive and willow had parallel stems. These were the examples they had chosen for their group. The other group members corrected them saying that monocotyledons do not have wooden stems. They also had corrected a fault of another group.

They were not only listening but also watching carefully. Such as:

- The students watched the VCD about the viruses so carefully that they were willing and able to answer all of the questions the teacher asked them about the viruses.
- They also watched and listened to the play about the investigation of viruses very carefully. Even though their classmates were not experienced actors, they still got the main ideas from the play.
- The demonstration of the yeast experiment and observing the protests under the microscope were the other two activities that captured most of the students' attention (Figure L.2.5). Each of the students observed the protests under the microscope carefully. It was realized that this was the first time the students had used the microscope. In the beginning, some of the students

did not understand which of those views contained the protests. The teacher wanted them to focus on the ones moving. They were very interested when the teacher started to lecture about the general characteristics of those living organisms. They listened to her carefully and again completed her sentences by using their experiences they already have had.

- They seemed interested with the cartoons, "The joke of the earth worm to his friend", "The drama of the millipede" and "The fear of the ants". They said, "It can not be an earth worm if it does not have a head part", so they offered to change the name of the cartoon to "the joke of the worm to his friend". Moreover, they stated the cartoon should be drawn again, because worms live in the intestines. Looking at the second cartoon, one of the students mentioned the name; "The drama of the millipede" would be fine if there were two pairs of jointed legs to each segment. Since there were one pair of jointed legs to each segment, they offered changing the name to the "The drama of the centipede". In the "Fear of the ants" cartoon, they agreed the ants had 3 pairs of legs, a head, and a body part.

They had great enthusiasm for this lesson. They were ready for the lesson to begin as soon as the teacher entered the classroom.

- Realizing that she is good at composing and singing, one of the students had made a search about the usage of viruses from different sources,
- Most of the students stood in line over and over again to see the protests under the microscope. Some of these students mentioned how fast they were moving, and one of them described the shape of the protest she saw by using her body language (see Figure L.5.6).
- They were really willing to go and paste the animals on to the classification pyramid board. Especially they did not like not being selected when the teacher had selected another student for pasting the animals,
- When one student was pasting the animals on the board, the other students sat at their desks and checked to make sure it was right and corrected if they found something wrong,

- When students were working in groups about the plants, a student came into the classroom and said they were looking for a voluntary student on duty, but nobody wanted to go. Although the teacher chose some of the students, they refused to leave the classroom. They all seemed to be enjoying the lesson and were more interested with the group work rather than the volunteer opportunity.

Even the teacher realized how interested they were during the treatment. In some of the lessons, she asked students whether they realized their friends' great enthusiasm and participation during that lesson. It was a nice motivator for the students to be noticed by the teacher.

Since there were many different types of activities for each topic; there were times that the classroom was buzzing. However, this was never a handicap for the students because they shared their ideas with their classmates, discussed them with enthusiasm, and moved freely in the classroom. When the students were working in groups, they were only talking about one topic and not any other subject. An example of this was demonstrated during the "choose the plants included in your group" activity. While the groups were presenting the plants they chose for their group, there were comments from the other students. Those students were sharing their thoughts with their group members, finding the missing or wrong points of the other groups, and warning them of the mistakes with great willingness and enthusiasm.

One important observation was that the students seemed to learn during the lessons. Here are some of the examples:

- It was really easy for them to solve multiple choice tests about the classification of living organisms. They not only selected the correct answer, but also explained them logically. Such as, they agreed that the legs of the living organisms in the same phylum were not the same. One of the students explained that although the whale and the wolf are in the same phylum, whales do not have legs. They also agreed that their feeding may be different from each other. Another student said elephants eat plant, wolves eat meat. They said they may have different colors, but also agreed that they

have the same characteristics within the phylum. For example, cats, dogs, and wolves are all mammalian, and they all have vertebrata.

- The teacher seemed shocked when one of the students explained the reason a Hindu does not get ill washing himself or herself in Ganj. She asked whether she had heard about it before or watched a documentary film about it. The student said she just guessed.
- It was observed that the teacher was saying "well-done" to the students most of the time. For example, Students were so good at filling the Venn diagrams about the plants that when those diagrams were completed the teacher said "well-done, you learned very well".

It was observed that the students enjoyed moving in the classroom. Some of the bodily/kinesthetic activities that made them move in the classroom were:

- They played the game "stand up if this is your characteristic" (see Figure L.5.8). It seemed they loved playing this game. There were groups sitting or standing up with respect to the characteristics told by the teacher. Then they were checking which of the groups were standing up and warning those that should not have stood up.
- During the activity "choose the plants included in your group", they moved to the blackboard in order to differentiate the plants included in their groups with respect to their veins, roots, and stems. Although at first there were only a few students looking at the pictures pasted on the blackboard, the teacher motivated them to use the pictures by showing the ones at the blackboard. She asked, "Have you noticed what your friends are doing?". After replying that they were looking at the leaves and the stems, the other students also started to use the pictures in order to see the parts of the plants in details (see Figure L.3.9).
- As all of the groups formed by the teacher completed their activity, they came in front of the classroom one by one and read the plants they chose, explained the reasons why those were chosen, took the plant pictures from the blackboard, and pasted them onto the pasteboards. The second group seemed very proud of themselves when they gave their presentation to the

class. After one of those group members told the plant names, they congratulated each other.

In one of the lessons the students had the opportunity to choose the activity they wished. This way, they had an opportunity to learn to use their strong intelligences, and show this to their friends. With the other activities used in the other lessons, the students not only used their strong intelligences, but also improved their weaker areas. They seemed to like using their strong areas and sharing these areas with their friends, and learning more about their friends' strengths. For example, the class loved listening to the songs of "The little bacteria" and the "The Caterpillar". After listening to "The Caterpillar" song, they said, "wow, it was nice". The class also had fun singing the song of "Viruses", and ordering the classification units in a rhythmic way. They were putting those steps in order whenever it was needed. It was also observed that as the time passed, they started to use this rhythmic pattern of putting things in order if it was called for. For example, they used it for the classification of the living organisms, and reading the groups they sorted from simple to past.

5.2.4 Summary of the Findings of the Qualitative Study

The results of the qualitative study about the implementation of MIBI and implications of the MI theory on the teacher and the students can be summarized as follows:

1. The teacher's role being a lecturer changed being a guide, motivator, and a facilitator. Instead of lecturing most of the time, she guided and motivated her students to be engaged in the activities and learn by themselves. She guided the ones in need of her help and checked all of the activities done by the students.
2. She realized the differences among her students and was interested with what ever they had prepared.
3. They learned the "Diversity and classification of living organisms" unit easily. When they were asked to mention the name of the unit they learned best in their ninth grade biology course, all of the students in the classroom

gave the name of this unit. During the interview, some of the students stated the high retention level of themselves about this unit.

4. The students felt themselves more successful. Some of the students mentioned they got higher points from their last biology exam than their previous exam and some mentioned about their biology grade being higher than the first term grade.
5. Different types of activities based on eight intelligences gave students opportunity to use not only their strong intelligences but also their weaker areas.
6. The students experienced using different types of learning styles that they had never used before. Although the students mentioned that they had learned by reading, writing, solving problems, and preparing questions and answering them, during MIBI in addition to those, they stated they learned by watching, doing, singing, feeling and cooperative learning.
7. The teacher realized the students learn in different ways.
8. The students' self confidence increased. Realizing their own strengths, they felt themselves important and different from their friends. There were times they felt themselves as the leader of their friends. This self confidence made them feel themselves comfortable in the lessons. The more they felt comfortable, the more they actively participated.
9. They had great enthusiasm for the lesson. They were ready for the lesson as soon as the teacher was entering into classroom. They all tried to actively participate with willingness in all of the activities. They enjoyed what they were engaged in. They were not aware of the time during the lessons. No disturbing behavior was observed. There were times there was a buzz in the classroom but it was just because the students were sharing their ideas or discussing when they were working on their activities. Moreover, their enthusiasm made them ask more meaningful question during their biology classes.
10. The teacher was satisfied in her students' enthusiasm. As the students mentioned, rather than being an angry authoritarian teacher using her grade

notebook in order to make them study, she was lovely and understandable toward them.

11. The students realized not only their own strengths but also their classmates' strengths. They used the strong points of each other. Such as in their group study, a student was responsible for collecting the invertebrate animals and bringing into the classroom, another was responsible for writing a poem, and others were responsible for composing it...etc.
12. Their cooperative skills were improved. They shared their ideas and learned to listen to each other carefully. They also helped, motivated, and encouraged each other.
13. They had closer relations with their classmates and the teacher.
14. They had fun during the lessons. Moving in the classroom, singing songs, listening to the songs their classmates composed, observing the invertebrate animal models were some of the activities made the lesson amusing.
15. The students learned to have responsibilities. They did whatever they were supposed to do. Such as, they made small presentations, prepared posters for the classroom, and searched from different types of sources.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

This chapter includes the conclusions drawn from the results of the quantitative and qualitative research and discussion of these results, internal and external validities of the study, implications and recommendations for further researchers.

6.1. Conclusion and Discussion of the Findings

When trying to grasp the notion of human intelligences, the question of "Are the intelligences learned or are they due to genetic differences?" is often asked. As cited in Gray and Viens (1994), Hatch and Gardner point out that, individuals are born with potential in all intelligences. They then develop this initial intellectual profile depending on the cultural, local, and personal contexts within which they grow. What is considered intelligent in one culture may be inaccurate or inappropriate in another culture. Thus, while particular intelligences might be highly evolved in many people of one culture, those intelligences might not be as developed in the individuals of another. For example, a society in the South Seas may value the ability to navigate through island passings using the stars, just as Western society values the ability to write a symphony or perform open heart surgery (Gardner, 1983).

In this study the most dominant intelligence in control and multiple intelligences based group was found to be the naturalist intelligence. As the teacher mentioned during the interview before the treatment, most of the students' parents in these two groups are villagers. Hence these students are used to work in their gardens and farms. Moreover, Ereğli by itself is a natural beauty where in, green of the different types of the trees mainly the pine trees and blue of the sea and the sky is mixed together. In this small town, as the spring starts, families spend their

weekends in the forests, near the riverside or sea sides. Role-playing going to the picnic with their families is a common game among little children in Ereğli. The government of Ereğli is also very sensitive about the conversation of natural beauty of Ereğli. There has been strawberry festival organized by the government in order to motivate the cultivation of a special strawberry species in every first week of June. During this week the government also organizes picnic, trekking, and hiking to different parts of Ereğli. In addition, in ten years time the seaside at the centre of Ereğli also has been restorated and now whatever the season is you can see the green plants and colorful flowers around. This seaside is the place where the youth and most of the people love spending their time.

Differently from this result, Gardner believes because native wilderness areas are rare today, and youth spend their time in air conditioned malls, playing sports in suburban fields or courts, today's youth have a few opportunities to make sense of the world of plants and animals, and develop their naturalist intelligence (Hoerr, 1997).

In this research musical and bodily/kinesthetic intelligences were the two following dominant intelligences in multiple intelligences based group whereas intrapersonal and musical intelligences were the two following dominant intelligences in control group. The common points of these two groups were the higher frequency of the naturalist and musical intelligence than the others and no frequency of the logical/mathematical intelligence. Teele's (2000) study on the determination of dominant intelligences of the students by using Teele Inventory for Multiple Intelligences (TIMI), pictorial inventory based on seven basic intelligences, showed that students at the primary level had a strong preference for verbal/linguistic and logical/mathematical intelligences than students at the middle and high school levels. Bodily/kinesthetic and musical intelligences were two of the most preferred intelligences by the upper grades of primary level, including fourth, fifth, and sixth graders, middle and high school students. Administering TIMI for over 500 college students, Diaz-Lefebrve (1998) also reported that students' most dominant intelligence was bodily/kinesthetic intelligence. Moreover, the research conducted by Göğebakan (2003) revealed that although bodily/kinesthetic and musical intelligences were two of the most dominant intelligences of fifth and

eighth graders, verbal/linguistic and logical/mathematical intelligences were the most preferred intelligences of the first graders.

In this research, the interview with the teacher and the students revealed that textbook based instruction dominated their regular biology classrooms. The main reason the teacher used the textbook based instruction in her regular biology classrooms was the low socioeconomic status of the students who could not afford to buy different types of sources. In addition, she explained how her students were used to be passive receivers and get the information ready from their teachers. According to the teacher, there were not many curious, interested students left in our education system that even the ones that were so rare to see were close to vanish. Besides lecturing and asking questions to the students from their text books, there were times she was narrating the subject, but although this narration took their attention for that moment, the only part they were remembering for the future was the story part, not the scientific part. As most of the students stated, their regular biology courses in which they listened to their teacher at their desks, answered her questions and studied from their text books were so boring to them that it was hard to listen to the teacher carefully for long time period during the lessons. Therefore, although the teacher was narrating the subject, since they were not interested with listening to the scientific parts; those parts of narrating might be missed.

Although research in science education has demonstrated that text book based instruction dominates most science classrooms, today it is known that this type of education is inadequate meeting the goals of science education (Finley, 1991, as cited in Dillon et. al., 1994). As Diaz-Lefebrve (1998) stated, restriction of educational programmes only on verbal/linguistic and logical/mathematical intelligences, representative of a minority, means ignoring most of the students. Presentation based on these two intelligences might be effective for most of the students years ago. The students of those terms were used to listening. The programmes they were following were the ones on the radio, not the ones on television. Even if there was television, there were not as many channels as today. Today students are so media and computer-wise that they have information and stimulation in a colorful world outside the classroom. Hence, it really is getting harder to be one step ahead of them and keep them focused during the lessons in a

pale classroom environment in which the lecturing is dominant. The first strategy for teaching in multiple intelligences classroom is to begin with what the students already know, are familiar with and capable of. This way the participation level of the students will increase (Diaz & Heinning-Boynton, 1996). Therefore especially these three dominant intelligences of the students in multiple intelligences based group were taken into consideration when the lesson plans, materials and activities were being implemented but because it was aimed to be sure each child not only used their strong intelligences but also developed their less-preferred intelligences, other five intelligences were also considered. Because the use of MI includes not labeling people by their prefered intelligences (Armstrong, 1994b, Gardner, 1999, Shearer, 1999), none of the students was informed about their strongest intelligences.

During the interview all of the students mentioned about fun activities they enjoyed and learned from doing during the implementation of multiple intelligences based instruction. Those students, who were labeled as "passive receivers" and "uninterested" by their teacher before the implementation of the MI theory, actively engaged in all of the activities, made research from different types of sources, made small presentations, and colored their bared walls with the posters and the models they prepared. They started to learn by using their own strengths. Realizing that they learned easily this way, their self confidence increased. As La Farge states, as students have success in easier areas, they will also attempt to try more complex activities (1994). They seemed more confident in trying out new skills. Some discovered abilities they never knew they had. This result is supported by the study of Greenhawk (1997) about the implementation of the MI theory for students in Maryland elementary school. The study of Gibson and Govendo (1999), in which students who were using their areas of strength to learn felt more confident, and enjoyed learning new information, is another study supporting this finding of the study. This self confidence let several students who had not previously displayed leadership abilities took the lead with their friends. This result was also noted by the action research of Campbell (1990) which was carried out to explore student reactions to the MI based instructional model in his third grade classroom. Kallenbach and Viens (2002) also state how multiple intelligences based instruction

helps students able to see the strengths of each other. The same with this thought, the students in multiple intelligences based group also realized the strengths of each other. They shared their strengths and ideas. Beckman (1996) believes each individual brings strengths to the classroom environment to be shared by everyone. When it was asked students whether they ever felt themselves as a leader in the classroom during the implementation of MI theory, all of the students mentioned they did, but most of them added that they were not the only leader of the classroom. They also mentioned the beauty of bringing a piece to the whole, a piece which formed the final product. As they learned more about each other, they had closer relations with their classmates. They motivated, encouraged, and helped each other. The teacher had an important role on students to realize their own strengths and strengths of each other. She was interested with all of the activities they did and used all the materials taken into classroom by them. As the students mentioned during the interviews, since the teacher was interested with them, they felt themselves very special and comfortable. She was not getting angry with them as she had been in the regular biology courses and not using the grade notebook of her for making them study. She was not getting angry anymore, because there was not any disturbing behavior in the classroom. Oppositely, the students were interested during the lesson, listened to their teacher, peers, and group members carefully, stayed focused on their tasks, asked different types of questions, even seemed to lose track of the time. There were times that the classroom was buzzing but this was never a handicap because the students were sharing their ideas with their classmates and discussing with enthusiasm. She was not using the "grade notebook" anymore, because they were actively engaged in the activities, willing to take responsibilities and showing how well they learned during the lessons. The role of the teacher being a lecturer evolved into a guide, motivator, and a facilitator during multiple intelligences based instruction. Her objectives of the unit were not limited with the cognitive domains of the students; they also included psychological and psychomotor domains of the students. The students had closer relations with their teacher. These findings support the quantitative finding of this study related with multiple intelligences based instruction and the students' attitudes toward biology. The finding of this study shows that multiple intelligences based instruction is

effective for developing positive attitudes towards Biology. As seen in Figure 5.1, the histograms of students' attitudes toward biology posttest scores (POST-ATT) for the multiple intelligences based group and control group present that the mean of POST-ATT for multiple intelligences based group was greater than that for the control group. Table 5.1 shows that there is a mean increase of 3.41 from PRE-ATT to POST-ATT in multiple intelligences based group whereas there is a slightly mean decrease of 0.69 from PRE-ATT to POST-ATT in control group. In addition, as seen in Table 5.14, estimated means of attitude after the extraction of the effect of the covariate preattitude are 55.96 for control group and 60.47 for multiple intelligences based group out of 75. Campbell (1990) also stated that multiple intelligences based instruction improved the attitude of the third graders. Güneş (2002) and Kaya's (2002) master's projects for the seventh graders' science course for two weeks and five hours, respectively are the other two studies supporting the finding of this study. However, this finding is not supported by Coşkungönüllü's (1998) master's project applied for the fifth graders' mathematics course for three weeks, Aşçı's (2003) master study conducted for the ninth graders' ecology course for two weeks, Gürçay's (2003) doctorate study conducted for the ninth graders' physics course for three weeks and Akbaş's (2004) master's project for the sixth graders' science course for over three weeks. In these studies limited implementation time might have affected students' developing attitudes, because the development of attitudes needs more time. Including the pilot study implementation of multiple intelligences based instruction in this study lasted for over 7 weeks.

Previous studies related to multiple intelligences based instruction and achievement show that multiple intelligences based instruction has a positive effect on achievement. Project SUMIT which began in 1997 in order to identify, document, and promote effective implementations of multiple intelligences, and lasted for three years showed that MI had a great influence in improved test scores and improved achievement (Gardner, 1999). In another study about the implementation of the MI theory for students in Maryland elementary school, as the teachers realized that students started to retain more knowledge, they used different intelligences in each of their lessons. In one year time the scores in this school was

reported 20% higher (Greenhawk,1997). Other studies showing that multiple intelligences based instruction made significant effect on students' achievement in Turkey are; the research conducted for the third graders' social science course (Şahin, 2001) and the other researches (Akbaş 2004; Aşçı 2003; Coşkungönüllü, 1998; Gürçay 2003; Kaya 2002). As it is seen from the previous studies, whatever the application period is, the MI theory has a great role on students' achievement in different courses in different educational levels. The finding of this study also supports these previous findings. When histograms with normal curve related with students' biology achievement posttest scores (POST-ACH) for the multiple intelligences based group and control group are investigated in Figure 5.2, it is seen that mean of posttest scores for the multiple intelligences based group was greater than that for the control group. As shown in Table 5.2, for the multiple intelligences based group it is 10.66 and for the control group it is 7 out of 20. Although the multiple intelligences based group students' POST-ACH was greater than the control group students, it can be said that there was not a high level of achievement. This may be because of the time period that these tests were applied 2 weeks after the end of the treatment. Because the students had to have a general exam for the next week and most of the students were absent for the following week. Therefore, this POST-AT was kind of an achievement test applied for retention.

The interview results with the students also indicated the higher achievement of the students. As the students mentioned they had higher scores from the last biology exam they had after the application of the MI theory. The teacher also said that from the general multiple choice biology exam applied to all of the ninth graders in Ereğli high school, they had the highest mean scores (Yavuz, personal communication, August 15, 2003). It can be said that multiple intelligences based instruction resulted in positive attitudes of students towards biology and this positive attitudes resulted in higher achievement. As Reece and Walker (1997) stated emotions, and feelings of the students have an important place in education. If students get pleasure then they enjoy, if they get satisfaction from what they do, they learn better.

As Dickinson (1998) stated when an individual becomes more proficient in one area, the whole constellation of intelligence may be enhanced.. Based on this

belief, in this study it was assumed that if one type of intelligence of a student would be affected, the overall MI score of the child would also change. The finding about the effect of multiple intelligences based instruction on overall MI of the ninth graders was not significant in this research. Although there was no significant effect, multiple intelligences based instruction including various activities should have an important role on students' intelligences. Paired t-test results revealed that although there was not any significant mean difference between the pretest and posttest scores of any of the intelligences in control group, there was a significant mean difference between the pretest and posttest scores of logical/mathematical intelligences in multiple intelligences based group. As seen in Table 5.16, this mean increase was 2.34 from pretest to posttest score for MIBIG's logical/mathematical intelligence. The reason of this higher score of logical/mathematical intelligence in multiple intelligences based group may be explained as students using their stronger intelligences with the activities during multiple intelligences based instruction also improved their weaker area, logical/mathematical intelligence which the educational system focuses on. Aşçı's (2003) study revealed that multiple intelligences based instruction had a significant effect on overall MI of ninth grade students but she did not search for which of the intelligences of the students were affected based on this study.

Another finding was that learning style differences in students do not affect collective dependent variables of biology achievement, attitudes towards biology, and overall MI. Güneş (2004) is another researcher who determined that there were not any significant differences among the learning styles of 367 preparatory school students from different faculties at Gazi university in terms of achievement. Conti and Welborn (1986) also found no significant difference in achievement based on students' dominant learning styles in their study of 256 adults taking courses in allied health research, and health administration (cited in Howell, 2001). The doctorate study of Çakır (2002) also supports this finding that learning style differences among students did not affect students' academic knowledge, attitudes towards biology, performance skills, and higher order thinking skills. Although there was no significant effect, learning style is an important variable in students'

learning. Individuals can learn better, easier, faster, and retain more information when the presentation is based on their prefered learning styles.

Learning styles are concerned with differences in the learning process, whereas MI centers on learning content and outputs (Silver, 1997). The correlation results, as seen in Table 5.17, revealed that there was not any significant relationship between the dimensions of intelligence and types of learning styles of the ninth graders enrolled in control and multiple intelligences based groups. Because learning styles are the combinations of two continuums of ways of learning, concrete experience-reflective observation and abstract conceptualization-active experimentation, the correlation between the dimensions of intelligence and ways of learning was also investigated. Table 5.18 shows the significant positive correlation between logical/mathematical intelligence and Abstract Conceptualization in both control and multiple intelligences based groups and the significant negative correlation between logical/mathematical intelligence and Reflective Observation, and the significant negative correlation between logical/mathematical intelligence and Active Experimentation in multiple intelligences based group. This means the ones who are abstract conceptualizers are logical/mathematical intelligent, who love thinking. The reason of this significant correlation is, traditionally educational system is slanted heavily in favor of verbal/linguistic and logical/mathematical smarts and the teachers use teaching methods based on these two intelligences and guide students study this way. Interview results with the teacher and the students indicate that believing that the best way of learning was abstract conceptualization, the teacher suggested the students study by preparing questions, answering the questions she gave them and solving the problems and answering the questions in their text books. Studying by reading, writing, preparing questions, and answering them were the ways students were studying for their biology courses. Therefore, students talented in other areas had no idea about the best way for them to learn. Truth the teachers and students should always keep in mind that all people are different and they have different preferences, tastes, and personalities (Reiff, 1992). During the implementation of MI theory students had opportunities to learn in different ways. The correlation results seen in Table 5.18, can be interpreted as, the ones who were not

logical/mathematical intelligent preferred learning by Reflective observation including learning by watching, observing, using her or his own beliefs, experiences and feelings or Active experimentation including learning by doing. It can be said that recognizing the learning strategies available can give the students wider range of choices and prevent the rote use of strategies that may not be the best choice for a particular task.

As a result it can be said that multiple intelligences based instruction had positive effects on teaching and learning process. As the interviews with the students and the classroom observations revealed, the main point is how the teacher applies the theory. In general the teachers are wedded to traditional instruction strategies and resistant to change. This resistance is mostly because of the examination system in Turkey. If they realize these positive effects of the MI theory in their courses, they will continue using different teaching strategies and activities. As an anonymous observer said "All children are gifted, some just open their packages later than others" (cited in Armstrong, 1993). Ways to have more interested and successfull students, and bring out the best of those students by the teachers in a classroom can be summarized as followings:

- exposing students to a variety of experiences and encouraging them to be enrolled in different types of activities,
- being patient to give enough time for them to complete their activities,
- letting them discover their own and classmates' strengths. According to Wilson (1999), the MI theory is a tool for developing deep understanding self and others for the complexity of their talents. Shearer (1999) recommends teachers give the message of "It is ok that we may not be strong in all of the areas but let's find out what our strong point is and how we can use it in any type of situation" to their students and not focus on the negatives only. This way students realizing their own strengths and others realized by their friends will have higher self-esteem and self-efficacy.
- giving them choices and paying attention to the activities they choose,
- checking what ever they do,
- letting them experience a sense of loving and belonging,

- guiding to the ones in need of help and motivating them,
- never limitting the students with labels,
- sharing their prior experiences, feelings, opinions and success,
- praising their participation to the lessons and sense of responsibilities,
- doing things with them,

and the most important thing

- accepting them as they are and letting them to realize the diversity of learning among their classmates and respect to each other.

Armstrong (1993) also mentions about smilar ways for parents to awaken latent talents or develop current strengths of a child.

Another main finding of this study is the applicability of the MI theory in high school biology courses. Although the teacher had thought that multiple intelligences based instruction might last longer than TI, the time period in both of the classrooms during the instruction of the unit were the same. After the treatment, the teacher said that because her students understood better and faster during the implementation of MIBI, she got rid of repeatations over and over in this classroom (Yavuz, personal communication, August 15, 2003). In addition the teacher who was worried about the application of the MI theory would be limited with only this unit because of the lack of physical conditions and materials in the school continues to apply the theory in her current biology courses (Yavuz, personal communication, October 20, 2005). In short, the implications of MI for modern classes, private schools were equally apparent and relevant to the public schools even lack of many sources. Similar results were also found out by Campbell (1999) in Tibetan culture, and Ellison and Rothenberger (1999) in Bangladesh.

6. 2 Implications of the study

The implications below are offered based on the literature review and findings of this study.

1. Teachers not only pay attention to the students' academic lives, but also to the cultural, physical, social, and emotional lives of them.

2. A teacher's primary responsibility in education system should be to be sure all children experience success and learn. Instead of focusing on the negatives of a child, a teacher should focus on the positives.
3. All people are different and learn differently. The teachers should respect, value and nurture that diversity. The goal of education should be to provide an equitable environment for all children; one way of accomplishing this is to represent knowledge in different ways. Knowing where students' natural talents and interests lie may help teachers tailor lessons to their particular way of seeing the world.Hence it can be said that change in classrooms is dependent first on understanding the perspectives of the students in the classrooms (Dillon et. al., 1994).
4. Class sizes should be decreased in order to be aware of the students' needs and development.
5. Performance based classroom assessment should be used in addition to the paper-pen tests in order to measure the progress of the students.
6. In-service-education related to the MI theory and applications of it in educational settings could be prepared by National Ministry of Education for the teachers.
7. The theory of MI, MI based activities, MI techniques; applications of it in different educational settings should be included in curriculum of the preservice teachers studying in the universities. They should be guided to prepare MI based lesson plans and implement the theory.
8. The teachers should be in close collaboration with their colleagues.

6.3. Recommendations for Further Research

The present study has suggested a variety of useful topics for further researches concerning the MIBI in biology education. These are as follows:

1. Similar research studies might be conducted by using different biology topics for different grade levels.
2. Similar research might be conducted to private schools or Anatolian high schools
3. Similar research having a greater sample size might be conducted to obtain more accurate and generalizable results.

4. Similar study with a longer period of treatment might be conducted in order to determine the long term effects of MI based instruction.
5. Performance assessment might be used in a similar study in order to measure the progress of the students.
6. The relationship between the students' intelligences and the activities they prefer to the others, the way they express their knowledge might be determined.
7. Other types of learning styles might be used in order to investigate the relationship of those with multiple intelligences.
8. Similar research study might be conducted in order to improve the creativities of the students.
9. Similar research study might be conducted by using prior preferred learning styles of the students.

6.4. Validity for the Quantitative Study

Validity is the adequacy, appropriateness, meaningfulness, and usefulness of the inferences researchers make based on the data they collect, while reliability is the consistency of these inferences overtime.

6.4.1. Internal Validity of the Quantitative Study

One of the keys to understanding internal validity (IV) is the recognition that when it is associated with experimental research it refers both to how well the study was run and how confidently one can conclude the change in the dependent variable was produced solely by the independent variable and not extraneous ones (Huitt & Kaeck, 1999). In this research, IV answers the question, "Was it really the MIBI that caused the difference between the means/variances of the subjects in the control and experimental groups?"

Whether the dependent variables are directly related to the independent variables or related to the extraneous variables determine the internal validity of the study. In this study, since the control group (CG) and the experimental group (MIBG) were assigned randomly, subject characteristics such as gender, prior achievement, attitude, and intelligence could be regarded as potential extraneous variables affecting this study.

In the CG 17 of the 32 students were female with the remaining 15 being male, whereas in the MIBG 15 of the 32 students were male with the remaining 17 being female. The groups were similar with respect to gender; therefore it can be considered that gender would not be a significant influence to this study.

In order to determine the students' prior attitude toward biology (PRE-ATT), prior achievement (PRE-ACH) and prior multiple intelligences (PRE-MIS) an attitude scale toward biology (ATBS), a diversity and classification of living organisms unit achievement test (AT) and a multiple intelligences inventory (MII) were administered to both groups at the beginning of the study. As shown in Table 4.4, PRE-ATT, PRE-ACH and PRE-MIS of the students were included in a covariate set to statistically match subjects to these factors. The statistical analysis indicated that these three variables were covariates.

The students' perception of the study can create a subject attitude threat to internal validity. Experimental group students may perform better because of the novelty of the treatment rather than the specific nature of the treatment (Fraenkel & Wallen, 1996). In order to control the responses of the study were not partly a function of the *newness* or *novelty* of the experimental approach, a pilot study was instructed for the students enrolled in MIBG for two weeks in the subject of structure and functions of the nucleic acids. Moreover, the experimental and control groups were selected from particular classes and physical interaction between the groups was minimized thereby eliminating the "novelty effect".

For eliminating the history and location threats, all of the tests used in this study were administered to both of the groups at the same time using the same instructions and under the same conditions.

Before the administration of the tests in order to eliminate the mortality threat of the study, all of the students in both groups were informed about the importance of attendance to all of the tests.

Administration of the pretest might be a threat because of the effect of taking one test may influence the scores of a subsequent test. Remembering the questions in the pretest, students may score higher in the posttest, regardless of the type of instruction in between. However, it is assumed that the pretest would affect both groups equally. Testing is more likely to be a threat when the time between

testings is short. The pretests taken before the treatment are not likely to affect performance on the posttests taken eight weeks later.

Since the same teacher taught both the experimental and the control group, the study was not affected from the implementer threat. Finally, confidentiality did not cause any problems since the names of the students were not used in the study and they were informed about this situation at the beginning of the treatment. One of the biggest threats to the internal validity which could not be controlled in this study might be the Hawthorne effect. The fact that the students exposed to MIBI were receiving atypical attention, that the instruction and the activities were different, that the researcher was present for the videotaping might cause this effect.

6.4.2 Population and Ecological (External) Validity of the Quantitative Study

The population validity refers to the extent to which the results of a study can be generalized from a specific sample of a larger group of subjects. In this study the accessible population was the students enrolled in a public high school in Kdz Ereğli. The subjects of the study were 64 high school students from two ninth grade classes at one school. The use of non-random sampling limited the generalization of the research results. The generalizations of similar populations of students at public high schools might still be acceptable.

The ecological validity refers to the extent to which the results of an experiment can be generalized from the set of environmental conditions created by the researcher in reference to other environmental conditions. The number of the students in each classroom was 32. There were student-student and teacher- student interactions in both classes. The results of this study can be generalized to similar settings in the classroom.

6. 5 Validity and Reliability for the Qualitative Study

In this research, the procedures for checking on or enhancing validity and reliability suggested by Fraenkel and Wallen (1996) were used:

- When a conclusion is supported by data collected from a number of different instruments, its validity is thereby enhanced. Therefore, by using the triangulation technique, research findings were compared. This triangulation

consisted of ATBS, AT, and interviews with the students and the teacher and classroom observations.

- The descriptions of the informants were compared with the others' descriptions and as a result no discrepancies were found.
- The interview questions had been written down in order to reduce distortions attributed to selective forgetting.
- The context in which questions were asked described the situations that were observed.
- Audiotapes for the interviews, and videotape for the classroom observation were used.
- In order to check whether the individual was a reliable informant, the information given by the informant was confirmed. No inconsistencies in the information were discovered.
- The results of the observation and interviews were shared and discussed with the teacher to review the accuracy of the research results.
- An expert from Secondary School Science and Mathematics education reviewed and evaluated the results.
- The results that were revealed from the observations were also consistent with each other (Yıldırım and Şimşek, 1999).

External validity maybe a problem in a qualitative research because social events, phenomena may change. Therefore, the experimental group classroom environment, the students exposed to the MIBI, their relations with their classmates and their teacher, and the role of the teacher were clearly described for the generalization from the experiences in this study.

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APPENDIX A

LEARNING STYLE INVENTORY

Öğrenme Stilleri Envanteri

Sevgili öğrenciler,

Aşağıda her birinde dörder cümle bulunan oniki tane durum verilmektedir. Her durum için en uygun cümleyi 4, ikinci uygun olanı 3, üçüncü uygun olanı 2, en az uygun olanı ise 1 olarak ilgili cümlenin başında bırakılan boşluğa yazınız.

Teşekkür ederim.

Arzu İrfan Bozkurt

Örnek

Öğrenirken 4 mutluyum, 1 hızlıyım, 2 mantıklıyım, 3 dikkatliyim

****

* Hatırlamanız için *

* *

* 4 en uygun olan *

* 3 ikinci uygun olan *

* 2 üçüncü uygun olan *

* 1 en az uygun olan *

****

---

1. Öğrenirken

_duygularımı göz önüne almaktan hoşlanırım
_izlemekten ve dinlemekten hoşlanırım
_ fikirler üzerine düşünmekten hoşlanırım
_ bir şeyler yapmaktan hoşlanırım.

2. En iyi

_ duygularıma ve önsezilerime güvendiğimde
_ dikkatlice dinlediğim ve izlediğimde
_ düşünmeyi temel aldığımda
_ bir şeyler elde etmek için çok çalıştığımda
öğrenirim.

3. Öğrenirken

_ güçlü duygu ve tepkilerle dolu olurum.
_ sessiz ve çekingen olurum.
_ sonuçları bulmaya yönelirim.
_ yapılanlardan sorumlu olurum.

4.

_ Duygularımla
_ İzleyerek
_ Düşünerek
_ Yaparak
öğrenirim.

5.

_ Yeni deneyimlere açık olurum.
_ Konunun her yönüne bakarım.
_ Analiz etmekten ve onları parçalara ayırmaktan hoşlanırım.
_ Denemekten hoşlanırım.

6. Öğrenirken

_ Sezgisel
_ Gözleyen
_ Mantıklı
_ Hareketli
biriyim.

7. En iyi

_ kişisel ilişkilerden
_ gözlemlerden
_ akılcı kurallardan
_ uygulama ve denemelerden
öğrenirim.

8. Öğrenirken

_ kişisel olarak o işin bir parçası olurum.
_ işleri yapmak için acele etmem.
_ kuram ve fikirlerden hoşlanırım.
_ çalışmamdaki sonuçları görmekten hoşlanırım.

9. En iyi

_ duygularıma dayandığım zaman
_ gözlemlerime dayandığım zaman
_ fikirlerime dayandığım zaman
_ öğrendiklerimi uyguladığım zaman
öğrenirim.

10. Öğrenirken

_ kabul eden
_ çekingen
_ akılcı

_ sorumlu
biriyim.

11. Öğrenirken
_ katılırım
_ gözlemekten hoşlanırım
_ değerlendiririm
_ aktif olmaktan hoşlanırım

12. En iyi

_ akılcı ve açık fikirli olduğum zaman
_ dikkatli olduğum zaman
_ fikirleri analiz ettiğim zaman
_ pratik olduğum zaman
öğrenirim

SY: YG: SK: AD:
SK- SY:
AD-YG:

APPENDIX B

MULTIPLE INTELLIGENCES INVENTORY

Çoklu Zeka Envanteri

Adı Soyadı :
No : Sınıf :

Değerli Öğrenciler,

Aşağıda verilen her bir ifadenin yanında sırasıyla 5, 4, 3, 2, ve 1 olmak üzere 5 ayrı sütun yer almaktadır.

5: Bana çok uyuyor
4: Bana uyuyor
3: Bana orta derecede uyuyor
2: Bana biraz uyuyor
1: Bana çok aza uyuyor

Buna göre her bir ifadenin size uygunluk derecesine göre ilgili sütuna (X) işareti koyunuz. Sizler için etkin öğretim etkinliklerini hazırlayabilmemiz açısından vereceğiniz cevaplar bizler için çok önemlidir.Gösterdiğiniz hassasiyet için teşekkür ederiz.

		5	4	3	2	1
1	Kitaplar benim için çok önemlidir.					
2	Sayıları zihnimde kolaylıkla hesaplayabilirim.					
3	Gözlerimi kapattığımda sıkça net resimler görürüm.					
4	Düzenli olarak en az bir spor dalı veya fiziksel etkinlikle uğraşırım.					
5	Her tür hayvanı severim.					
6	Şarkı söylerken kulağa hoş gelen sesim vardır.					
7	İş ve arkadaş çevremde görüş ve düşüncelerine başvurulan biriyim.					
8	Düzenli olarak yalnız başıma meditasyon yapmaya (derin düşünme) veya yaşamla ilgili önemli sorunları düşünmeye zaman harcarım.					

		5	4	3	2	1
9	Kavramları okumadan , söylemeden veya yazmadan önce zihnimde canlandırabilirim.					
10	Matematik ve / veya fen bilimleri okulda en çok sevdiğim dersler arasındadır.					
11	Renklere karşı duyarlıyımdır.					
12	Bir yerde uzunca bir süre oturmak benim için zordur.					
13	Bir takım şeyleri organize etmeyi veya düzenlemeyi severim.					
14	(Duyduğum) bir notanın yanlış olup olmadığını söyleyebilirim.					
15	Koşu (jogging) veya yüzme gibi bireysel sporlar yerine badminton, voleybol ve basketbol(softball) gibi grup sporlarını tercih ederim.					
16	Kendi hakkımda daha çok şey öğrenebilmek için , danışma oturumlarına veya kişilik geliştirme seminerlerine katılmaktayım.					
17	Doğada ve dışarıda olmaktan zevk alırım					
18	Televizyon veya film seyretmekten çok radyo veya konuşma kasetlerini dinlerim					
19	Oyunlar oynamaktan veya mantıksal düşünmeyi gerektiren zeka bulmacalarını çözmekten hoşlanırım.					
20	Genellikle etrafımda gördüğüm şeyleri kaydetmek için kamera veya benzeri bir alet kullanırım.					
21	Dikiş, dokumacılık,oymacılık ve doğramacılık veya model inşa etmek gibi el becerisi gerektiren etkinliklerle uğraşmayı severim.					
22	Sıkça , radyo , kaset veya CD (kompakt disk) dinlerim.					
23	Bir problemim olduğunda bunu kendi başıma çözmek yerine daha çok bir başka kişiden yardım almayı yeğlerim.					
24	Aksilikleri olgunlukla karşılayabilirim.					
25	Bir kelimeden başka kelimeler türetme ya da sözcük bulmacası gibi oyunlardan hoşlanırım.					
26	"..... olursa ne olur ?" şeklinde küçük deneyler tasarlamaktan (kurmaktan) hoşlanırım. Örneğin (gül ağacıma verdiğim suyun miktarını her hafta iki katına çıkarırsam ne olur ?)					

		5	4	3	2	1
27	Yap Boz labirentler ve diğer görsel bulmacaları çözmekten hoşlanırım.					
28	En iyi fikirler, uzun bir yürüyüşe çıktığımda veya koşu yaparken ya da herhangi bir fiziksel etkinlikle uğraşırken aklıma gelir					
29	Balık tutma , avcılık, bahçe düzenlemesi, bitki yetiştirme ve yemek yapmaktan hoşlanırım.					
30	Bir müzik aleti çalıyorum.					
31	En az üç yakın arkadaşım var.					
32	Kendime ait özel bir hobim veya ilgi alanım var.					
33	Tekerlemeler, komik şiirler veya kelime oyunları ile kendimi ve başkalarını eğlendirmekten hoşlanırım.					
34	Olaylarda yapı, düzen veya mantıksal sıralama ararım					
35	Geceleri canlı rüyalar görürüm.					
36	Taş ,kabuk ,yaprak, böcek , kelebek, pul, spor kartları veya mücevher gibi şeylerin koleksiyonunu yaparım.					
37	Genellikle boş zamanımı dışarıda geçirmeyi severim.					
38	İçinde hiç müzik olmasaydı hayatım çok zevksiz (sıkıcı) olurdu					
39	Bireysel eğlenceler (video oyunları ve solitaire gibi) yerine l oyunları (monopol ve briç gibi) tercih ederim.					
40	Hayatımla ilgili üzerinde düzenli olarak düşündüğüm bazı önemli hedeflerim vardır.					
41	Diğer insanlar bazen beni durdurup, yazarken veya konuşurken kullandığım kelimelerin anlamlarını açıklamamı isterler.					
42	Dolaplarım, çekmecelerim ve çalıştığım yer genellikle temiz ve düzenlidir.					
43	Bilimdeki yeni gelişmelerle ilgilenirim.					
44	Tanımadığım yerlerde genellikle yolumu bulurum.					
45	Biriyle konuşurken el ve çeşitli beden hareketleri kullanırım.					

		5	4	3	2	1
46	Bazen kendimi aklıma bir reklam müziği veya başka bir melodi takılmış halde yolda bulurum.					
47	Nasıl yapılacağını bildiğim bir şeyi bir başka kişi veya grup insana öğretme konusunda meydan okumayı severim.					
48	Güçlü ve zayıf yönlerim konusunda gerçekçi bir görüşüm vardır (bu görüşüm başka kaynaklar tarafından da destekleniyor).					
49	Okulda İngilizce, sosyal alanlar ve tarih benim için matematik ve fen bilimlerinden daha kolaydır.					
50	Hemen her olayın mantıklı bir açıklaması olduğuna inanırım.					
51	Düzenli olarak değişen hava şartlarını öğrenmek için hava durumunu takip ederim.					
52	Resim çizmeyi veya bir şeyler karalamayı severim.					
53	Nesneler (cisimler) hakkında daha çok şey öğrenmek için onlara dokunma gereği duyarım.					
54	Bir müzik parçasına, davul veya tamburin gibi, basit bir vurmalı çalgıyla kolaylıkla tempo tutabilirim.					
55	Kendimi bir lider olarak görüyorum (ya da diğer insanlar öyle olduğumu söylüyor).					
56	Bir hafta sonunu etrafta bir çok insanın bulunduğu havalı bir yerde geçirmektense, yalnız başıma ağaçlar arasında bir kulübede geçirmeyi tercih ederim.					
57	Nesneleri benzer gruplara ayırmak veya sınıflandırmaktan daima hoşlanırım.					
58	Araba ile giderken yol boyundaki manzarayı seyretmekten çok, yoldaki levhalara (bilbordlarda) yazılan yazılara daha çok dikkat ederim.					
59	Bazen soyut, sözsüz, görüntüsüz kavramlar hakkında net bir şekilde düşünürüm.					
60	Okulda Geometri, Cebir'den daha kolaydır.					
61	Tehlikeli ve eğlenceli gezintiler veya benzeri heyecan verici fiziksel deneyimlerden hoşlanırım.					
62	Pek çok değişik şarkının veya müzik parçasının melodisini bilirim.					
63	Kalabalığın ortasında kendimi rahat hissederim.					
64	Kendimi güçlü veya hür iradesi olan biri biliyorum.					

		5	4	3	2	1
65	Konuşmalarımda, okuduğum veya duyduğum şeylere sıklıkla başvururum.					
66	"Aletlerin nasıl çalıştığını" anlamak isterim.					
67	İnsanların evde, iş yerinde veya okulda söylediği ve yaptığı şeylerde mantık eksiklikleri bulurum.					
68	Bir şeye yukarıdan kuşbakışı bakıldığında nasıl görünebileceğini rahatça gözümde canlandırabilirim .					
69	Kendimi iyi koordine olmuş biri olarak tarif edebilirim.					
70	Bir müzik parçasını bir veya iki defa duyarsam, onu genellikle doğru bir şekilde söyleyebilir veya mırıldanabilirim.					
71	İşimle, okulumla, dini kurumlarla veya içinde bulunduğum toplumla ilgili sosyal etkinliklere katılmayı severim.					
72	Olayları veya özel hayatımı kaydetmek için günlük veya ajanda tutarım.					
73	Özellikle gurur duyduğum ve diğer insanlar tarafından tanınmamı sağlayan bir şeyler yazdım.					
74	Bir şey bir yolla ölçüldüğü, gruplandırıldığı, analiz edildiği veya miktarı hesaplandığı zaman kendimi daha rahat hissederim.					
75	İçinde çok resim bulunan okuma materyaline bakmayı (incelemeyi) tercih ederim.					
76	Yeni bir beceriyi edinmek için onun hakkında okumak veya videodan onunla ilgili bir şeyler izlemek yerine o beceriyi pratik yapmaya ihtiyacım vardır.					
77	Ders çalışırken, iş yaparken veya yeni bir şey öğrenirken sıkça ufak tefek melodiler söyler veya ayağımla yere vurarak tempo tutarım.					
78	Okulda en sevdiğim dersler edebiyat ve sosyal alanlardan çok laboratuar bilimleridir.					
79	Akşamlarımı evde yalnız oturmaktansa hareketli bir partide geçirmeyi tercih ederim.					
80	Serbest meslek sahibiyim veya en azından kendi işimi kurma konusunda ciddi düşüncelerim var.					

APPENDIX C

ATTITUDE SCALE TOWARD BIOLOGY

Adı Soyadı:
Sınıfı:

Biyolojiye Yönelik Tutum Ölçeği

Açıklama: Bu ölçekte, Biyoloji dersine ilişkin tutum cümleleri ile her cümlenin karşısında TAMAMEN KATILIYORUM, KATILIYORUM, KARARSIZIM, KATILMIYORUM ve HİÇ KATILMIYORUM olmak üzere beş seçenek verilmiştir. Her cümleyi dikkatle okuduktan sonra kendinize uygun seçeneği işaretleyiniz.

	Tamamen Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Hiç Katılmıyorum
1.Biyoloji çok sevdiğim bir alandır.	0	0	0	0	0
2.Biyoloji ile ilgili kitapları okumaktan hoşlanırım	0	0	0	0	0
3.Biyolojinin günlük yaşamda çok önemli yeri yoktur.	0	0	0	0	0
4.Biyoloji ile ilgili ders problemlerini çözmekten hoşlanırım	0	0	0	0	0
5. Biyoloji konularıyla ilgili daha çok şey öğrenmek isterim	0	0	0	0	0
6. Biyoloji dersine girerken sıkıntı duyarım	0	0	0	0	0
7. Biyoloji deslerine zevkle girerim	0	0	0	0	0
8. Biyoloji derslerine ayrılan ders saatinin daha fazla olmasını isterim.	0	0	0	0	0
9. Biyoloji dersine çalışırken canım sıkılır.	0	0	0	0	0
10.Biyoloji konularını ilgilendiren günlük olaylar hakkında daha fazla bilgi edinmek isterim.	0	0	0	0	0
11. Düşünce sistemimizi geliştirmede biyoloji öğrenimi önemlidir.	0	0	0	0	0
12. Biyoloji çevremizdeki doğal olayların daha iyi anlaşılmasında önemlidir.	0	0	0	0	0
13. Dersler içinde biyoloji dersi sevimsiz gelir.	0	0	0	0	0
14. Biyoloji konuları ile ilgili tartışmaya katılmak bana cazip gelmez.	0	0	0	0	0
15. Çalışma zamanının önemli bir kısmını biyoloji dersine ayırmak isterim.	0	0	0	0	0

APPENDIX D

DIVERSITY AND CLASSIFICATION OF LIVING ORGANISMS UNIT ACHIEVEMENT TEST

"Canlıların Çeşitliliği ve Sınıflandırılması" Ünitesi Başarı Testi

Adı Soyadı:

Sınıfı:

Sevgili Öğrenciler,

Bu test sizin *Canlıların çeşitliliği ve sınıflandırılması* ünitesi hakkında ne derece bilgiye sahip olduğunuzu ölçmek için hazırlanmıştır. Teste verilen yanıtlar Çoklu zeka temelli tekniklerin etkisini araştırmak amacıyla kullanılacaktır. Araştırmanın doğru sonuçlar vermesi açısından lütfen tüm soruları çözmeye çalışınız.

- Bu testte toplam 20 adet soru bulunmaktadır.
- Her bir soruyu cevaplamadan önce dikkatle okuyunuz
- Her soruda **biri** doğru olmak üzere beş seçenek yer almaktadır.
- Test süresi 30 dakikadır.

Katkılarınız için teşekkür eder başarılar dilerim.

Arzu İrfan Bozkurt

BAŞARI TESTİ

1. Virüslerde bulunan enzimler nerede kullanılır?

a) Metabolik faaliyetlerde
b) Yabancı hücre zarını eritmede
c) Protein sentezinde
d) Enerji üretiminde
e) Nükleik asit sentezinde

2. Aşağıdaki canlı gruplarının hangisinde, ortak özelliklerinin daha fazla olması beklenir?

a) Bir sınıfta toplanan canlılarda
b) Bir takımda toplanan canlılarda
c) Bir familyada toplanan canlılarda
d) Bir cinste toplanan canlılarda
e) Bir türde toplanan canlılarda

3. Bir virüsün çoğalabilmesi için ortamda aşağıdakilerden hangisinin olması gereklidir?

a) Canlı bir hücrenin
b) Metabolik enzimlerin
c) Yeterli miktarda moleküllerin
d) Organik besinlerin
e) İnorganik besinlerin

4. Aslanın bilimsel adı *Felis leo*, kaplanın ise *Felis tigris*' tir.
Bu adlandırma dikkate alındığında aşağıdakilerden hangisi doğru olur?

a) Aynı cins, farklı türlerdir
b) Aynı tür, farklı alemdedir
c) Aynı tür, farklı cinslerdir
d) Aynı cins, farklı alemdedir
e) Aynı tür, farklı familyadadır

5. Aşağıdaki çiftlerden hangisi, homolog organlardan değildir?

a) Kuşun kanadı, insanın kolu
b) Kuş kanadı, sinek kanadı
c) Kuş tüyü, yılan pulu
d) Kuşun kanadı, balığın ön yüzgeci
e) Atın ön bacağı, kuşun kanadı

6. Prokaryot organizmalar, aşağıdaki özelliklerden hangisiyle ökaryot organizmalardan ayrılır?

a) Zarla çevrili organellerinin olmaması
b) Hücre çeperinin bulunmasıyla
c) Nükleik asitlerinin bulunmasıyla
d) Parazit yaşamlarıyla
e) Enzim sistemlerinin gelişmemesiyle

7. Aşağıdakilerden hangi organizma grubunda, yönetici molekül stoplazma içinde serbest bulunur?

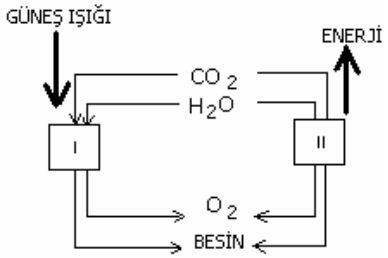
a) Bakteriler
b) Fungi
c) Sporlular
d) Silliler
e) Yalancı ayaklılar

8. I. Maya- Monera
II. Ekmek peynir küfleri- Fungi
III. Bakteri- Monera
IV. Sünger- Bitki
V. Amip- Protista
VI. Mavi-yeşil algler- Monera

Yukarıdaki hangi canlı, karşısındaki Alem içerisinde sınıflandırılmaz?

a) I ve II
b) I ve IV
c) II, III ve IV
d) II, III ve V
e) III, IV ve V

9.



Madde döngüsünü gösteren şemada, I ve II ile gösterilen olayların her ikisinide aynı anda gerçekleştirebilen canlı aşağıdakilerden hangisinde verilmiştir?

a) Mantarlar
b) Hayvanlar
c) Yeşil bitkiler
d) Parazit bakteriler
e) Saprofit bakteriler

10. I. Hidra
II. Tavşan
III. Semender
IV. Çekirge
V. Tavuk
VI. Yılan

Yukarıda verilen hayvanların basitten karmaşığa doğru sıralanışı nasıl olur?

a) I, IV, III, VI, V, ve II
b) II, III, IV, VI, V, ve I
c) I, IV, III, II, V ve VI
d) I, IV, II, III, VI ve V
e) III, V, IV, II, VI ve I

11. Aşağıdaki hangi özellikleriyle açık tohumlu bitkiler, kapalı tohumlu bitkilerden ayrılır?

a) İletim demetinin olması
b) Tohumlarının meyve içerisinde yer alması
c) Oksijensiz solunum yapması
d) Tohumlarının kozalakta yer alması
e) Gerçek çiçeklerinin olması

12. Virüslerde aşağıdaki canlılık özelliklerinden hangisinin bulunması, bunları canlı kabul eden hipotezi destekleyen bir kanıttır?

a) Çoğalmayı gerçekleştirme
b) Enzimleri ile enerji üretme
c) Büyüme
d) Aktif hareket etme
e) Organellere sahip olma

13.

- Bir hücreli ve çok hücreli olanları vardır.
- Hetetrofturlar
- Çürükçül ve parazit yaşayanları vardır
- Hücre çekirdekleri ve organelleri bulunur.

Açıklamalar hangi alemin özellikleridir?

a) Monera
b) Protista
c) Mantarlar
d) Bitkiler
e) Hayvanlar

14. Aşağıdaki canlı gruplarından hangisi diğerlerine göre daha basit yapılıdır?

a) tenya
b) sülük
c) toprak solucanı
d) uyuz böceği
e) midye

15. Aşağıda verilen hangi özelliğinden dolayı öglenayı sınıflandırmak güçtür?

I. Ökaryot canlı olması
II. Kloroplast taşıması
III. Bir hücreli olması
IV. Kamçısının bulunması
V. Besin kofulunun olması

a) I ve II
b) II ve III
c) I, II ve III
d) II ve IV
e) II, IV ve V

16. Aşağıdakilerden hangisi diğerlerinden farklı sınıftandır?

a) köpekbalığı
b) balina
c) hamsi
d) uskumru
e) sazan

17.Bakterilerde aşağıdaki beslenme çeşitlerinden hangisine rastlanmaz?

a) Fotoototrof
b) Çürükçül
c) Parazit
d) Kemoototrof
e) Holozoik

18. Köpekbalığı, kurbağa, kertenkele, kartal ve kirpi aşağıdaki hangi sınıflandırma birimlerinde birlikte incelenirler?

a) Familya (aile)
b) Şube
c) Sınıf
d) Cins
e) Takım

19. Aşağıdaki canlılardan hangisi aynı şube içerisinde incelenmez?

a) Semender
b) Serçe
c) Sülün
d) Sazan
e) Sülük

20. Bakterilerde kalıtsal varyasyon (çeşitlilik)un ortaya çıkmasında aşağıdakilerden hangisi etkilidir?

a) Endospor oluşturma
b) Eşeysiz üreme
c) Eşeyli üreme
d) Oksijenli solunum yapma
e) Hücre çeperinin kalınlaşması

APPENDIX E

UNIT OBJECTIVES

Students will be able to

- explain the importance of classification of Living Organisms
- distinguish the homologous and analogous organs
- comprehend the principles and fundamentals of classification
- comprehend the binomial naming
- list the classification units; species, genius, family, ordo, phylum and kingdom
- interpret the relationships among these classification steps with respect to the number of living organisms and common characteristics
- comprehend the structure of viruses
- explain the reproduction of viruses
- comprehend the relationship of the viruses with human beings and with the other living organisms
- divide the living organisms into 5 kingdoms (Monera, Protista, Fungi, Plants and Animals)
- explain the general characteristics of each kingdom.
- order the 5 kingdoms from simple to complex
- comprehend the structure of bacteria
- explain the reproduction of bacteria
- comprehend the types of bacteria
- explain the biological, economical importance of bacteria and their relation with human beings
- comprehend the structure of protista
- comprehend the types of protista
- explain the biological, economical importance of protista and their relation with human beings

- comprehend the structure of fungi
- comprehend the types of fungi
- explain the biological, economical importance of fungi and their relation with human beings
- describe the main structure of non flowering plants
- classify the non flowering plants
- describe the main structure of flowering plants
- classify the flowering plants
- explain the biological, economical importance of the plants and their relation with human beings
- describe the main structure of invertebrata
- comprehend different types of invertebrata
- order the different types of invertebratas from single to complex
- describe the main structure of vertebrata
- comprehend different types of vertebrata
- order the different types of vertebratas from single to complex
- classify the animals
- detect to which kingdom, phylum or class a living organism is belonging to with respect to general characteristics
- comprehend the biological richness of Turkey.

APPENDIX F

INTERVIEW QUESTIONS FOR THE STUDENTS

Öğrencilerle Görüşme Soruları

1. Uygulama yaptığımız biyoloji deslerinizi işleniş yönünden daha önceki biyoloji derslerinizle kıyaslayınız.
2. Uygulama yaptığımız biyoloji derslerinizi daha önceki biyoloji derslerinizle öğrenme stilleriniz açısından kıyaslayınız.
3. Biyoloji derslerinizin bu şekilde işlenmesinin sizin üzerindeki etkileri nelerdi?
4. Uygulamalar esnasında kendinizi nasıl hissettiniz?
   Uygulama yaptığımız biyoloji derslerinde kendinizi hiç lider konumunda hissettiğiniz oldu mu?
5. Uygulamalar sürecinde sınıf arkadaşlarınıza dair gözlemleriniz nelerdir?
6. Uygulamalar sürecinde öğretmeninize özgü gözlemleriniz nelerdir?
7. Lise 1 konuları çerisinde en iyi anladığınızı düşündüğünüz biyoloji konusu hangisidir?
8. Uygulama yaptığımız derslerin işlenişi esnasında eksik gördüğünüz ya da aksayan yönler nelerdir?
9. Derslerin bundan böyle nasıl işlenmesini istersiniz?
10. İlave etmek istediğiniz şeyler ya da bu ders planları işlendiği sırada yaşadığınız ve paylaşmak istediğiniz durumlar varsa belirtiniz.

APPENDIX G

INTERVIEW QUESTIONS ASKED FOR THE TEACHER

Biyoloji Öğretmenine Sorulan Ön Görüşme Soruları

1. Önbilgileri ve geçmiş yaşantıları (deneyimleri) doğrultusunda öğrencileriniz "Canlılıların sınıflandırılması" konusunda ne kadar bilgiye sahipler?
   Önbilgilerini kullanabildiklerine inanıyor musunuz?
2. Canlıların sınıflandırılması ünitesinde temel hedefleriniz nelerdir? Niçin bu hedeflerin önemli olduğuna inanıyorsunuz?
3. Bu ünitede kullandığınız öğretim yöntem ve teknikleri nelerdir?
4. Hedeflerinize ulaşıp ulaşamadığınızı nasıl ölçüyorsunuz?
5. Bu ölçmenin gerçeği yansıttığına inanıyor musunuz?
6. Öğrencilerinizin biyoloji derslerine çalışırken tercih ettikleri öğrenme stilleri nelerdir?
7. Başarısız bir öğrenciyi başarılı bir öğrenciden ayıran temel farklılıklar (özellikler) nelerdir?
8. Öğrencilerinizin başarısını nasıl değerlendiriyorsunuz?
9. Biyoloji dersinde başarısız olan öğrencilerinizin diğer derslerindeki başarı durumlarını biliyor musunuz? Evetse, diğer derslerindeki başarı durumları nasıl?
10. Sizce öğrenci başarısını etkileyen temel faktörler nelerdir?

Projeyle İlgili Düşüncelerini ve Kaygılarını Ortaya Çıkarmak Amacıyla Öğretmene Sorulan Ön Görüşme Soruları

1. Çoklu Zeka Teorisine yönelik neler biliyorsunuz?
2. Bu projeden beklentileriniz nelerdir?
3. Projeyi uygularken öğrencileriniz ya da sizin için kısıtlı olabileceğini düşündüğünüz faktörler var mı?

APPENDIX H

LESSON PLANS

Günlük Ders Planları

DERS PLANI 1:

Konu: Canlıların çeşitliliği ve sınıflandırılması

Süre: 40 dakika

Amaç: Canlıların çeşitliliğini ve sınıflandırma ilkelerini anlama

Davranışlar:

1) Yeryüzünde mevcut canlı çeşitliliğinin farkına varma,
2) Bu çeşitliliğin sebebini açıklama,
3) Canlıları sınıflandırmanın önemini söyleme,
4) Yapay sınıflandırmanın kriterlerini söyleme,
5) Doğal sınıflandırmanın kriterlerini açıklama,
6) Homolog organ tanımını yapma,
7) Analog organ tanımını yapma,
8) Verilen ikili organ örneklerinin homolog organ mı analag organ mı olduğunu ayırt etme,
9) Sınıflandırmada hangi organın önemli olduğunu açıklama.

Kaynak ve Materyaller: Posterler, tepegöz, asetatlar, ders kitabı, kalem, kağıt.

Hedeflenen zeka türleri: Matematiksel/mantıksal zeka, görsel/uzamsal zeka, özedönük/bireysel zeka, kişilerarası/sosyal zeka, sözel/dilsel zeka, müzikal zeka, doğa zekası.

Dersin işlenişi:

1. Öğrencilerin önbilgileriyle yeni ünite arasında bir köprü kurabilmelerini sağlayabilmek amacıyla öğrencilere Appendix K.1' de yer alan ödev konusu verilir.

Böylece daha önceki ünitelerde görülen kavramların "Canlıların Çeşitliliği"yle nasıl bir bağlantısı olduğunu araştırıp gelmeleri sağlanmış olur (Matematiksel/mantıksal zeka).

2. Derse başlamadan önce ünitenin hedefleri (Appendix K.2) öğrencilere dağıtılır. Öğrencilere bu hedefleri her dersin sonunda işledikleri yerleri işaretliyecekleri, eve gittiklerinde kontrol edecekleri, işledikleri yerlerden anlayıp anlayamadıkları yerleri belirleyerek eksikliklerini giderecekleri söylenir (Özedönük/kişisel zeka).

3. Dersin başlangıcında 3er kişilik gruplar oluşturulur. Bu etkinlik sırasında öğrenciler araştırıp geldikleri ödev konusu hakkında konuşacaklardır.

Tüm öğrencilerin konuşma şansı bulabilecekleri, fakat konuşmaya başlamadan önce kendilerinden önce konuşan arkadaşlarının söylediklerini özetlemeleri gerektiği vurgulanır. Bir önceki öğrenci, yapılan özetin doğru olduğunu onaylamak zorundadır. Her konuşmacıya 2 dakika süre verilir.

-Tüm grupların konuşmaya başlayacak olan birinci kişiyi, dinleyecek olan ikinci kişiyi ve gözleyecek olan üçüncüyü kişiyi seçmeleri sağlanır.

-Birinci kişi notlarına bakmaksızın ödev sorusunu yanıtladıktan sonra ikinci kişi özetler.

-Birinci ve üçüncü kişi özetin doğru olduğunu onayladıktan sonra ikinci kişi konuşmaya başlar. Bu sefer birinci kişi gözlemci, üçüncü kişi dinleyici olmuştur.

-Bu süreç tüm gruplardaki öğrenciler konuşma sırasını elde edene kadar devam eder (Figure L.1.4).

4. Öğrencilere dağıtılan kağıtlara öğrencilerin grup çalışmalarını değerlendirmeleri istenir.

Değerlendirme:

-Grup elemanları ödev konusunu araştırıp gelmişler mi?

-Gruptaki en zor görev neydi? (Konuşmacı, dinleyici, yoksa gözlemci olmak mı? Niçin?

-Bir konuşmacı yapılan özeti onaylamadığında grup ne yaptı? (Sözel/dilsel, kişilerarası/sosyal zeka).

5. Öğretmen rehberliğinde öğrencilerle birlikte verilen kavramların canlıların çeşitliliğiyle bağlantısı verilir.

6. Öğretmen tarafından söylenen harfle başlayan canlı isimlerinin öğrenciler tarafından söylenmesi gerçekleştirilir. Öğrencilerin hep bir ağızdan canlı ismi söylememeleri gerektiği vurgulanarak parmak kaldıran öğrencilere sırasıyla söz hakkı verilir. Buradaki amaç bir öğrenci bir harfle başlayan canlı ismi söylediğinde diğer öğrencilerin aklından başka bir canlı isminin geçmesini ve öğrencilerin doğadaki çeşitliliği fark etmelerini sağlamaktır. (Sözel/dilsel zeka).

7. Öğrenciler tarafından söylenen canlı isimleri sırasıyla tahtaya yazılır,

8. Tüm harfler tamamlandıktan sonra tahtada görülen canlı isimlerinden başka daha kaç tane canlı isminin yazılabileceği sorulur,

9. Canlı çeşitliliğinin çokluğu vurgulandıktan sonra tahtada mevcut olan canlılardan aynı gruba dahil edilebilecek canlı organizmaları öğrencilerin bulmaları istenir (Doğa zekası).

Amip	Çam	Fil	Isırgan	Karides	Nar	Portakal	Şempanze
Üzüm	Bülbül	Devekuşu		Goril	İstakoz	Leylak	Orangutan
Roka	Tenya	Vaşak	Ceylan	Eğreltiotu	Hidra	Havuç	Jaguar
Mandalina		Öglena	Sülük	Uskumru	Yengeç		Zeytin

10. Öğrencilerin yapmış oldukları bu sınıflandırmalar ve doğadaki çeşitlilik vurgulanarak "Neden sınıflandırmaya ihtiyaç duyulmuştur?", "Sınıflandırma olmasaydı ne olurdu?" sorularının cevabını öğrencilerin vermesi beklenir (Mantıksal/matematiksel zeka).

11. Günlük hayatımızda marketlerdeki raflardaki sınıflandırma örnek gösterilir (Özedönük zeka).

Markete gitmeyi seviyor musunuz?

En çok ne almak hoşunuza gidiyor?

Aradığınızı nasıl bulabiliyorsunuz?

12.Öğretmenin öğrencilerin bu çeşitliliği doğada kendi kendilerine görebileceklerini vurgulamasının ardından sınıf ilerleyen haftalarda hazırlanıp gelmek üzere 3 guruba ayrılır. Birinci gruptakilerin bitkileri, ikinci gruptakilerin omurgasız hayvanları, üçüncü gruptakilerin ise omurgalı hayvanlarla ilgili bir gurup çalışması gerçekleştirmesi istenir. Öğrencilere gurup çalışmaları esnasında neler

hazırlayabileceklerini gösteren listeler (Appendix K.12) dağıtılır. Bu arada doğada canlıların sadece bitki ve hayvanlardan meydana gelmediği vurgulanır.

14. Canlıların sınıflandırmasında önemli olan kriterler öğrenciler aracılığıyla çıkartılır.

15. Bu kriterlerden öncelikle Ampirik sınıflandırmaya özgü olanlar tahtaya yazılır,

16.Ampirik sınıflandırmada baz alınan kriterlerin günümüzdeki bilimsel sınıflandırmada kullanılmadığı vurgulanarak ampirik sınıflandırmadaki 2 temel kriterin üstüne çarpı koyulur,

17. Bilimsel sınıflandırmaya özgü kriterler tahtaya yazılır,

18. Öğrencilere ikişer organizmaya ait organ ve karşılarında homolog mu analag mu olduğu yazılı asetat kağıdı (Appendix I) tepegöz aracılığıyla gösterilerek öğrencilerin homolog organ ile analog organ arasındaki farklılığı bularak bu organların tanımlarını yazmaları istenir (Sözel/dilsel zeka).

19. Denizle içiçe olan öğrencilere,

Hiç balık solungacı gördünüz mü?

Hiç midye yediniz mi?

Midyeyi açıp hiç içine baktınız mı?

Hiç midye solungacı gördünüz mü?, soruları sorularak öğrencilerin midye solungacı ile balık solungacının yapısal olarak birbirine benzemediğini algılamaları sağlanır (Doğa, görsel/uzamsal zeka) ve bu 2 organın homolog mu analog mu olduğunu öğrencilerin bulmaları istenir (Mantıksal/matematiksel zeka)

20. **A**nalo**g**: görevleri aynı

Analog organ ismi tahtaya yazılarak burada yer alan a'nın aynı, g'nin ise görevi sembolize edebileceği vurgulanır. Böylece Analog organ kavramı öğrencilere bu kavramın anlamı hakkında bir ipucu teşkil etmesi sağlanır (Sözel/dilsel, görsel/uzamsal zeka).

21. Öğrencilerin asetat kağıdında yer alan organlara dikkat ederek burada mevcut olan kuralı bulmaları istenir (Mantıksal/matematiksel zeka). (Appendix J. 1)

22. Kural bulununca sınıfça ritmik olarak verilen organların homolog mu analog mu olduğu söylenir. Ritmin homolog-analog/homolog-analog-analog/ homolog-analog-analog-analog şeklinde olması gerekmektedir (Müzikal/ritmik zeka).

23. Bilimsel/ Filogenetik/ Sistematik sınıflandırmada hangi tip organların kullanılabileceği öğrenciler aracılığıyla ortaya çıkarılır (Mantıksal/matematiksel zeka).

DERS PLANI 2:

Konu: Binomial adlandırma ve sınıflandırma birimleri

Süre: 40 dakika

Amaç: Binomial adlandırmanın nasıl yapıldığını ve sınıflandırma birimlerini anlama

Davranışlar:

1) Tür tanımını söyleme,
2) Binomial/ikili adlandırmanın önemini açıklama,
3) İkili adlandırma örneklerinde, birinci kelimenin türün bağlı olduğu cinsi, ikinci kelimenin ise tamamlayıcı ad olduğunu söyleme,
4) Sınıflandırma basamaklarını sırasıyla söyleme,
5) Bu basamakların birbiriyle ilişkisini açıklama,
6) Türden aleme doğru gidildikçe o birim içerisinde bulunan canlı çeşitliliği sayısının arttığını söyleme,
7) Alemden türe gidildikçe o birim içerisinde bulunan canlıların ortak özelliklerinin arttığını söyleme.

Kaynak ve Materyaller: 7 adet küçükten büyüğe doğru dikdörtgen şeklinde kesilmiş kağıt, sınıflandırma birimleri tablosu, sınıflandırma piramidi, ders kitabı, defter, kalem.

Hedeflenen zeka türleri: Matematiksel/mantıksal zeka, görsel/uzamsal zeka, kişilerarası/sosyal zeka, sözel/dilsel zeka, müzikal zeka, doğa zekası, bedensel zeka, özedönük/bireysel zeka.

Dersin işlenişi:

1. Öğrencilerden bildikleri farklı köpek türlerini söylemeleri istenir (Doğa zekası).
2. Öğrenciler tarafından ismi verilen 2 köpek türünden ikisi çiftleştiğinde yavrularının hangisine benzeyeceği sorulur (Doğa zekası).
3. Öğrencilerden kendilerine özgü tür tanımı yapmaları istenir (Sözel/dilsel zeka).
4. Bir örnek üzerinde bir türün adlandırılmasında kullanılan binomial isimlendirmenin kuralları öğrenciler yardımıyla çıkartılır ardından öğrencilerin binomial ismilendirmede gösterilen hangi kısmın türü hangi kısmın cinsi gösterdiğini bulmaları sağlanır (Mantıksal/matematiksel zeka).
5. Bilimsel sınıflandırmada yer alan birimler sırasıyla verilir (sözel zeka).

6. Bu birimler reklam müziği olan "Direct-Drive" a uyarlanarak ritmik olarak Tür-Cins-Aile/ Takım- Sınıf- Şube- Alem olacak şekilde sınıfça söylenir (Müzikal/Ritmik zeka).

7. Öğrencilerin küçükten büyüğe doğru hazırlayıp getirdiği 7 adet kağıda sırasıyla bu birimleri yazması istenir (see Appendix J.2) (Kinestetik/bedensel zeka).

8. Sınıflandırma birimleri tablosu (Appendix J.3) öğrencilere dağıtılarak 5er kişilik gruplar oluşturulur (Kişilerarası/sosyal zeka).

9. Öğrencilerin grup arkadaşlarıyla birlikte kendilerine verilen hayvan isimlerini sınıflandırma birimleri tablosunda uygun yerlere yerleştirmeleri istenir (Doğa zekası).

10. Araştırmacı tarafından hazırlanan sınıflandırma piramidine yine araştırmacı tarafından hazırlanan hayvan resimleri (Appendix J.4) öğrenciler tarafından yapıştırılır (Kinestetik/bedensel zeka).

11. Piramit aracılığıyla öğrencilerin türden aleme doğru gidildikçe canlıların benzer özellikleri ve canlı sayılarının nasıl olabileceğini öğrencilerin söylemesi sağlanır (Görsel/uzamsal zeka).

12. Öğrencilerin defterlerine venn şemalarıyla bu sınıflandırma birimlerini göstermeleri istenir (Görsel/uzamsal, matematiksel/mantıksal zeka)

13. Öğretmen tarafından tahtaya venn şeması oluşturularak son tekrar gerçekleştirilir.

14. Konuyla ilgili test soruları (Appendix J.5) öğrencilere çözdürülür (Mantıksal/matematiksel zeka).

15. Son olarak öğrenciler hep birlikte "Direct-drive" melodisiyle sınıflandırma birimlerini tekrar ederler (Müzikal/ritmik zeka).

16. Bir sonraki ders için sınıftan seçilen öğrencilerin tiyatral bir metin yazmaları istenir (Sözel zeka). Bu metnin isteyen öğrenciler tarafından ders içerisinde canlandırılabileceği vurgulanır (Kinestetik/bedensel zeka). Buna bağlı olarak istekli öğrenciler belirlenir.

16. Bir sonraki ders için tüm öğrencilerden istenen bir diğer unsur birer virüs modeli yapıp gelmeleridir (Kinestetik/bedensel zeka).

DERS PLANI 3:

Konu: Virüsler

Süre: 40 dakika

Amaç: Virüslerin temel özelliklerini ve diğer canlı organizmalarla ilişkisini anlama

Davranışlar:

1) Virüslerin genel özelliklerini söyleme,
2) Bir virüs modeli oluşturma,
3) Virüs çeşitlerini ayırt etme,
4) Virüslerin nasıl üredi̇ğini açıklama,
5) Virüslerin insan sağlığı ve diğer canlı organizmalarla ilişkisini açıklama.

Kaynak ve Materyaller: Öğrencilerin hazırlayıp getirdikleri virüs modelleri, bir bakteriyofajın üremesine özgü resimler, Televizyon, VCD, ders kitabı.

Hedeflenen zeka türleri: Matematiksel/mantıksal zeka, görsel/uzamsal zeka, kişilerarası/ sosyal zeka, sözel/dilsel zeka, müzikal zeka, kinestetik/ bedensel zeka, doğa zekası.

Dersin işlenişi:

1. Öğrenciler arkadaşları tarafından hazırlanan ve öğretmenleri tarafından kontrol edilen virüslerin keşfine özgü metni canlandırır (Kinestetik/bedensel, kişilerarası/sosyal zeka).

2. Hep birlikte 2002 yılına özgü reklam müziklerinden "Biz biz üniversiteliyiz biz" melodisi kullanılarak "Biz biz virüsleriz biz" şarkısı (Appendix J.6) söylenir (Müzikal/ritmik zeka). (Appendix J. 6).

3. Öğrencilere virüsleri ve üremesini anlatan bir video film izlettirilir (Görsel/uzamsal, sözel zeka).

4. Öğrencilerin sınıf ortamına getirdikleri virüs modelleri ve izledikleri VCD baz alınarak öğrencilerin virüslerin genel özelliklerini çıkartmaları sağlanır (Sözel/dilsel zeka).

5. Öğrencilerin virüslerin üremesiyle ilgili olarak kendilerine dağıtılan resimlerin üzerindeki virüslere ve bakterilere özgü kısımların isimlerini yazmaları istenir (Appendix J.7) (Sözel zeka)

6. Öğrencilerin virüslerin üremesindeki temel prensibi baz alarak bu resimleri sıralamaları istenir (Görsel/uzamsal, matematiksel/mantıksal zeka).

7. Öğrenciler tarafından düzgün sıralama yapıldıktan sonra resimlerin sırasıyla renkli kağıtlar üzerine yapıştırılması (Kinestetik/bedensel) ve nasıl üredıklerinin yazılması istenir (Sözel/dilsel zeka).

8. Öğretmen tarafından virüslerin üremesi asetat üzerinde son kez tekrar edilerek öğrencilerin varsa hatalarını düzeltmeleri sağlanır.

9. Hindistanda insanların ayin sırasında ne yaptıklarını bilip bilmedikleri sorulur,

10. İnsanların Ganj nehrinde yıkandıklarının vurgulanmasının ardından, Siz olsaydınız bu nehre girer misiniz? Neden? Sorusu sorulur (özedönük zeka).

Neden o insanlara bir şey olmadığını tahmin etmeleri istenir? (Matematiksel/mantıksal zeka)

11. Farklı hastalık etkeni virüslerin insan vücunda yerleşim alanlarını gösteren tablo öğrencilere dağıtılır (Appendix J.8).

9. Bu tablonun doldurulması istenir (Doğa zekası).

10. Farklı virüs çeşitleri ve yerleşim alanları öğretmen tarafından özetlenir.

11. Bakteriler konusuyla ilgili aktivite seçimini içeren çalışma kağıtları (Appendix K.12) öğrencilere dağıtılarak istedikleri aktiviteyi seçmeleri ve sınıf başkanına isimlerini yazdırmaları istenir.

DERS PLANI 4:

Konu: Canlıların sınıflandırılması ve Monera alemi

Süre: 40 dakika

Amaç: Canlıların 5 Aleme ayrıldığını ve bu 5 Alemden biri olan Monera aleminde yer alan bakterilerin yapıları, üremeleri, biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisini anlama.

Davranışlar:

1) Bakterilerin prokaryotik hücreler olduğunu söyleme,
2) Bakterilerin genel özelliklerini söyleme,
3) Bakterilerin hangi özelliklerine göre sınıflandırıldığını söyleme,
4) Bakterilerde eşeysiz üremenin nasıl gerçekleştiğini açıklama,
5) Bakterilerde eşeyiz üremenin önemini söyleme,
6) Bakterilerde eşeyli üremenin nasıl gerçekleştiğini açıklama
7) Bakterilerde eşeyli üremenin önemini söyleme,
8) Bakterilerin fayda ve zararlarını anlama,
9) Bakterilerde mevcut olan endosporun ne olduğunu açıklama.

Kaynak ve Materyaller: Seçmece aktiviteler (Appendix K.6), önlük, maskeler, ders kitabı ve farklı kaynaklar, pet şişeleri, oyun hamuru, renkli kartonlar.

Hedeflenen zeka türleri: Mantıksal/matematiksel zeka, bedensel/kinestetik zeka, görsel/uzamsal zeka, özedönük/bireysel zeka, kişilerarası/sosyal zeka, sözel/dilsel zeka, müzikal zeka, doğa zekası.

Dersin işlenişi:

1. Öğrenciler seçmiş oldukları aktivitelere göre gurup gurup oturtturulur,
2. Sınıflandırma gurubu üyeleri tarafından hazırlanan sınıflandırma tablosu duvara asılır (doğa zekası),
3. Mantık gurubu üyelerinin kendilerine sorulan soruları yanıtlamaları istenir,
4. Öğrencilerin kişilerarası yönlerini devreye sokmak amacıyla:

"Çocuklar 4 gün önce enfes bir çorba pişirdim. Çorba şu an mutfakta tezgahın üzerinde. Canım bugün hiç yemek pişirmek istemiyor eve gidince. En iyisi ben bugün o çorbayı yiyeyim" diyerek öğrencilerin vereceği cevaplara odaklanılır,

- Ne olur içersem?
- Siz hiç herhangi bir besinden zehirlendiniz mi?

- Neler hissettiniz? sorularıyla öğrencilerin özedönük zekalarının devreye girmesi sağlanır.

5. Öğrencilerin endospor kavramını açıklamaları istenir,

6. Endospor tanımında geçen kötü ortam koşullarının neler olabileceği sorulur (matematiksel/mantıksal zeka),

7.Mantıksal gurup elemanlarınca tahtaya çizilen ven şemaları sınıfça gözden geçirilir,

8. Müzikal gurup üyeleri şarkılarını söylerken sınıfça şarkı sözlerine (Appendix M.4) dikkat edilir,

9.Görsel gurup üyeleri hazırlamış oldukları üreme şekillerini kullanarak bu konuda arkadaşlarını bilgilendirir,

10.Kinestetik gurup üyeleri hazırlayıp getirdikleri modelleri kullanarak bakterilerde üremeyi anlatır,

11.Bakterilerin faydasıyla ilgili olarak öğrencilerin yazdığı metin canlandırılır (kinestetik/bedensel zeka),

12.En son olarak sözel gurubu üyelerince hazırlanan kare bulmaca (see Appendix M.1.2) sınıfça çözülür.

DERS PLANI 5:
Konu: Protista alemi

Süre: 40 dakika

Amaç: Protista aleminde yer alan canlıların yapıları, üremeleri, biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisini anlama

Davranışlar:

1) Protista aleminde yer alan canlılara örnekler verme,
2) Bu canlıların genel özelliklerini açıklama,
3) Protistaların biyolojik, ekolojik önemini ve insan sağlığıyla ilişkilerini açıklama.

Kaynak ve Materyaller: Mikroskop, dere suyu, lam-lamel, ders kitabı, defter, kalem, tahta, tebeşir.

Hedeflenen zeka türleri: Mantıksal/matematiksel zeka, görsel/uzamsal zeka, özedönük/bireysel zeka, sözel/dilsel zeka, doğa zekası.

Dersin işlenişi:

1. Gönüllü bir öğrencinin getirdiği (Appendix K.7) dere suyundan temin edilen bir damla sudan hazırlanan preparatta, mikroskop aracılığıyla protistaların bulunduğu alan tespit edilir,
2. Öğrencilere protista aleminde yer alan bazı tek hücreli organizmaları mikroskopta görecekleri söylenir,
3. Mikroskopta gözlem yapmaya başlamadan önce, gördükleri canlıları tanıyabilmelerinde yardımcı olacağı inancıyla kitaplarında yer alan protista alemindeki canlı organizmaların şekillerini dikkatle incelemeleri istenir (Görsel/uzamsal zeka),
4. Öğrenciler sırayla tek tek mikroskop altındaki canlı organizmaları izlerler (Görsel/uzamsal zeka),
5. Yerine oturan öğrenci defterine gördüğü şekli şematize etmeye çalışır (Görsel/uzamsal zeka) (see Appendix L.3.13),
6. Bu esnada öğretmende tahtaya protista aleminde yer alan canlıların genel hatlarıyla şekillerini çizer (Görsel/uzamsal zeka),
7. Tüm öğrenciler gözlemlerini yaptıktan sonra, öğrencilerin gözlemleri değerlendirmeye katılarak bu canlı organizmaların genel özellikleri çıkarılır,

Örneğin: Bu canlıları gördüğümüz preparatımızı nasıl hazırladık?

O halde bu grup canlılar genel olarak nasıl ortamlarda yaşar diyebiliriz? (Matematiksel/mantıksal zeka)

8. Ek olarak öglenanın kloroplasta sahip olduğu, plazmodyumdaki kontraktil kofulların ne işe yaradığı hakkında bilgi verilir (Sözel/dilsel zeka),

9. Öğrencilerin bulmaları istenilen diğer hususlar, bu gruptaki canlıların hücre sayıları, hüre çeşitleri ve genel olarak nasıl üredikleridir (Mantıksal/matematiksel zeka),

10. Ardından alglerin genel özellikleri açıklanır (Sözel/dilsel zeka),

11. Cıvık mantarların hücre yapıları ve görünüşleri hakkında bilgi verilir (Sözel/dilsel zeka),

12. Verilen bu bilgiler ışığında doğada hiç cıvık mantar görüp görmedikleri sorulur (Görsel/uzamsal zeka, doğa zekası),

13. Şapkalı mantarların cıvık mantarlar grubunda olup olamayacağı sorulur (Mantıksal/matematiksel zeka),

14. Öğrencilerin evlerinde basit bir deney düzeneği kurarak cıvık mantarları gözlemlemeleri istenir. Buna göre:

Bir kova su içerisine evde kullanılan temiz bir paspası koyup belirli bir süre bekleyecekler ve ne kadar süre içerisinde ne gördüklerini not edeceklerdir (Görsel/uzamsal zeka, doğa zekası, bedensel zeka).

15. Panoda yer alan protistalar hakkında “bunları biliyor musunuz?” adlı kısım (Appendix O) bir öğrenciye okutturularak öğrencilerin protistaların biyolojk, ekonomik önemini ve insan sağlığıyla ilişkilerini görmeleri sağlanır (Sözel/dilsel zeka).

16. İsteyen öğrencilerin Amip hastalığıyla ilgili bilgiyi panodaki haberler kısmından okuyabileceği söylenir (Sözel/dilsel zeka).

DERS PLANI 6:
Konu: Mantarlar alemi

Süre: 40 dakika

Amaç: Mantarlar aleminde yer alan canlıların yapıları, biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisini anlama

Davranışlar:

1) Mantarların genel yapılarını açıklama,
2) Mantar çeşitlerini söyleme,
3) Şapkalı mantarların bitkilerden ayrılan temel özelliklerini ayırt etme,
4) Şapkalı mantarların nasıl ortamlarda yaşadıklarını açıklama,
5) Küflerin hangi ortamlarda yaşadıklarını söyleme,
6) Küflerin genel özelliklerini söyleme,
7) Mayaların nasıl ortamlarda yaşayabildiklerini söyleme,
8) Mayaların üremeleri için ortam koşullarını söyleme,
9) Mayaların genel özelliklerini söyleme,
10) Mantarların, küflerin ve mayaların birbirinden farklı olan özelliklerini açıklama,
11) Mantarların biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisini açıklama.

Kaynak ve Materyaller: balon, bira mayası, ılık su, şeker, şişe, kap, küflenmiş simit, "mantar-ağaç şema", "mayaları canlandıralım" çalışma kağıdı, "küf oluşturalım" çalışma kağıdı, defter, kalem.

Hedeflenen zeka türleri: Görsel/uzamsal zeka, özedönük/bireysel zeka, doğa zekası, sözel/dilsel zeka, mantıksal/matematiksel zeka.

Dersin işlenişi:

1. Öğrencilere mantarlar ağaç şema dağıtılır (Appendix J.9),
2. Bu şemaların bugünkü dersin sonunda bireysel olarak doldurulacağı söylenir (Görsel/uzamsal zeka, özedönük zeka),
3. Daha önce öğrencilere dağıtılmış olan "mayaları canlandıralım" deney düzeneği (Appendix J.10), öğretmen tarafından demonstrasyon yöntemiyle uygulanır (Görsel/uzamsal zeka),
4. Hazırlanan düzenek beklemeye bırakılır,
5. Bugünkü konunun mantarlar alemi olduğu bu alemde sadece şapkalı mantarların değil aynı zamanda, küflerin ve mayaların bulunduğu vurgulanır,

6. Sınıfça mantarlar aleminin grupları olan, Şapkalı mantarlar, Küf mantarları ve Maya mantarları hep birlikte ritim tutularak söylenir (Müzikal/ritmik zeka),

7. Tüm öğrencilerin defterlerine bir papatya bir de mantar resmi çizmeleri istenir (Görsel/uzamsal zeka),

8. Öğrencilere aralarında kültür mantarı toplayan olup olmadığı sorulur (Doğa zekası, özedönük zeka),

9. Neden mantar topladıkları ve tüm mantar türlerinin bu amaçla toplanıp toplanamayacağı sorulur (Sözel/dilsel zeka),

10. Mantar toplayan öğrencilerden mantarların genel özellikleri hakkında bilgi alınır (Sözel/dilsel zeka),

11. Öğrencilerin arkadaşlarının deneyimleri ve çizmiş oldukları resimleri göz önünde bulundurarak mantarlarla bitkiler arasındaki ayırt edici özellikleri söylemeleri istenir (Mantıksal/matematiksel zeka),

12. "Bol miktarda mantarın ve papatyanın bulunduğu bir ortam düşünün. Burada 50 adet papatyayı mı daha çabuk toplarsınız yoksa 50 adet mantarı mı?" sorusu sorulur (Görsel/uzamsal zeka),

13. Eksik bilgiler tamamlanır.

14. Bir öğrencinin kendilerine dağıtılan çalışma kağıtlarına göre hazırlayıp sınıfa getirdiği küf örneği (Appendix K.8) kullanılarak, öğrencilerden küflerin genel yapısı hakkında bilgi istenir ,

15. Evde oluşturmuş oldukları küfü hazırlayabilmek için nasıl bir ortam hazırladıklarını baz alarak, küflerin nasıl ortamlarda yaşayabileceğini söylemeleri istenir (Görsel/uzamsal zeka, özedönük zeka, sözel zeka),

16. "Mayaları canlandıralım" deneyine geri dönülerek, bu deneyde kullanılan madde malzemeler, ortam koşulları ve deney sonuçları değerlendirilerek,

-mayalar nasıl ortamları tercih ediyorlar?

-hangi canlılık özelliklerine sahipler? sorularına yanıt bulmaları sağlanır (Mantıksal/matematiksel zeka).

17. Tüm gruplar göz önünde bulundurularak, mantarlar aleminin genel özellikleri çıkartılır ve dağıtılan ağaç şemada eksik kalan hususların ev ödevi (Appendix K.9) olarak hazırlanması istenir,

18. Bugünkü konuyla ilgili değerlendirme formlarının (Appendix K.10) doldurulması istenir.

DERS PLANI 7:

Konu: Bitkiler alemi

Süre: 40+40=80 dakika

Amaç: Bitkilerin sınıflandırılmasını ve biyolojik, ekonomik önemlerini ve insan sağlığıyla ilişkilerini anlama

Davranışlar:

1. Bitkilerin genel özelliklerini söyleme,
2. Bitkilerin çiçeksiz bitkiler ve çiçekli bitkiler olmak üzere ikiye ayrıldığını söyleme,
3. Çiçeksiz bitkilerin damarsız çiçeksiz ve damarlı çiçeksiz bitkiler olmak üzere ikiye ayrıldığını söyleme,
4. Çiçeksiz bitkilerin genel özelliklerini söyleme,
5. Damarsız bitkilere ve damarlı bitkilere örnek verebilme,
6. Damarsız bitkilerle damarlı bitkilerin benzer özelliklerini söyleme,
7. Damarsız bitkilerle damarlı bitkilerin farklı özelliklerini söyleme,
8. Çiçekli bitkilerin genel özeliklerini söyleme,
9. Çiçekli bitkilerin açık tohumlu ve kapalı tohumlu bitkiler olmak üzere ikiye ayrıldığını söyleme,
10. Açık tohumlu bitkilerin özelliklerini söyleme,
11. Açık tohumlu bitkilere doğadan örnekler verme,
12. Kapalı tohumlu bitkilerin tek çenekli bitkiler ve çift çenekli bitkiler olmak üzere ikiye ayrıldığını söyleme,
13. Tek çenekli ve çift çenekli bitkilerin genel özelliklerini söyleme,
14. Tek çenekli ve çift çenekli bitkiler arasındaki farklılıkları söyleme,
15. Tek çenekli bitkilere doğadan örnekler verme,
16. Çift çenekli bitkilere doğadan örnekler verme,
17. Bir bitkinin özelliklerine bakarak hangi guruba ait olduğunu belirleme,
18. Bitkilerin hayatımızdaki yerini ve önemini açıklama.

Kaynak ve Materyaller: 8er adet sticker, renkli dosya kağıtları, kurşun kalem, 2 adet karton, sınıflandırma kağıtları, çiçeksiz-çiçekli bitkiler ve açık tohumlu bitkiler-tek çenekli bitkiler ve çift çenekli bitkiler ven şemaları çalışma kağıtları, açık tohumlu-tek çenekli-çift çenekli bitkiler ven şeması kartonları, çeşitli bitki

resimleri, tahta, kalem, farklı bitki isimlerinin bulunduğu gurup çalışma kağıdı, gurup elemanlarınca hazırlanan gazete, dergi yazıları ve resimleri içeren panolar, farklı bitki isimlerini içeren asetat.

Hedeflenen zeka türleri: Sosyal/kişilerarası zeka, Görsel/uzamsal zeka, özedönük/bireysel zeka, doğa zekası, mantıksal/matematiksel/zeka, kinestetik/bedensel/zeka, sözel zeka.

Dersin işlenişi:

1. Ders öncesinde sınıfın duvarları bitkiler gurubu elemanlarınca hazırlanan panolarla donatılır (görsel/uzamsal zeka, sosyal zeka, doğa zekası)
2. Her bir öğrenciye 8'er adet sticker ve bir adet renkli dosya kağıdı (Appendix J.11) verilir (Görsel/uzamsal zeka),
3. Öğrencilere bu stickerların bitkileri sınıflandırmak üzere kullanılacağı söylenir,
4. Öğrencilerden ders sürecinde her bir stickera bir sınıflandırma biriminin adını kurşun kalemle yazmaları istenir (Stickerlara başka kavramlar yazılmayacağı, sadece alt gurupların yazılacağı vurgulanır) (Sözel/dilsel zeka),
5. İlk olarak boş kağıda hep birlikte "Bitkiler" yazılır,
6. Ve Bitkilerin sınıflandırılması konusuna giriş yapılır,
7. Bitkiler gurubu elemanlarından bitkilerin kaça ayrıldığını arkadaşlarına söylemeleri istenir,
8. Sınıftan çiçeksiz bitkilere örnekler vermeleri istenir (Doğa zekası),
9. Çiçeksiz bitkilerin tohumlarının olmadığı vurgulanır,
10. "Damar" kavramıyla ne kastedildiği, damarsız çiçeksiz bitkilerin suyu nasıl alabilecekleri, damarsız çiçeksiz bitkilerin üremeleri, damarsız çiçeksiz bitkilerin kök, gövde ve yaprak yapıları gurup elemanlarına söz hakkı verilerek açıklattırılır,
11. Bitkiler gurubuna çiçekli bitkilerin kaça ayrıldığı sorulur,
12. Öğrencilerin açık tohumlu bitkilere doğadan örnekler vermeleri istenir (Doğa zekası),
13. Verilen örneklerin doğrulanması gurup elemanlarına yaptırılır,
14. Gurup elemanlarına kapalı tohumlu bitkilerin kaça ayrıldığı sorulur,
15. Çenek kavramı öğretmen tarafından açıklanır,
16. Tek çeneklilerin ve çift çeneklilerin özellikleri gurup elemanları tarafından söylenir,

17. Öğrencilerden tek çenekli ve çift çenekli bitkilere örnekler vermeleri istenir (Doğa zekası),

18. Öğrencilere stickerlarını uygun şekilde yerleştirmeleri için zaman tanınır (see Figure L.5.9 and Appendix M.8.2) (Doğa zekası, Matematiksel/mantıksal zeka),

19. Çiçeksiz Bitkileri temsil eden boş kartonlardan biri gurup elemanları tarafından tahtanın sol tarafındaki duvara, çiçekli bitkileri temsil eden diğer karton ise tahtanın sağ tarafındaki duvara yapıştırılır (Görsel/uzamsal zeka),

20. "Damarsız Çiçeksiz Bitkiler", "Damarlı Çiçeksiz Bitkiler", " Açık Tohumlu Bitkiler", "Tek Çenekli Bitkiler", "Çift Çenekli Bitkiler" kağıtları (Figure L.3.10) bitkiler gurubu tarafından uygun sırayla yapıştırılır (Bedensel zeka),

21. Öğrencilerin tahtadaki kartonlarla kendi kağıtlarını kontrol etmeleri, hataları varsa gerekli düzeltmeleri yapmaları istenir,

22. "Damarsız-Damarlı Çiçeksiz Bitki" ve "Açık tohumlu-tek çenekli-çift çenekli bitkiler" Ven şemaları çalışma kağıtları öğrencilere dağıtılır (Appendix J.12). (Görsel/uzamsal zeka),

23. Öğrencilerin öncelikle damarsız ve damarlı çiçeksiz bitkilerin ortak ve farklı özelliklerini kendilerine dağıtılan bu şemalara uygun şekilde yerleştirmeleri istenir (silinebilir kalem kullanmaya dikkat edilir) (Mantıksal/matematiksel zeka),

24. "Damarsız-Damarlı Çiçeksiz Bitki" bitkiler kümelerini içeren ven şema kartonları tahtaya asılır (Görsel/uzamsal zeka),

25. Bu guruptaki bitkilerin ortak ve farklı özellikleri öğrenciler aracılığıyla uygun şekilde yerleştirilir (Görsel uzamsal zeka),

26. Ardından öğrencilerin açık tohumlu bitkiler, tek çenekli bitkiler ve çift çenekli bitkilerin ortak ve farklı özelliklerini kendilerine dağıtılan bu şemalara uygun şekilde yerleştirmeleri istenir (silinebilir kalem kullanmaya dikkat edilir) (Mantıksal/matematiksel zeka),

27. Açık tohumlu bitkiler, tek çenekli bitkiler ve çift çenekli bitkiler kümelerini içeren ven şemaları kartonları tahtaya asılır (Görsel/uzamsal zeka),

28. Bu guruptaki bitkilerin ortak ve farklı özellikleri öğrenciler aracılığıyla uygun şekilde yerleştirilir (Görsel uzamsal zeka),

29. Sınıf damarsız çiçeksiz bitkiler, damarlı çiçeksiz bitkiler, açık tohumlu bitkiler, tek çenekli bitkiler ve çift çenekli bitkiler olmak üzere 5 guruba ayrılır (Sosyal/kişilerarası zeka),

30. Her bir guruba üzerinde farklı bitki isimleri yazılı kartlar verilir (see Appendix J.13),

31. Öğrencilerden kendi guruplarına ait olan bitkileri seçerek daire içerisine almaları istenir (Mantıksal/matematiksel zeka, doğa zekası),

32. Öğrencilerin özelliklerini hatırlayamadıkları bitkileri özellikle gövde,yaprak ve çiçek yapılarını inceleyerek rahatlıkla sınıflandırabilmeleri için, tahtaya bu bitkilerin resimleri (Figure J.13.1) yapıştırılır (Görsel/uzamsal zeka),

33.Öğrencilerin kendi guruplarındaki bitkileri seçerken tahtadaki resimlerden faydalanabilecekleri vurgulanır,

34. 10 dakika sonra öğrenciler gurup gurup tahtaya gelerek, seçtikleri bitkileri sınıf arkadaşlarına okurlar, neden seçtiklerini açıklarlar ve daha önce bitkiler gurubunca düzenlenen sınıflandırma kartonlarında uygun yerlere bu bitkilerin resimlerini yerleştirirler (Kinestetik/Bedensel zeka),

35. Ardından öğretmen öğrencilere belirli guruptaki bitkilerin özelliklerini söyleyeceğini ve eğer söylediği özellik kendi dahil oldukları guruba uygunsa gurupça ayağa kalkacaklarını söyler,

36. Sırasıyla Çiçeksiz bitkilerin,

Çiçekli bitkilerin,

Damarlı bitkilerin,

Kapalı tohumlu bitkilerin,

Tohumlu bitkilerin,

Dölalmaşı görülen bitkilerin ayağa kalkması istenir (see Figure L.5.8) (Kinestetik/Bedensel zeka),

37. Bu arada ayağa kalkan öğrencilerin hangi gurubu temsil ettiklerini söylemeleri istenir (Sözel zeka).

38. Farklı bitki isimlerini içeren asetat (Appendix J.14) yansıtılarak öğrencilerin gurupça bu bitkilerin kullanım alanlarını tespit etmeleri istenir (sosyal/kişilerarası zeka),

39. Sınıfta en fazla hangi gurubun kullanım alanı bulduğu tespit edilir,

40. En fazla kullanım alanı bulan gurubun buldukları kullanım alanlarını sırasıyla söylemeleri istenir (sözel zeka),

41. Diğer guruplarda farklı kullanım alanı mevcut ise eklenir,

42. Öğretmen tarafından eksik görülen hususlar tamamlanır.

43. Bitkiler alemiyle ilgili olarak dağıtılan değerlendirme formlarının (Appendix K.11) evde doldurulması istenir

DERS PLANI 8:
Konu: Hayvanlar alemi

Süre: 40+40=80 dakika

Amaç: Hayvanların sınıflandırılmasını ve biyolojik, ekonomik önemlerini ve insan sağlığıyla ilişkilerini anlama.

Davranışlar:

1. Hayvanlar aleminin omurgasızlar ve omurgalılar şubesi olmak üzere ikiye ayrıldığını söyleme,
2. Omurgasızlar şubesinin sınıflarını basitten komplekse doğru süngerler, sölenterler, solucanlar, eklembacaklılar, yumuşakçalar, ve derisi dikenliler olarak sıralama,
3. Omurgasızlar şubesine ait her bir sınıfın genel özelliklerini açıklama,
4. Omurgasızlar şubesine ait her bir sınıfa doğadan örnek canlılar gösterme,
5. Omurgalılar şubesinin sınıflarını basitten komplekse doğru balıklar, kurbağalar, sürüngenler, kuşlar ve memeliler olarak sıralama,
6. Omurgalılar şubesine ait her bir sınıfın genel özelliklerini açıklama,
7. Omurgalılar şubesine ait her bir sınıfa doğadan örnek canlılar gösterme,
8. Bir hayvanın özelliklerine bakarak hangi sınıfa ve hangi şubeye ait olduğunu belirleme,
9. Hayvanların hayatımızdaki yerini ve önemini açıklama,
10. Bir canlının özelliklerine bakarak hangi aleme ait olduğunu belirleme,
11. Ülkemizin biyolojik zenginliklere sahip olmasının sebeplerini örneklerle açıklama,
12. Ülkemizin biyolojik zenginlikler açısından önemini açıklama,
13. Ülkemizin sahip olduğu biyolojik zenginliklerin niçin korunması gerektiğini açıklama.

Kaynak ve Materyaller: ders kitabı, asetatlar, tepegöz, örümcek ağı pano, omurgasız hayvan modelleri, gurubun getirmiş olduğu hayvan örnekleri, yine gurup elemanlarının hazırlamış oldukları hayvanlar ve biyolojik çeşitlilik panoları, çalışma kağıdı, kurşun kalem, her biri yuvarlak kesilmiş 7 adet karton, toplu iğne, omurgasız hayvanlar sınıflandırma tablosu çalışma kağıdı, hikaye, karikatürler, numaralandırmalı ve sıralamalı sınıflandırma tablosu.

Hedeflenen zeka türleri: Sosyal/kişilerarası zeka, Görsel/uzamsal zeka, özedönük/bireysel zeka, doğa zekası, mantıksal/matematiksel/zeka, kinestetik/bedensel/zeka, müzikal zeka, sözel zeka.

Dersin işlenişi:

1.Ders öncesinde sınıfın duvarları gurup elemanlarınca hazırlanan panolarla donatılır,

2. Şu ana kadar hangi alemlerin işlendiği basitten komplekse doğru ritmik olarak öğrencilere sıralattırılır (Müzikal zeka),

3. Bugünkü konunun son alem olan hayvanlar alemi olduğu vurgulanarak, öğrencilerin kendilerine dağıtılan kağıtlara "ne biliyorum?", biraz boşluk bırakarak "ne öğrenmek istiyorum?", ve yine eşit oranda boşluk bırakarak "ne öğrendim?" (özedönük zeka) yazmaları istenir,

4. Öğrencilere "ne biliyorum?" ve "ne öğrenmek istiyorum?" sütunlarını doldurmaları için belirli bir süre verilir,

5. Son sütunun konu bitiminde doldurulacağı vurgulanır,

6. Hayvanlar aleminin sınıflandırılmasında özellikle "hayvanlar alemi" gurup elemanlarının ön plana çıkarılmasına dikkat edilir,

7. Omurgasızlar gurubu öğrencileri tarafından hazırlanan "örümcek ağ" tahtaya asılarak sırasıyla omurgasızlar şubesinin sınıfları sınıfça okunur,

8. Süngerlerin yapısı hakkında çok genel bilgi verilir,

9. Sölenterlere özgü canlı organizma resimleri asetat aracılığıyla öğrencilere gösterilir (Görsel/uzamsal zeka),

10.Bunlardan hangilerini günlük hayatlarında gördükleri sorulur ve varsa başlarından geçen ilginç olaylara yer verilerek bu sınıftaki canlıların genel özellikleri çıkartılır (Özedönük zeka),

11."Yuvarlak solucanlar, … renkli dantel ipliğine benzer. Çünkü……."

"Yumuşakçalar solungaç solunumu yapar. Çünkü……." ifadeleri öğrenciler tarafından tamamlanır, ve solucanlar ile yumuşakçaların genel özellikleri çıkartılır (Matematiksel/mantıksal zeka),

12. Eklembacaklılara gelindiğinde bu alana asılan omurgasız hayvan modellerini içeren sürpriz paket açılır, içerisinde yer alan hayvan modellerini (see Figure L.2.6)

içeren 4 paket çıkarılarak her bir guruba birer paket ve sınıflandırma tablosu (Appendix J.17) verilir,

13. Her bir öğrenciye omurgasız hayvanlar sınıflandırma tablosu dağıtılır,

14. Öğrencilerin guruplarına verilen pakette yer alan hayvanları gurupça incelemeleri istenir (Görsel/uzamsal, bedensel/kinestetik zeka),

Öğrencilerin cevap vereceği sorular,

Bu organizmalar hangi alemde/alemlerde yer almaktadır?

Bu organizmalar hangi şube/şubeler içerisindedir?

Bu organizmalar hangi sınıfı/sınıfları temsil etmektedir?

Bu organizmalar hangi özelliklerine göre birbirinden ayrılmaktadır?

Bu soruların cevaplarına göre öğrencilerin her bir hayvanın ismini kendilerine dağıtılan sınıflandırma tablosunda uygun alana yerleştirmeleri istenir (Doğa zekası),

15. Doğadan bazı eklembacaklı örnekleri verilerek hangi guruba girebileceği öğrencilere sorulur (Matematiksel/mantıksal, doğa zekası),

16. Böcekleri ve örümcekleri içeren bir asetat (Appendix I) öğrencilere gösterilerek böceklerle örümcekler arasındaki temel farklılığı net olarak algılamaları sağlanır (Görsel/uzamsal zeka),

17. Omurgasız hayvanlarla ilgili karikatürler (Appendix J.18) projektörle yansıtılır (Görsel/uzamsal zeka),

18. Öğrencilerin bu karikatürleri öğrendikleri bilgileri değerlendirerek incelemeleri istenir (Matematiksel/mantıksal zeka),

19. Gurubun diğer hazırlıklarına (Appendix M.1.3, M.2.3, M.3.3, M.3.4, M.4.2) yer verilir,

20. Sınıf 4 guruba ayrılır,

21. Tahtaya her bir guruba özgü omurgasız hayvanların isimleri yazılır (Appendix J.19),

22. Öğrencilerin gurupça evde kesip getirdikleri daire şeklindeki kağıtlar (Bedensel/kinestetik zeka) üzerine bu hayvan isimlerini ve hangi sınıfa ait olduğunu yazmaları istenir,

23. Yazma işlemi bittikten sonra bu kağıtların basitten komplekse doğru sıralanması ve birbirine toplu iğnelerle bağlanması istenir (Figure L.5.10) (Doğa zekası, matematiksel/mantıksal zeka),

24. Omurgasız hayvanlarla ilgili hikaye (Appendix J.20) okunur (Sözel/dilsel zeka),
25. Hikayede geçen hayvan isimlerinin omurgasızlar tablosuna yerleştirilmesi istenir (Doğa zekası, matematiksel/mantıksal zeka).
26. Gurubun hazırladığı sınıflandırma posteri kullanılarak omurgalı hayvanlar basitten komplekse doğru sıralanır (Sözel/dilsel zeka),
27. Her bir sınıf hakkında genel bilgi verilir,
28. Hayvanların sınıflandırma tablosu (Appendix J.21)öğrencilere dağıtılır,
29. Tek başlarına ya da arkadaşlarıyla birlikte bu tabloda yer alan gurupları sıralamaları istenir (Doğa zekası, matematiksel/mantıksal zeka),
30. Doğru sıralama verilir,
31. Tüm öğrencilerin düzeltme yapıp yapmadıklarını kontrol etmek amacıyla hep birlikte sırayla okunur (Müzikal/ritmik zeka),
32. Ev ödevi olarak tablonun üzerinde yer alan resimlerin (see Appendix M.8.4) kesilerek uygun yerlere yapıştırılması istenir (Bedensel/kinestetik zeka),
33. Karikatür balonlarını (Appendix J. 22) hayvanların özelliklerini kullanarak doldurmaları istenir (Görsel/uzamsal zeka),
34. Bir haftalık süre içerisinde gurup elemanlarınca hazırlanan posterlerin incelenerek Türkiye'nin biyolojik zenginliği hakkında duygu ve düşüncelerini ifade eden birer yazı yazılacağı söylenir (Sözel/dilsel zeka).

APPENDIX I

SOME OF THE PROJECTS USED IN MIBG

Deney Gurubunda Kullanılan Bazı Asetat Ornekleri

Homolog and Analog Organs

AÇIKLAMA:

Aşağıda bazı homolog ve analog organlar yer almaktadır.
Sizce analog organlar ne tip organları ifade ediyor olabilir?

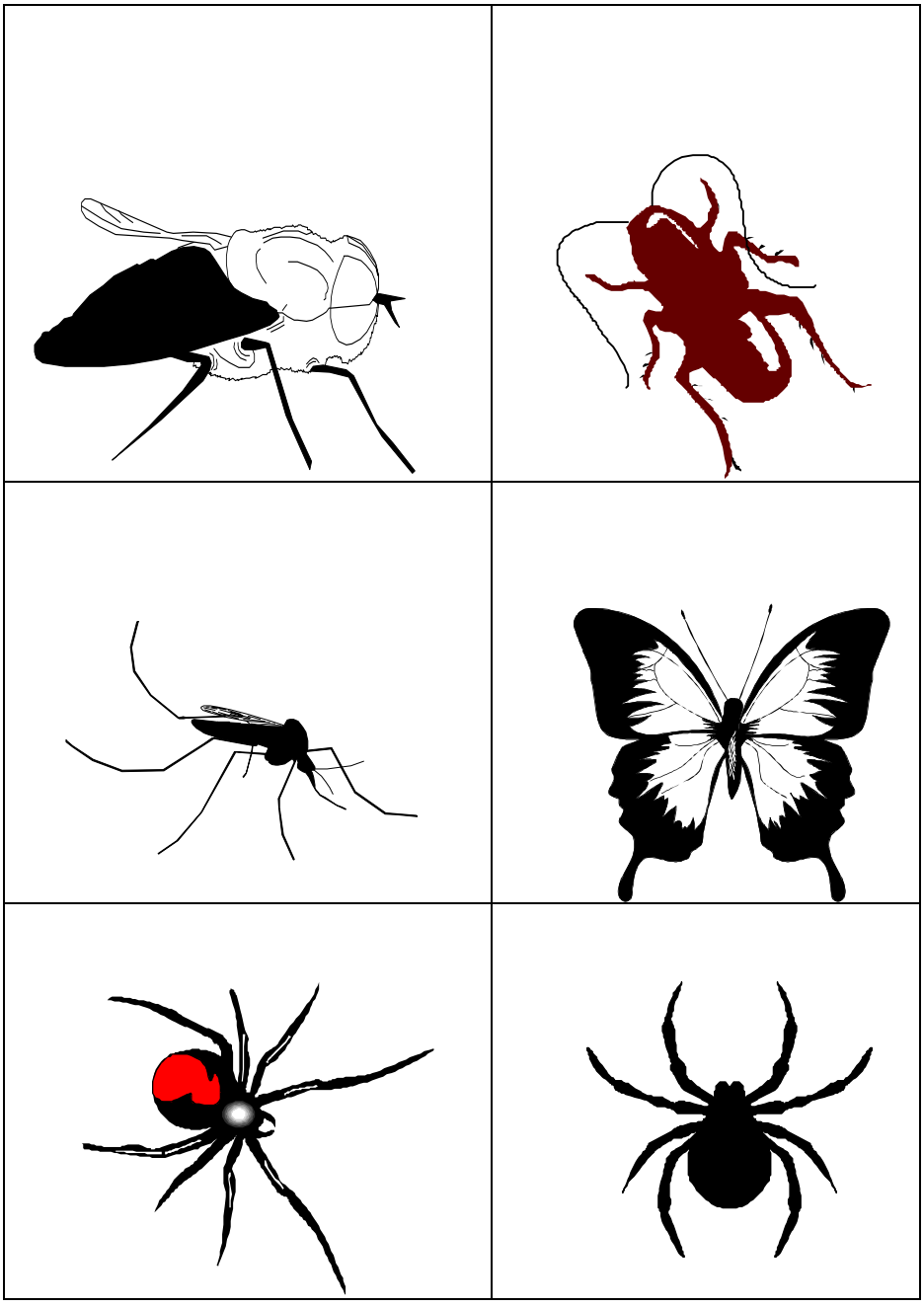
Balık solungaçları, midyenin solungaçları	analog
Atın ön bacağı, kuşun kanadı	homolog
Böcek kanadı, kuş kanadı	analog
Balinanın yüzgeci, insanın kolu	homolog
Kuş kanadı, kelebek kanadı	analog
Balık pulu, insan dişi	homolog

Mollusca

Yumuşakçalar

Insects and Spiders

Böcekler ve Örümcekler



APPENDIX J

ACTIVITIES

J.1 Find the Rule

Kuralı Bul

Aşağıda verilen organlar belli bir kurala göre dizilmiştir. Bu kuralın ne olduğunu bularak Yılanın pulları, kuşların tüyleri/ Kedi bacağı, sinek bacağı ve Yarasa kanadı, kelebek kanadının hangi sırayla yerleştirilmesi gerektiğini bulun (Sayısal zeka).

- Balık pulu, insan dişi
- Balığın solungaçları, midyenin solungaçları

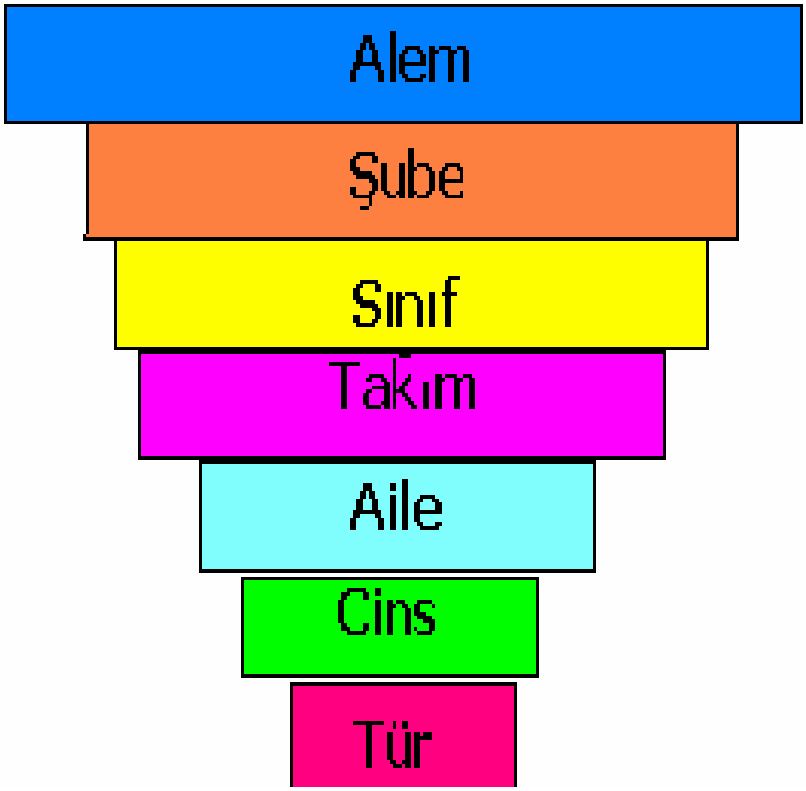
- Balinanın yüzgeci, insanın kolu
- Böcek kanadı, kuş kanadı
- Kuş kanadı, kelebek kanadı

- Atın ön bacağı, kuşun kanadı
- Kedi bacağı, sinek bacağı
- Yarasa kanadı, kelebek kanadı
- Kuş kanadı, sinek kanadı

- Balığın ön yüzgeci, kuş kanadı
-
-

J. 2 The classification units cards

Sınıflandırma Birimleri Kartları



J.3 The Classification Units Table

Sınıflandırma Birimleri Tablosu

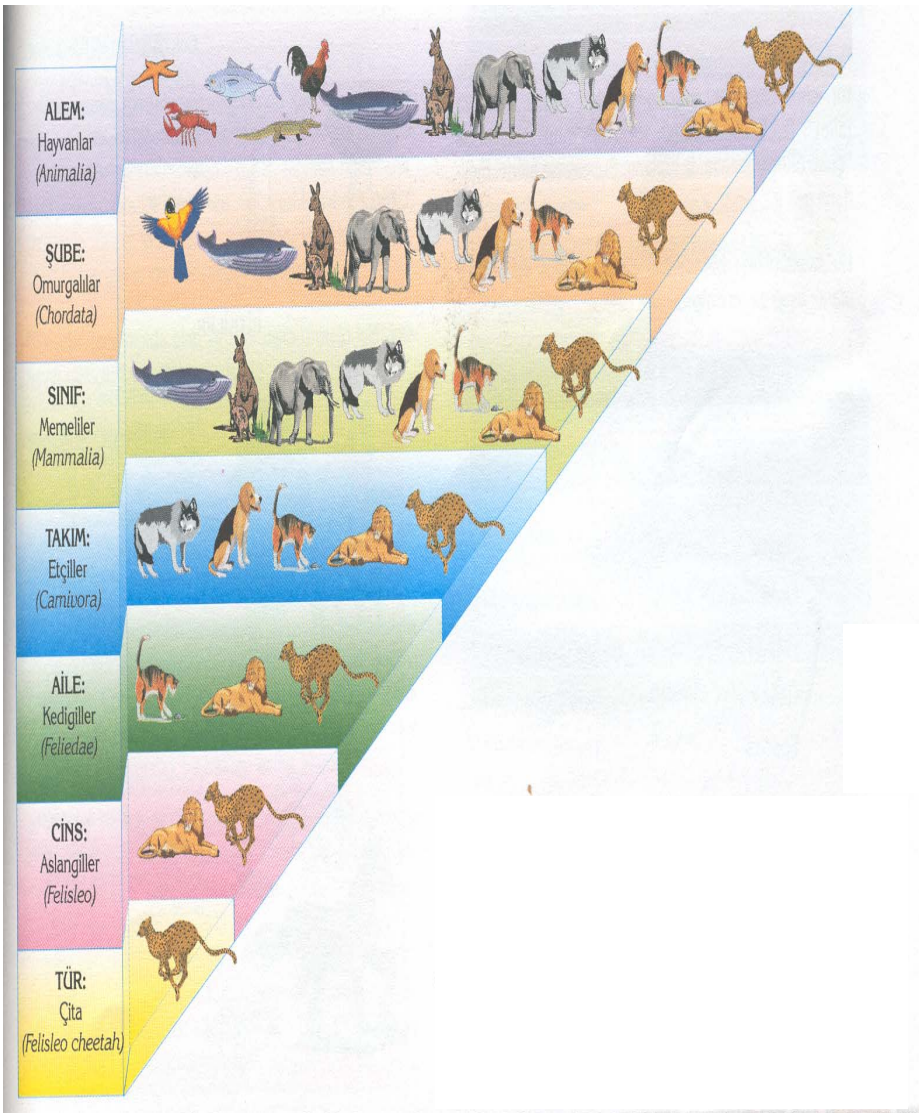
Aşağıda verilen hayvan isimlerini dikkatle inceleyerek ait oldukları sınıflandırma birimlerine yerleştiriniz.

Çita, Yengeç, Timsah, Balina, Köpek, Kanguru, Horoz, Kurt, Alabalık, Fil, Kedi, Denizyıldızı, Aslan

	SINIFLANDIRMA BİRİMLERİ	**CANLI ORGANİZMALAR**
ALEM	Hayvanlar (Animalia)	
ŞUBE	Omurgalılar (Chordata)	
SINIF	Memeliler (Mammalia)	
TAKIM	Etçiller (Carnivora)	
AİLE	Kedigiler (Felicidae)	
CİNS	Aslanlar (Felis leo)	
TÜR	Çita (Felis cheetah)	Çita

J.4 The Classification Pyramid

Sınıflandırma Piramidi



J.5 Questions about the diversity and classification of Living Organisms

Canlıların Çeşitliliği ve Sınıflandırılması ile İlgili Sorular

1) Aşağıdaki çiftlerden hangisi homolog organlardan değildir?

A) balinanın yüzgeci- insanın kolu
B) kuşun kanadı- kelebek kanadı
C) atın ön bacağı- kuşun kanadı
D) balık pulu- insan dişi
E) yılan pulu- kuş tüyü

2) Bir şube içerisine giren sınıflar için aşağıdakilerden hangisi söylenebilir?

A) bacak sayıları aynıdır
B) beslenme şekilleri aynıdır
C) aynı renge sahiptirler
D) vücut şekilleri farklıdır
E) şubelerin ortak özelliklerine sahiptir

3) Quercus rubra adındaki canlı organizmanın en yakın akrabası aşağıdakilerden hangisidir?

A) Brasella rubra
B) Quercus alba
C) Cortex quercus
D) Rhototorula rubra

4) Aşağıdaki sistematik birimlerinden hangisi diğer dördünü içine alır?

A) Irk B) Aile C) Şube D) Tür E) Takım

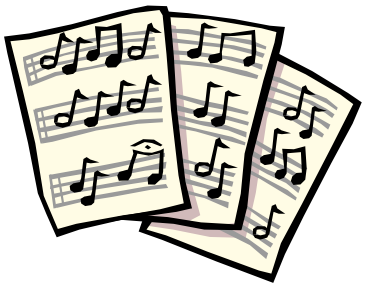
5) Aşağıdaki sınıflandırma birimlerinden hangisinde canlı birey sayısı en fazla ve ortak özellik en az olandır?

A) Canis lupus türünde
B) Köpek cinsinde
C) Kedigiller ailesinde
D) Etçiller takımında
E) Memeliler sınıfında

J.6 “We are the Viruses” Song

“Biz Biz Virüsleriz Biz” Şarkısı

“Biz biz üniversiteliyiz biz” reklam müziğine uyarlanan şarkı sözlerimize çalışalım ki derste hep birlikte söyleyebilelim.

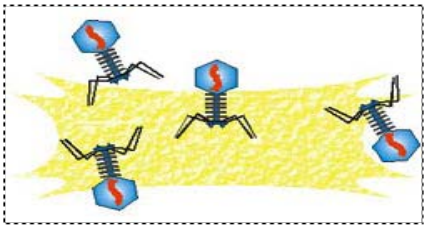


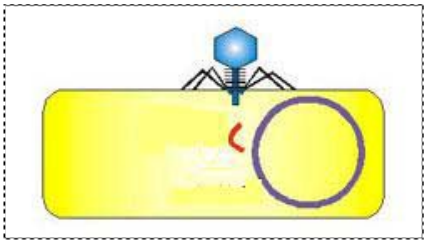
Biz biz virüsleriz biz
Sizsiz bir hiçiz biz
Bakteri, bitki, hayvan olmasa
Yaşayamazdık biz bu dünyada
Yok ki enzimimiz
Zorunlu parazitleriz

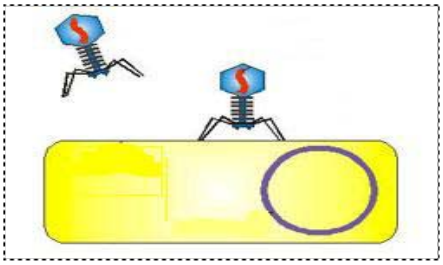
J.7 Reproduction of a bacteriofage

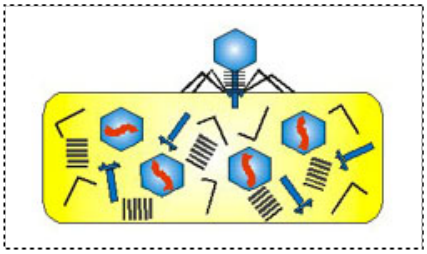
Bir bakteriyofajın üremesi

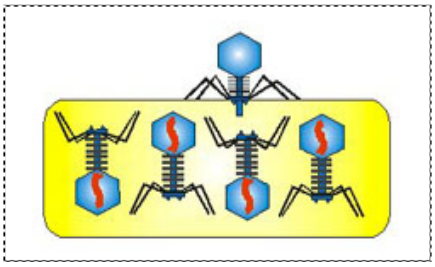
Aşağıda bir bakteriyofajın üremesi karışık sırada verilmiştir. Her bir resmi kesiniz. Resimler üzerine virüs ve bakterilere özgü kısımların isimlerini yazınız. Bir bakteriyofajın üremesindeki sıralamayı düşünerek sizlere dağıtılan renkli dosya kağıtları üzerine düzgün bir şekilde yapıştırınız.

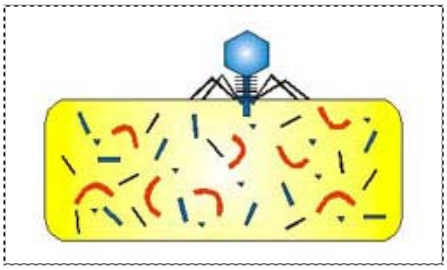












J. 8 Location of Different Types of Viruses in Human Body

Farklı Virüslerin İnsan Vücudunda Yerleşim Alanları

Açıklama: Aşağıda verilen tabloda her bir hastalık etkeni virüsün vücuda yerleşmiş olduğu alana (X) koyunuz.

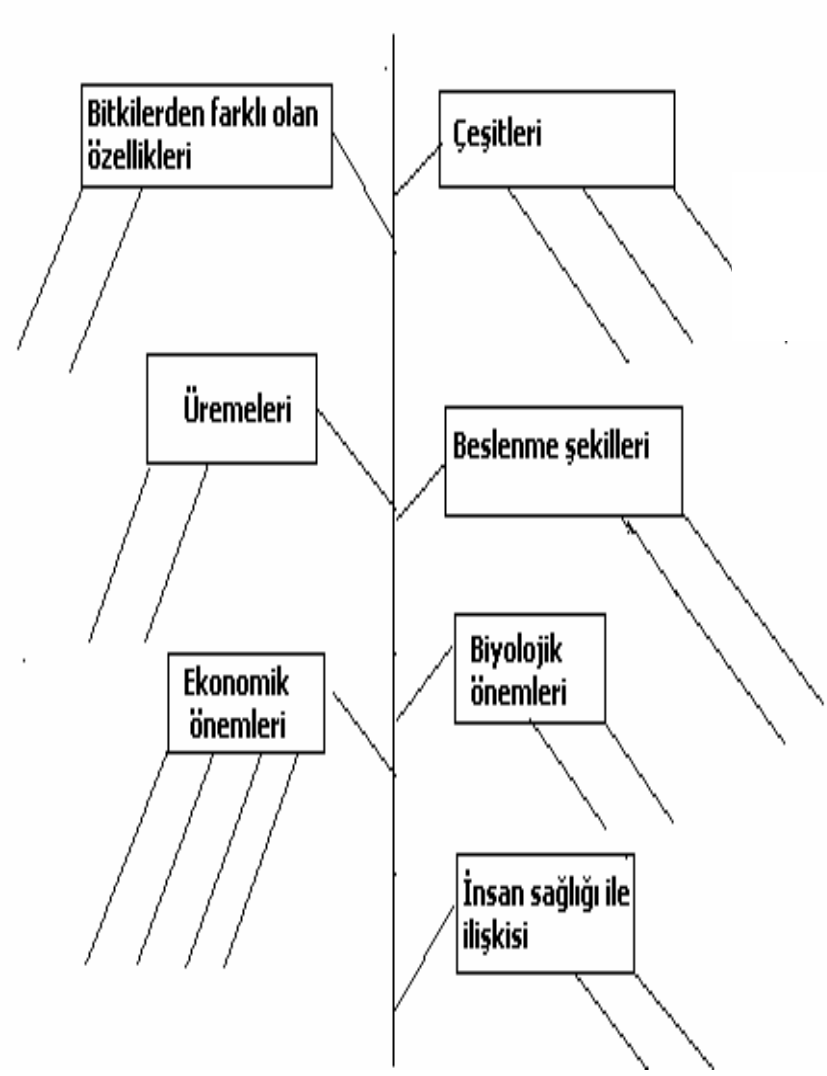
Yerleşim Alanı	**Hastalık adı**							
	Çocuk Felci	Çiçek virüsü	Kızamık virüsü	Sığil virüsü	Kuduz virüsü	Grip virüsü	Aids virüsü	Nezle virüsü
Beyin								
Akyuvarlar (Tlenfosit)								
Deri								
Omurilik								
Üst solunum yolları								

Bitki ve hayvan virüsleri bir canlıdan diğer canlıya hangi yollarla taşınmaktadır?

J. 9 Tree Diagram about the Fungi Kingdom

Mantarlar Alemi İle İlgili Ağaç Şema

Mantarlar alemi hakkında bugün öğrendiklerinizi ağaç şemaya yerleştiriniz.



J.10 “Let’s Revive the Yeasts” Experiment

“Mayaları Canlandıralım” Deneyi

Mikroplar yalnızca mikroskop altında görebileceğiniz ufacık canlılardır. Salmonella benzeri bazı mikroplar tehlikeli hastalıklara yol açarlar. Fakat bazıları da –maya gibi– yiyecek yapımında çok önemlidirler. Buradaki deneylerde bir bakkaldan satın alabileceğiniz kuru maya kullanacağız. Size 30 gram kadarı yetecektir.

Maya canlanıyor

Kuru maya cansız topaklar gibi görünür, fakat aslında serin ve kuru tutuldukları sürece etkinlik göstermeyen, milyonlarca minik mikroptan oluşmuştur. Mayaya su ve şeker ekleyerek sıcak tutup gözleyin.

Kullanacaklarınız

Kuru maya
Şeker
Sürahi
Cam şişe
Balon
Kâse

Şeker
Maya karışımı
1
Sürahinin içine iki çay kaşığı maya ve iki yemek kaşığı ılık su koyarak akıcı bir maya karışımı hazırlayın, sonra da bir çay kaşığı şeker ekleyip karıştırın.

Maya karışımı
Ilık su
2
Maya karışımını şişeye doldurun ve balonu şişenin ağzına geçirin. Şişeyi 15 dakika boyunca ılık su dolu bir kâsenin içinde bırakın.

Mayaya ne oluyor?

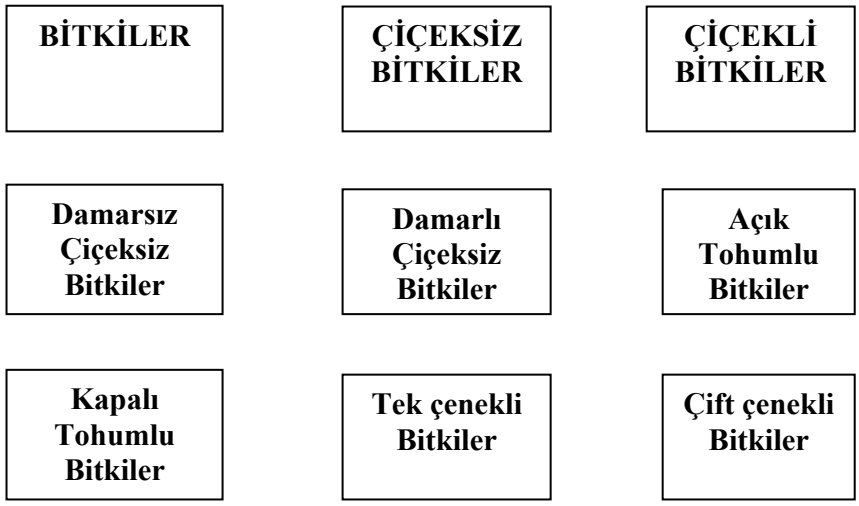
Maya beslendikçe, karbon dioksit gazı oluşturur. Bu gaz karışımı da kabarcıklar meydana getirerek balonu şişirir.

TÜBİTAK POPÜLER BİLİM KİTAPLARINDAN FERYAL HALATCI TARAFINDAN TÜRKÇEYE ÇEVRİLEN JANE BINGHAM’A AIT BİLİMSEL DENEYLER KİTABINDAN ALINMIŞTIR.

J. 11 Classification of Plants

Bitkilerin Sınıflandırılması

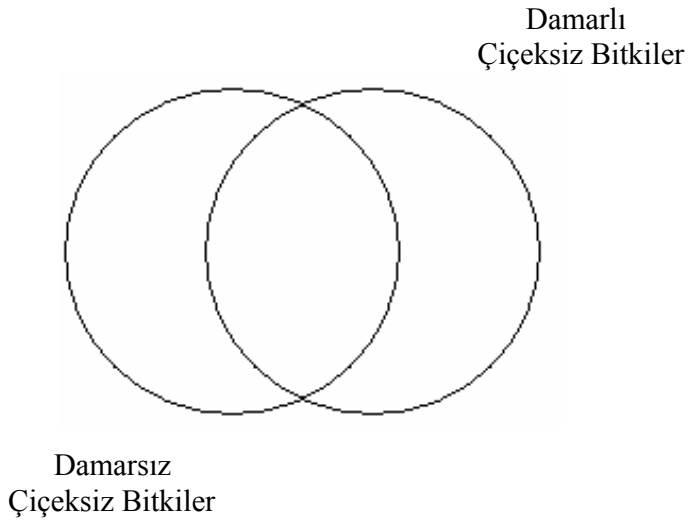
Ders sürecinde sizlere dağıtılan her bir sticker üzerine bir sınıflandırma birimini kurşun kalemle yazınız**.**



Stickerlara yazdığınız sınıflandırma birimlerini basitten komplekse doğru sıralayınız

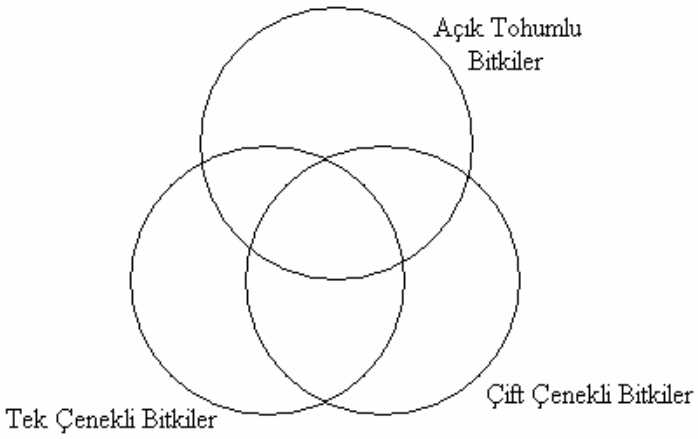
J.12 Unflowering Plants Venn Diagram

Çiçeksiz Bitkiler Ven Şemaları



Flowering Plants Venn Diagram

Çiçekli Bitkiler Ven Şemaları



J.13 Selection of the Plants Included in Your Group

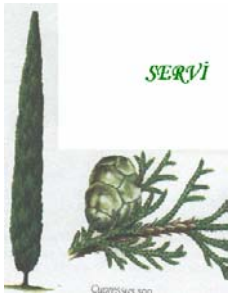
Gurubunuza Dahil Olabilecek Bitkilerin Seçimi

Verilen bitki isimlerinden kendi gurubunuza ait olan bitkileri seçerek daire içerisine alınız.

Ardıç	eğreltiotu	limon
at kuyruğu	ıhlamur	mor
ayrık otu	karadut	servi
ceviz	karayosunu	söğüt
ciğer otu	köknar	zeytin
Çam	ladin	sedir

Gurubunuza özgü bitkileri kök, gövde ve yapraklarına göre inceleyebilmeniz için tahtaya asılmış olan bitki resimlerinden faydalanabilirsiniz

Figure J.13.1 The Plant Pictures pasted on the Board



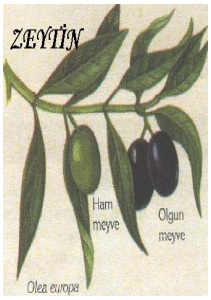


Figure J.13.1 (continued)

J.14 Biological, Economic Importance of the plants

Bitkilerin Kullanım Alanları

Buğday, Zeytin, Ayçiçeği, Pamuk, Soya Fasulyesi, yer fıstığı, çay, ıhlamur, nane, eğreltiotu, yulaf, pamuk, keten, kenevir, gül, limon, leylak, çam, nane, kekik.

Yukarıda günlük hayatımızda kullanılan bitkilerden sadece bir kaçının adı verilmiştir. Bu bitkileri inceleyerek bitkilerin günlük hayatımızda hangi alanlarda kullanıldıklarını bulalım.

J.15 KWL (What do I KNOW, what do I WANT to learn, What I LEARNED)

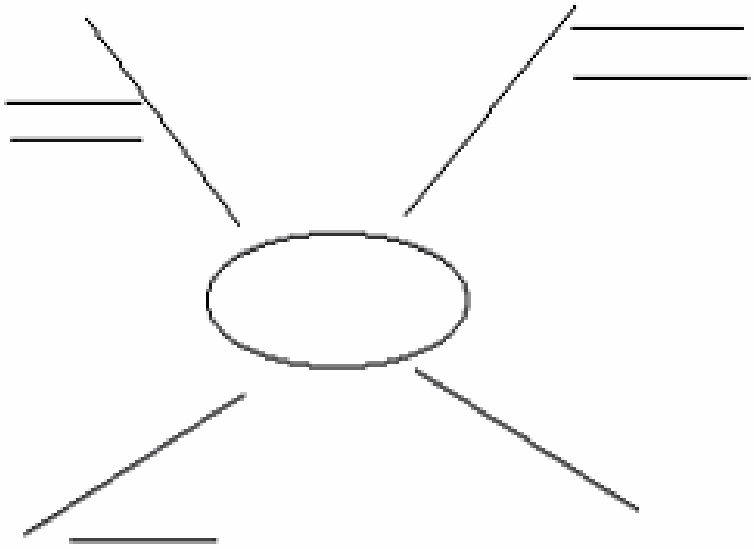
Ne BILIYORUM, Ne öğrenmek İSTIYORUM, Ne ÖĞRENDIM (BİÖ)

Sevgili öğrenciler lütfen sizlere dağıtılan kağıtlar üzerine öncelikle hayvanlar alemiyle ilgili olarak neler bildiğinizi, ardından bu konuda neler öğrenmek istediğinizi yazınız. Dersimizin bitiminde ise bu derste neler öğrendiğinizi yazacaksınız.

J.16 Spider Map

Örümcek harita

Bir karton üzerinde sınıf arkadaşlarınız için omurgasız hayvanların sınıflandırılmasını gösteren aşağıdaki gibi bir örümcek harita oluşturunuz:



J.17 Observation of the Invertebrate Animal Models

Omurgasız Hayvan Modellerinin İncelenmesi

Sevgili öğrenciler,

Gurupça sizlere verilen hayvan modellerini inceleyerek gözlem sorularını yanıtlayınız ve bu hayvanların isimlerini omurgasızlar şubesi sınıflandırma tablosunda uygun yerlere yerleştiriniz.

Gözlem soruları:

- Bu organizmalar hangi alemde incenebilir?
- Şubeleri hakkında yorum yapabilir misiniz?
- Bacakları var mı?
- Antenleri var mı?
- Hangi sınıflar mevcut? Bu 2 sınıfın benzer ve birbirinden farklı olan temel özellikleri nelerdir?
- Alt sınıflara ayırmamız mümkün mü? Bu ayrımı neye göre yaptınız?

Hayvanlar Alemi										
Omurgasızlar Şubesi										
Süngerler	Sölenterler	Solucanlar			Yumuşakçalar	Eklembacaklılar				Derisidikenliler
		Y	Yu	H		B	Ö	K	Ç	

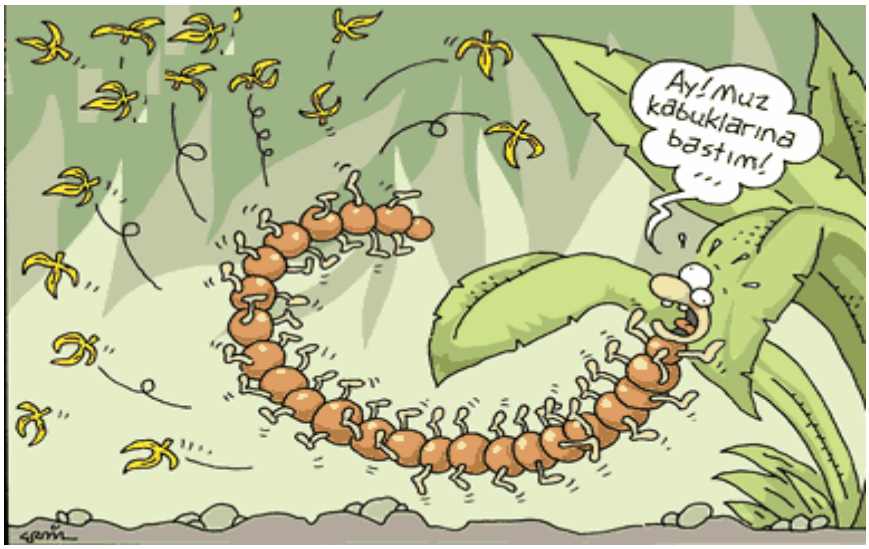
Y: Yassı solucanlar
Yu: Yuvarlak solucanlar
H: Halkalı solucanlar
B: Böcekler
Ö: Örümcekler
K: Kabuklular
Ç: Çok ayaklılar

J.18 Is there an Error in These Cartoons?

Bu Karikatürlerde bir Hata var mı?

TOPRAK SOLUCANININ TOPRAK SOLUCANINA ŞAKASI

KIRKAYAĞIN DRAMI



MİNİK KARINCALARIN KORKULU RÜYASI

J.19 Information Chains

Bilgi Zincirleri

Sevgili öğrenciler:

- Size verilen gurup numarasındaki canlı organizmaların isimlerini tek tek daire şeklinde kesmiş olduğunuz kartonlarınızın üzerine yazınız,
- Her bir canlı organizmanın arka sayfasına hangi sınıfta yer aldıklarını yazınız
- Bu sınıfın genel özelliklerini not ediniz
- Bu özellikleri kullanarak gurubunuza özgü canlı organizmaları basitten komplekse doğru sıralayınız
- Kağıtlarınızı uygun sıraya soktuktan sonra toplu iğneyle birbirlerine ekleyerek bilgi zincirlerinizi oluşturunuz.

1 Nolu gurup elemanlarına ait omurgasız hayvanlar	2 Nolu gurup elemanlarına ait omurgasız hayvanlar	3 Nolu gurup elemanlarına ait omurgasız hayvanlar	4 Nolu gurup elemanlarına ait omurgasız hayvanlar
Sünger	Sünger	Sünger	Sünger
Deniz yıldızı	Mercan	Hidra	Deniz anası
Deniz anası	Kıl kurdu	Deniz kestanesi	Mürekkep balığı
Salyangoz	Ahtapot	Midye	Toprak solucanı
Planarya	Uğur böceği	Peygamber devesi	Karides
Örümcek	Deniz hıyarı	Toprak solucanı	Deniz kestanesi

J.20 The Story of the Little Horse Mackerel

Okuma parçası: “Küçük İstavrit”

Sevgili öğrenciler,

“Küçük istavrit” isimli hikayeyi dikkatle dinleyiniz. Parçada geçen omurgasız hayvan isimlerini not alarak, bu hayvanları 17 nolu Aktivitede sizlere dağıtılmış olan “Omurgasızlar şubesi sınıflandırma tablosu”nda uygun olan yerlere yerleştiriniz.

KÜÇÜK İSTAVRİT

Küçük istavrit yiyecek bir şey sanıp hızla atıldı çapariye.
Önce müthiş bir acı duydu dudağında,
Gümbür gümbür oldu yüreği.
Aslında hep merak etmişti
Denizlerin üstünü,
Neye benzerdi acep gökyüzü.
Bir yanda ölüm korkusu,
"Dudağı yarıklar" denir, şanslıdır onlar,
Hani görüp de gökyüzünü,
İnsani oltadan son anda kurtulanlar.
Ne çare balıkçının parmakları hoyratça kavradı onu.
Küçük istavrit anladı, yolun sonu!
Koca denizlere sığmazdı yüreği.
Oysa simdi yüzerken,
Cansız uzanıvermiş dostlarına değiyordu minik yüzgeci.
İnsanlar gelip geçtiler önünden,
Bir kedi yalanarak baktı gözünün içine,
Yavaşça karardı dünya,
Başı da dönüyordu.
Son bir kez düşündü derin maviyi,
Beyaz mercanı, yanpiri yanpiri yürüyen yengeci,
Herbirinin içinde hazine gizli midyeleri,
bir de yeşil yosununu.
İşte tam o anda eğilip aldım onu.
Yürüdüm deniz kenarına.
Bir öpücük kondurdum başına.
İki damla gözyaşından ibaret,
Sade bir törenle
Saldım denizin sularına.
Bir an öylece baka-kaldı,
Sonra sevinçle dibe daldı.
Gitti,tüm kederimi söküp atarak.
Teşekkürü de ihmal etmemişti,
Bir kaç değerli pulunu
Elime avuçlarıma bırakarak.
Balıkçı ve kedi şaşkın baktılar yüzüme,
Sorar gibiydiler neden yaptın bunu niye?
Bir gün dedim
Bulursam kendimi
Yeşil leğendeki küçük istavrit kadar çaresiz,
Son ana kadar hep bir umudum olsun diye.

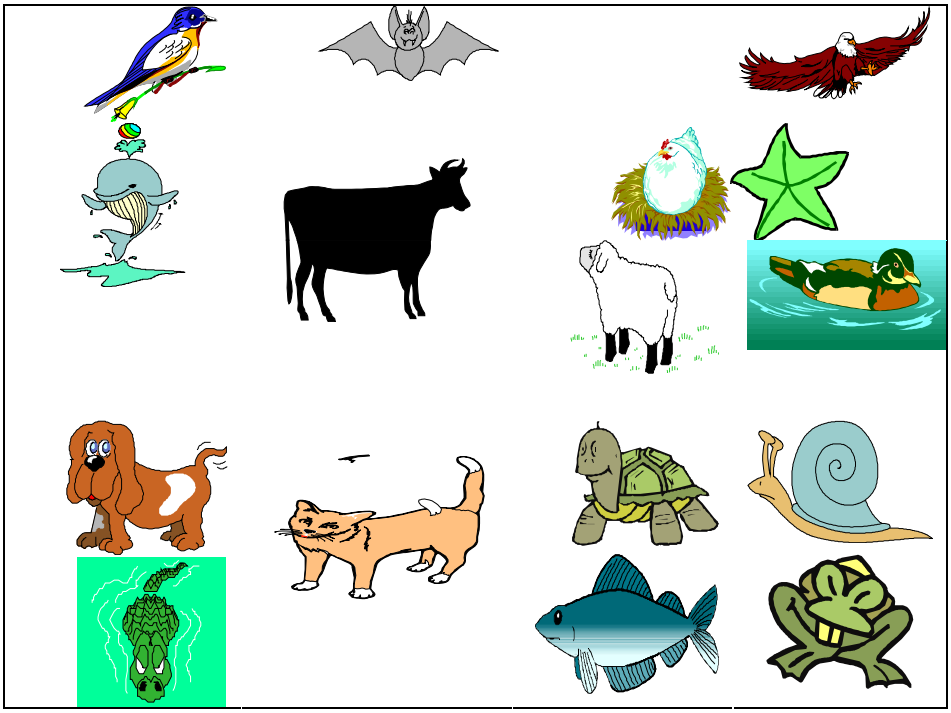
J.21 Classification of the Animals

Hayvanların Sınıflandırılması

Memeliler	Sölenterler	İkiyaşamlılar	Yumuşakçalar	Derisidikenliler
Sürüngenler	Süngerler	Kuşlar	Balıklar	

Solucanlar Yassı Yuvarlak Halkalı	Eklembacaklılar Böcekler Örümcekler Kabuklular Çok ayaklılar

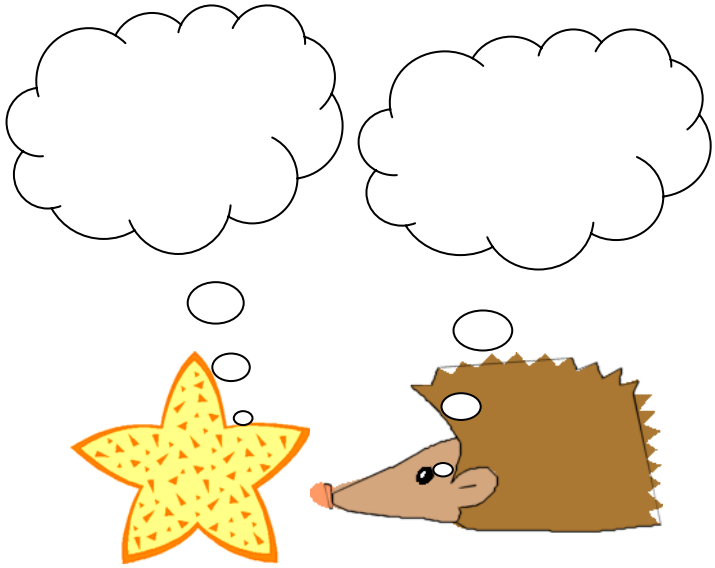
Yukarıda Hayvanlar alemine ait Omurgalılar ve Omurgasızlar şubesine ait sınıfları basitten komplekse doğru 1den 11e doğru numaralandırınız.



Yukarıda verilen hayvanları, yukarıdaki kategorilere ayırınız.

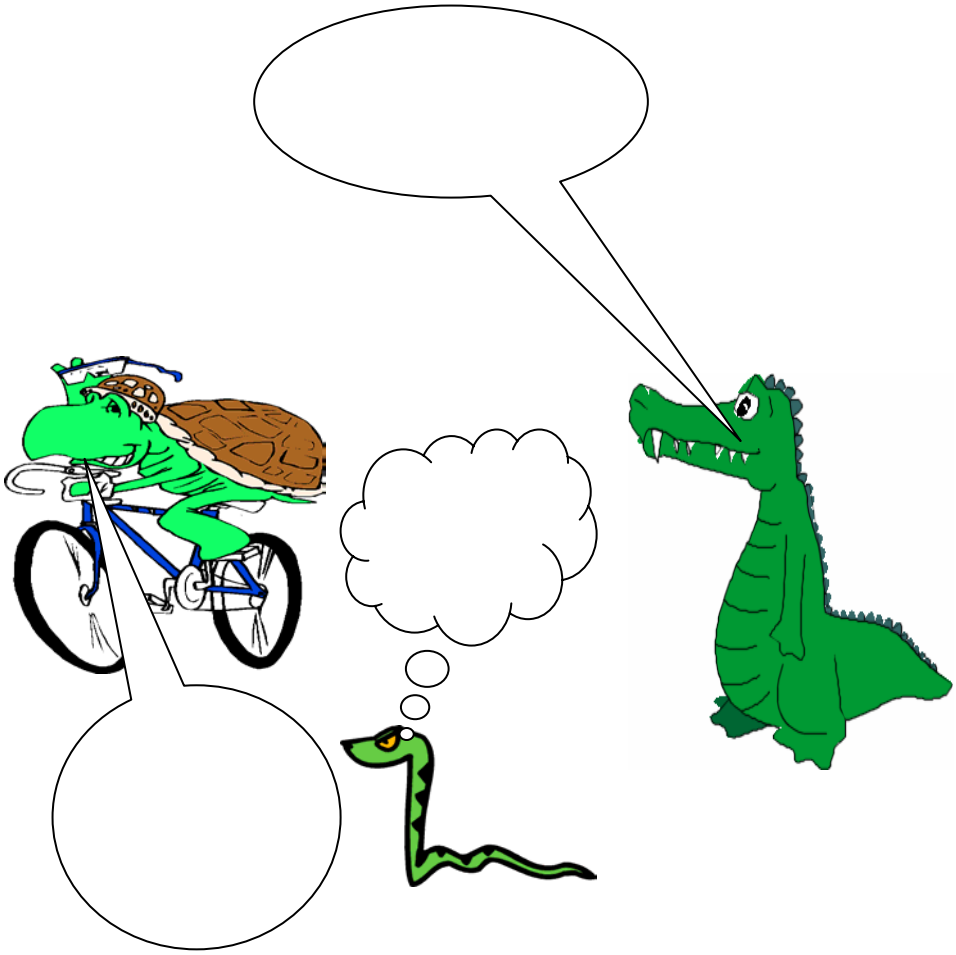
J. 22 Fill in the Speaking Balloons

Konuşma Balonlarını Doldurunuz



Kirpi ile deniz yıldızı ne düşünüyor acaba?

Bilge baykuş yavru fok ile yarasaya ne anlatıyor acaba?



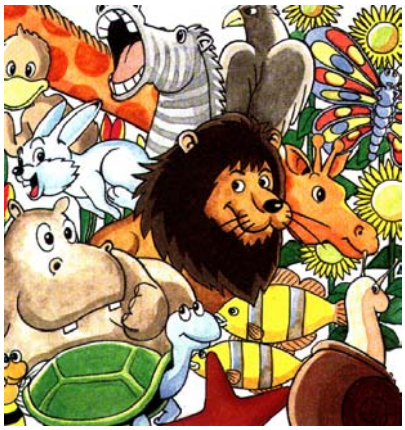
APPENDIX K

HOMEWORK-SHEET

Ev Ödevleri

K.1

Polisakkaritler (nişasta, glikojen, selüloz), yağlar (doymuş, doymamış), proteinler (hayvansal ve bitkisel proteinler), vitaminler, nükleik asitler, hücre (hücre duvarı, prokaryot& ökaryot hücre), mitoz ve mayoz bölünme



Daha önceki ünitelerimizde gördüğümüz bu kavramların " Canlıların Çeşitliliği"yle nasıl bir bağlantısı vardır?

K. 2 The Objectives of the Unit Given to the Students at the Beginning of the Study in order to Check the Missing Parts of Themselves

Öğrencilerin İşlediğimiz Konulardan Anlayamadıkları Yerleri Üzerine İşaretlemeleri İçin Dağıtılan Üniteye Özgü Konu Başlıkları

CANLILARIN ÇEŞİTLİLİĞİ VE SINIFLANDIRILMASI
ünitesinde neler öğreneceğiz?

SINIFLANDIRMA ve TAKSANOMİ

1. Neden sınıflandırmaya ihtiyaç duyulmuştur?
2. Canlıların sınıflandırılmasında neler esas alınmaktadır?
3. Ampirik ve bilimsel sınıflandırma arasındaki farklılıklar nelerdir?
4. Homolog ve analog organlar nelerdir?
5. Binomial (İkili) adlandırma nedir?
6. Sınıflandırmada kullanılan basamaklar nasıl sıralanır?
7. Bu basamakların birey sayısı ve ortak özellikleri arasında nasıl bir bağlantı kurulabilir?

VİRÜSLER

8. Virüslerin genel özellikleri nelerdir?
9. Virüslerin neden olduğu belli başlı hastalıklar hangileridir?
10. Virüs çeşitleri nelerdir?
11. Virüsler hangi yollarla bulaşır?
12. Virüsler hücre içerisinde nasıl çoğalır?
13. Virüslerle insan sağlığı arasında nasıl bir ilişki söz konusudur?

CANLILAR ALEMİ

14. Canlılar alemi kaça ayrılır?
15. Bu alemlerden prokaryot ve ökaryot olanlar hangileridir?

MONERA

16. Monera aleminden mavi yeşil alglerin genel özellikleri nelerdir?
17. Bakterilerin genel özellikleri nelerdir?
18. Bakteriler çeşitli özelliklerine göre nasıl gruplandırılabilir?
19. Bakterilerin biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisi nelerdir?

PROTİSTA

20. Protista aleminin genel özellikleri nelerdir?
21. Protista çeşitleri nelerdir?
22. Protistaların biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisi nelerdir?

MANTARLAR

23. Mantarların genel özellikleri nelerdir?
24. Mantar çeşitleri ve bunların özellikleri nelerdir?
25. Mantarların biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisi nelerdir?

BİTKİLER

26. Bitkilerin genel özellikleri nelerdir?
27. Bitkilerin çeşitleri ve bunların özellikleri nelerdir?
28. Bitkilerin biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisi nelerdir?

HAYVANLAR

29. Omurgasız hayvanların özellikleri nelerdir?
30. Omurgalı hayvanların özellikleri nelerdir?
31. Hayvanların biyolojik, ekonomik önemi ve insan sağlığıyla ilişkisi nelerdir?

TÜRKİYENİN BİYOLOJİK ZENGİNLİKLERİ

32. Türkiyedeki Biyolojik zenginliğin sebepleri ve önemi nedir?
33. Türkiyede biyolojik zenginliğin korunmasına yönelik ne tip çalışmalar yapılmaktadır?

K. 3

Virüslerin keşfiyle ilgili 5 dakikalık kısa bir tiyatral metin yazınız.

K. 4

Arkadaşınızın yazmış olduğu tiyatral metinden rol paylaşımınızı gerçekleştirerek bir sonraki dersimize canlandırma için hazır olunuz.

K. 5

Kitaplardan virüslerin yapısı hakkında araştırma yaparak kendinize ait bir virüs modeli oluşturunuz. Bu modelin oluşturulmasında dilediğiniz materyal (ip, kürdan, makarna, köpük, elişi kağıtları, karton, pet, cam şişe, makara, bardak, plastik top, sünger, oyun hamuru, ampul...vb) den faydalanabilirsiniz.

K. 6 The activities that will be Selected by the Students

Öğrenciler tarafından Seçilecek Ativiteler

Aşağıda verilenlerden size en uygun olanı seçerek sınıf arkadaşlarınız için gerekli hazırlığı yapınız.

1. Sayısal boyut

Monera alemi hangi organizmaları kapsar? Bu alemin özelliği nedir?

Bakterilerin hücre tipi prokaryot mu yoksa ökaryot mudur? Bakterilerin sahip olduğu bu hücre tipinin özelliği nedir?

Bakteriler ve virüslerin benzer ve farklı yönlerini venn şemasıyla gösteriniz?

Bakteriler özelliklerine göre nasıl sınıflandırılabilir?

Nasıl olmuşturda dev dinazorlar yok olurken, bakteriler günümüze dek gelebilmiştir?

Bakterilerin fayda ve zararları nelerdir?

2. Görsel-Uzamsal Boyut

9. sınıfların (Lise I) ders kitabında yer alacak bakteri resimlerinin çizim görevinin size verildiğini düşünün.

Bir bakteri hücresinin yapısını, ışık mikroskobu altında gözlenebilecek farklı şekillerdeki bakteri hücrelerini ve bakterilerin eşeyli, eşeysiz üremelerini nasıl resmederdiniz?

3. Doğa Boyutu

Bakterileri özelliklerine göre sınıflandırarak bir tablo hazırlayınız (Bu sınıflandırmayı yapabilmek için öncelikle farklı bakterilerin özelliklerini bilmeniz gerekmektedir).

4. Bedensel Boyut

Bakterilerde eşeysiz ve eşeyli üremenin nasıl gerçekleştiğini bir model üzerinde gösteriniz.

Bu üreme çeşitlerinden hangisi sayıca çoğalmayı gerçekleştirmektedir? Açıklayınız.

Bakterilerde varyasyona (çeşitliliğe) yol açan üreme hangisidir? Açıklayınız.

5. Müzikal Boyut

Bildiğiniz ve hoşunuza giden bir melodiye bakteriler konusunda öğrendiklerinizle ilgili söz yazınız (Dilerseniz sesinizi ve fon muzigini kasete kaydederek şarkınızı arkadaşlarınıza teyp aracılığıyla dinlettirebilirsiniz?)

6. Özedönük Boyut

Bir bilim adamı dünyada mevcut olan tüm bakterileri yok edecek deneyler düzenlemektedir. Bir diğer bilim adamı ise bu bilim adamına engel olmaya çalışmaktadır.

Siz hangi bilim adamı olmak isterdiniz. Bu konuda bakterilerin faydaları ya da zararları ile ilgili duygu ve düşüncelerinizi yansıtan bir yazı yazınız.

7. **Sosyal Boyut**

Arkadaşınızın/larınızın bakterilerin faydaları ya da zararları ile ilgili yazmış olduğu yazıyı okuyarak bu konuda sınıf arkadaşlarınıza bir dramatizasyon gerçekleştiriniz.

8. Sözel Boyut

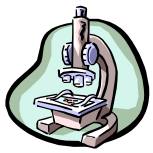
Bakteriler alemi ve bu alemde bulunan canlılar (bakteriler ve mavi yeşil algler) ile ilgili bir kare bulmaca (sözcük avıda olabilir) hazırlayınız.

K.7

Yakın çevrenizden bir kavanoz içerisinde dere suyu getiriniz. Eğer okula gelmeden birkaç gün önce suyu temin edecekseniz içerisine protistaların beslenmesi için bitki yapraklarından atabilir, meyve kabukları koyabilirsiniz. Bu arada tabii ki havasız kalmamaları için kavanozun kapağını açık bırakmayı unutmayınız☺

K.8 Observation of the Mouldy Bread

Küflü Ekmeğin İncelenmesi



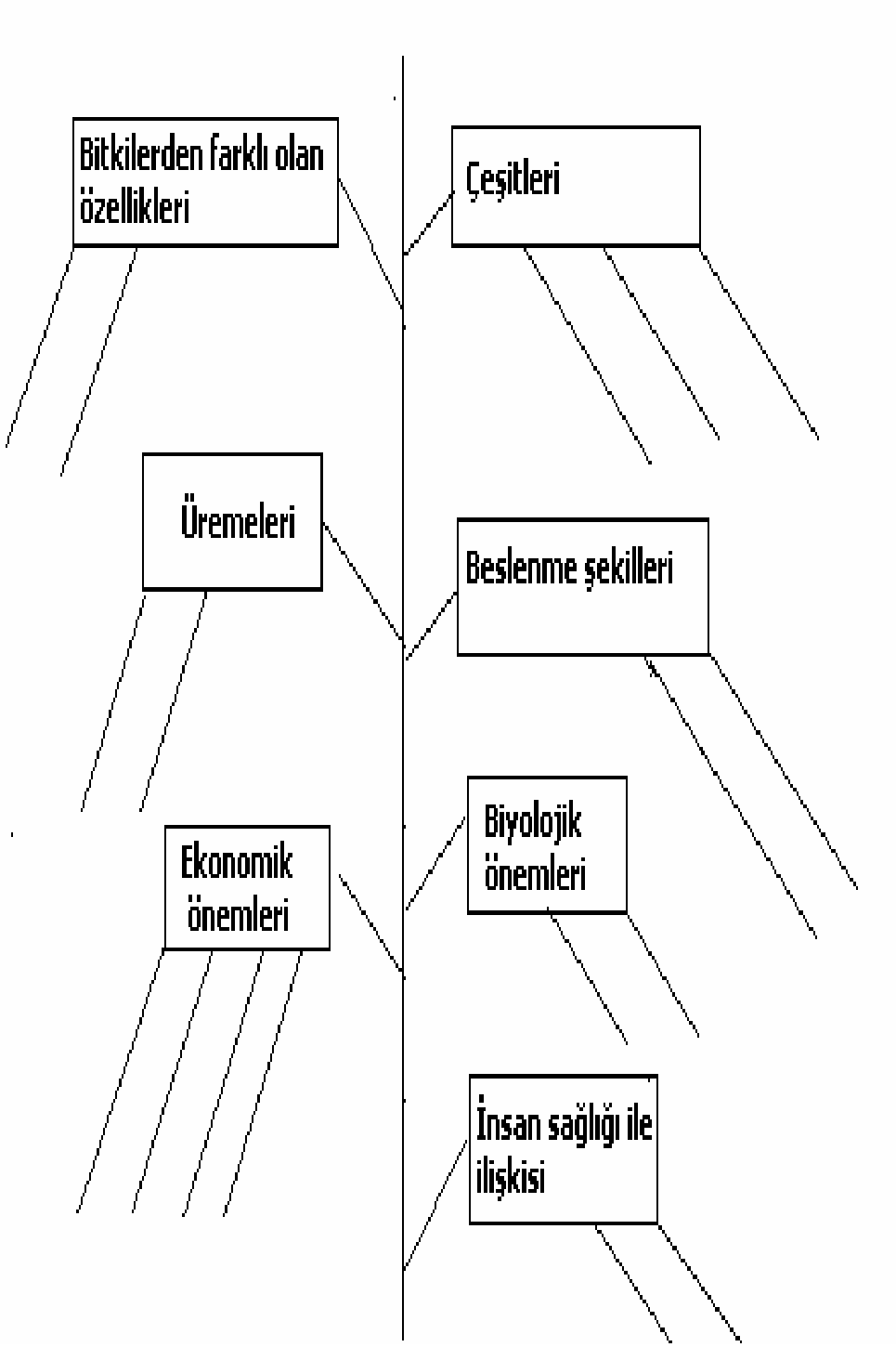
Günlük hayatınızda birçok çeşit küf ile karşılaşabilirsiniz. Bunlardan biride ekmek küfüdür. Evinizde bir ekmek küfü oluşturabilirsiniz. Ekmek küfünü gözleyebilmek için aşağıdaki yöntem izlenmektedir:

- Nemlendirilmiş bir ekmek ve ya domates dilimini petri kabı (kapanabilir herhangi bir cam eşyada olabilir) içine koyunuz.
- Parmağınızla etrafınızdan aldığınız tozu dilim üzerine sürünüz. Almış olduğunuz tozda küf sporlarının olmadığından şüphelenmenize gerek yoktur, çünkü hemen her yerde küf sporları bulunur.
- Petri kabını kapatarak ılık ve karanlık odada bekletiniz.
- Aradan geçen birkaç gün içinde dilim üzerinde pamuk benzeri yapılar (miselyum) gelişecektir.Daha sonra bu yapılar üzerinde siyah lekeler (spor keseleri) görülecektir.
- Dilerseniz hazırladığınız bu kültürü mikroskopta inceleyebilirsiniz. (Preparatınızı hazırlamak için lam üzerine aldığınız bir kaç damla suya bu kültürden bir miktar koymanız yeterlidir).

***Sınıfa getireceğiniz küf örneği incelenerek, hifler ve sporlar gözlenecektir.

K. 9

Mantarlar alemi hakkında bugün öğrendiklerinizi ağaç şemaya yerleştiriniz.



K. 10

Adı Soyadı :
No:

23 Mayıs 2003

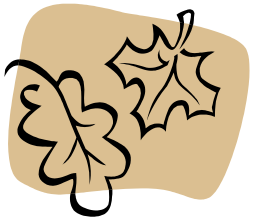
- Fungi (Mantarlar) alemini işlerken bu derste sizin için yeni olan daha önce hiç bilmediğiniz neler öğrendiniz?

- Bu dersimiz boyunca CD izledik, küfleri inceledik ve bir ekmek mayasının üremesi sonucunda karbondioksit gazı açığa çıkardığını deneysel olarak gösterdik. Bu aktiviteler esnasında neler hissettiniz?

- Bugün öğrendiğiniz bilgilerinizin yaşamınıza olan katkısı neler olabilir?

K. 11

27 Mayıs 2003



- Bu derste fark ettim ki…….....
- Bu derste……..……konusunu çok iyi anladığımı düşünüyorum.
- Bu derste…….……benim için çok zor oldu.
- Bu derste……konusunu çok iyi anlayamadım. Bu konudaki eksikliklerimi…….....ile giderebileceğimi sanıyorum.
- Bu dersi …….....olsaydı daha iyi anlayabilirdim.

K. 12 Group Work

Grupca yapılacaklar

- Konuyla ilgili olarak grup ismi ve ambleminin belirlenmesi,
- Gazete ve dergi yazılarından oluşturulmuş bir pano düzenlenmesi,
- Konuyla ilgili olarak sorular hazırlanması,
- Gazete ve dergilerden çeşitli resimlerin toplanması, isteğe bağlı olarak öğretmenden temin edilebilecek fotoğraf makinesiyle guruba özgü çevremizde görülen canlıların fotoğraflarının çekilmesi,
- Öğretmenden temin edilen Cd lerin izlenmesi,
- Konuya özgü canlıların sınıflandırılması,
- Bu sınıflandırma baz alınarak toparlanan resimlerin, çekilen fotoğrafların sınıflandırma basamaklarına göre düzenlenmesinin sağlanması,
- Arazi çalışması ile grubun temsil etmekle yükümlü olduğu canlı organizmaların incelenmesi,
- Bilinen bir melodiye konuyu kapsayan şarkı sözü uyarlaması gerçekleştirilmesi,
- Canlı organizmaların yeryüzünde öneminin şiir yada kompozisyon şeklinde verilmesi,
- İncelemiş olduğunuz canlılar grubu içerisinde özellikleri bakımından sizi ya da bir arkadaşınızı yansıtanı seçerek özdeşen özelliklerinizin yazılması.

Örneğin,

Ben bir **karayosunuyum**. Miniminnacık boyumla özellikle kayalık alanları yaşam alanı olarak seçerim. Minik olduğum için topraktan aldığım su ve minerallerin iletilmesi için tabii ki damar sistemine ihtiyacım yok. Neden olsun ki, müstakil minik bir eve asansör sistemi kurmaya benzerdi aksi takdirse... Eeeee...takdir edersiniz ki ben müstakil tek katlı yapı olsam, çiçeksiz bitkiler şubesinde birlikte anıldığım eğrelti otları gökdelen gibi kalırdı yanımda. Siz hiç asansörsüz bir gökdelen gördünüz mü? Gökdelenlerin asansörsüz olmayacağı bilinirde, etrafınızı

saran bu büyük bitkilerin besinlerinin taşınması için asansör misali damarlara ihtiyacı olduğu pek bilinmez nedense çoğumuzca.

K. 13

Ülkemizdeki Biyolojik Çeşitlilik ve bu çeşitliliğin korunmasıyla ilgili bir araştırma yapınız.

APPENDIX L

CLASSROOM PICTURES DURING THE MIBI

Çoklu Zeka Temelli Öğretim Sürecinde Sınıf içi Resimleri

L.1 Lesson Views about Verbal/linguistic Intelligence

Sözel-dilsel Zekayla İlgili Sınıf içi Görüntüleri

Figure L.1.1 "News poster" including news collected from different newspapers

Figure L.1.2 Different types of sources brought into the classroom by the students

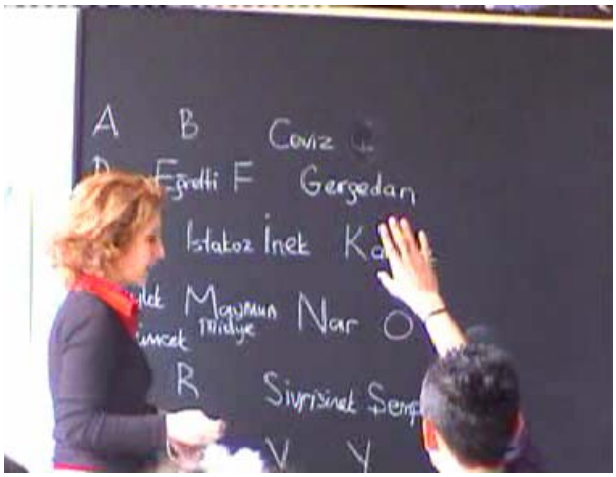


Figure L.1.3 The names of the living organisms given by the students during the “From A to Z” activity

Figure L.1.4 A group of students during the “Speaker-Listening-Observer” Activity

Figure L.1.5 Students listening to the teacher when she is reading the story of the “little horse mackerel”

L.2 Lesson views about Logical/mathematical Intelligence

Figure L.2.1 Students finding the rule for the homolog and analog organs

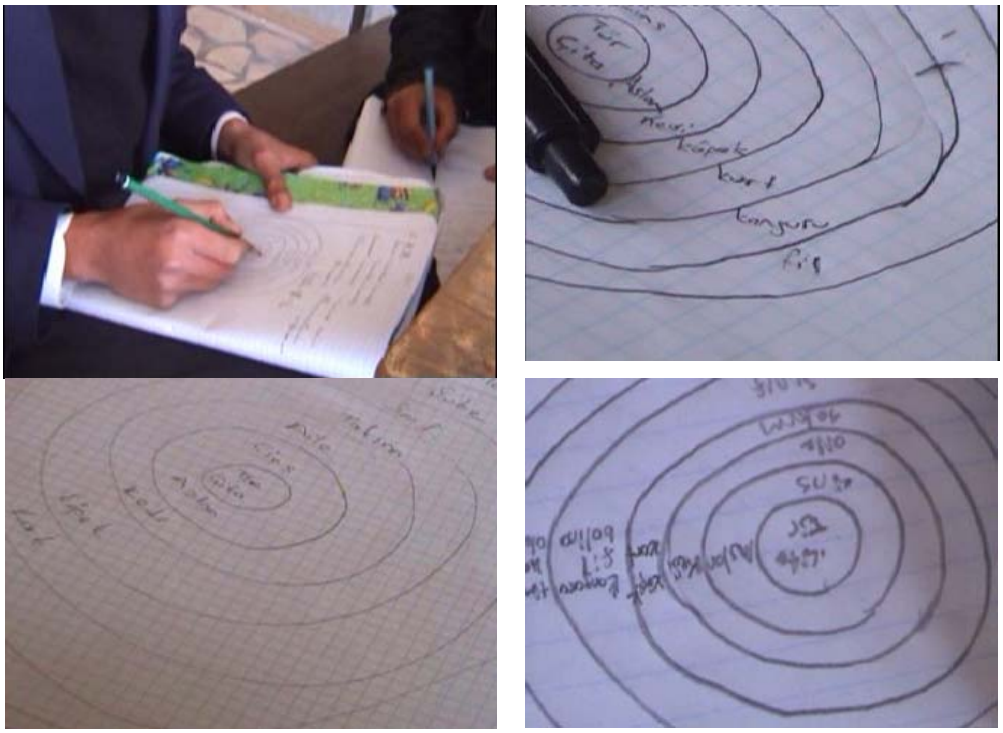


Figure L.2.2 Students' Venn Diagrams showing how classification units involve others

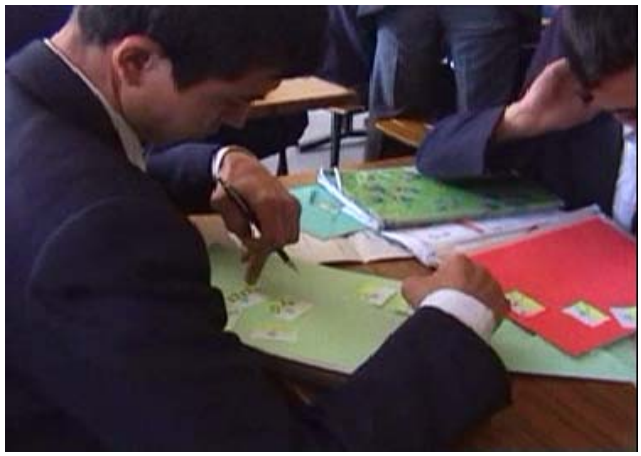


Figure L.2.3 Students sorting the virus reproduction pictures

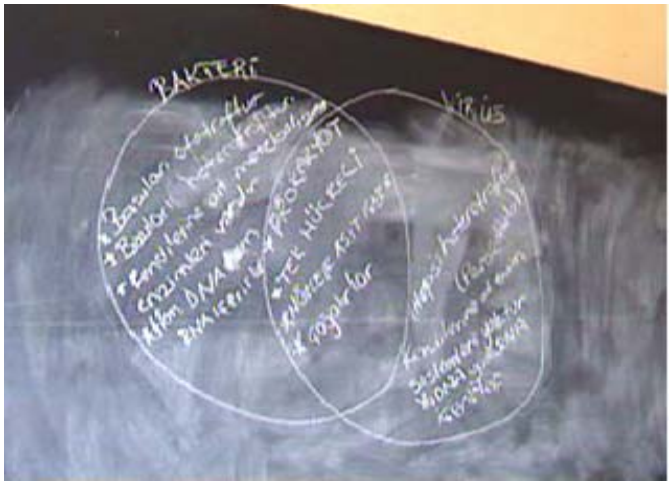


Figure L.2.4 Venn Diagrams showing the differences and similarities of viruses and bacteria

Figure L.2.5 “Let’s revive the yeasts” experiment

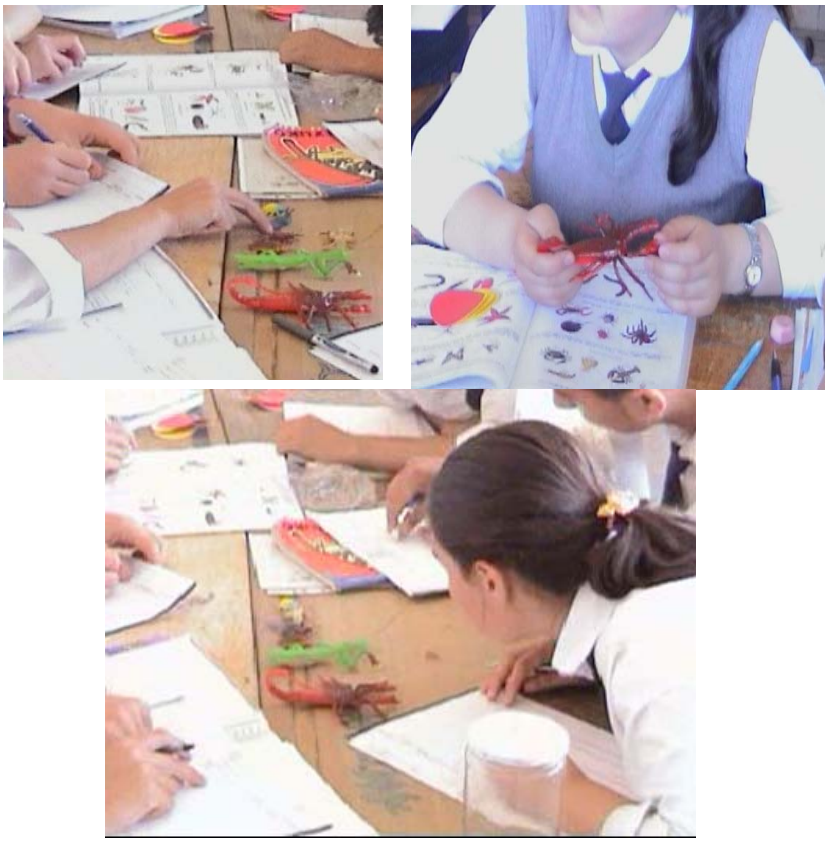


Figure L.2.6 Group members classifying the invertebrate animal models

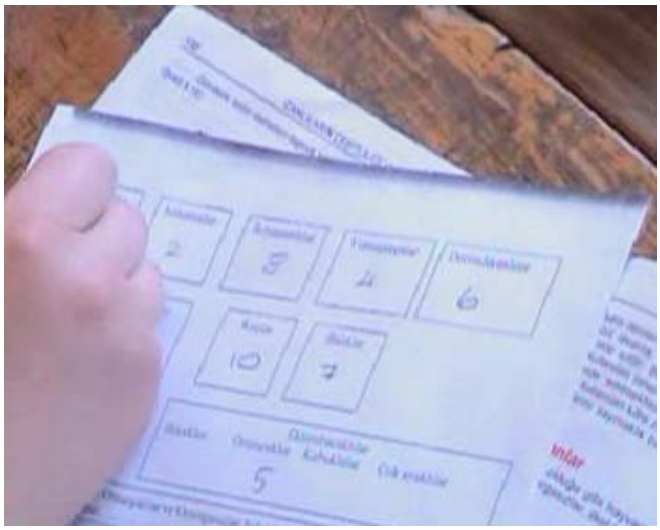


Figure L.2.7 Students classifying the animals and sorting them from simple to past

L.3 Lesson Views about Visual/spatial Intelligence

Görsel-uzamsal zekayla ilgili sınıf içi görüntüler

Figure L.3.1 “10 million Species posters” including different types of living organisms

Figure L.3.2 “Let’s smile poster” including some articles and cartoons about different types of living organisms

Figure L.3.3 The classification pyramid filled with animal pictures by the students

Figure L.3.4 A student trying to sort the virus reproduction pictures on the colorful sheet that were given in an envelope to them

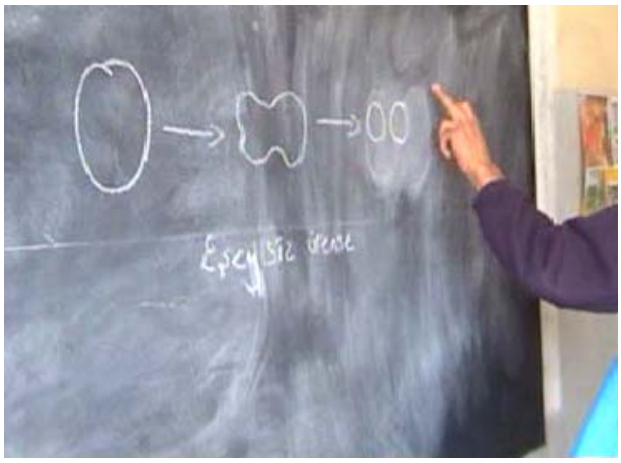


Figure L.3.5 A student drawing the asexual reproduction of bacteria on the blackboard

Figure L.3.6 A student making presentation of the sexual reproduction for his classmates

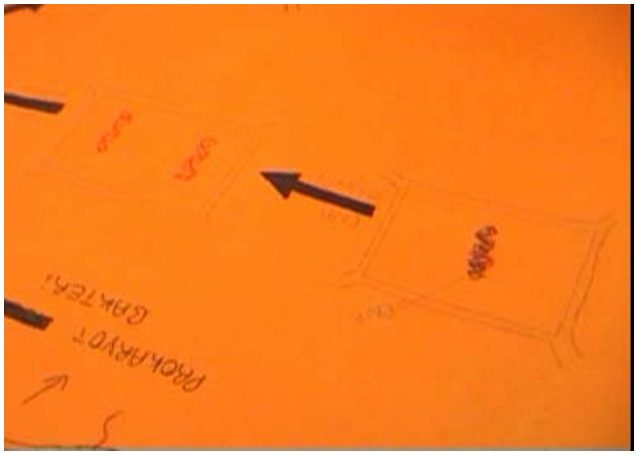


Figure L.3.7 A poster prepared by a student about the shapes and reproduction of bacteria

Figure L.3.8 Students looking at the posters that their friends prepared about the reproduction of the bacteria

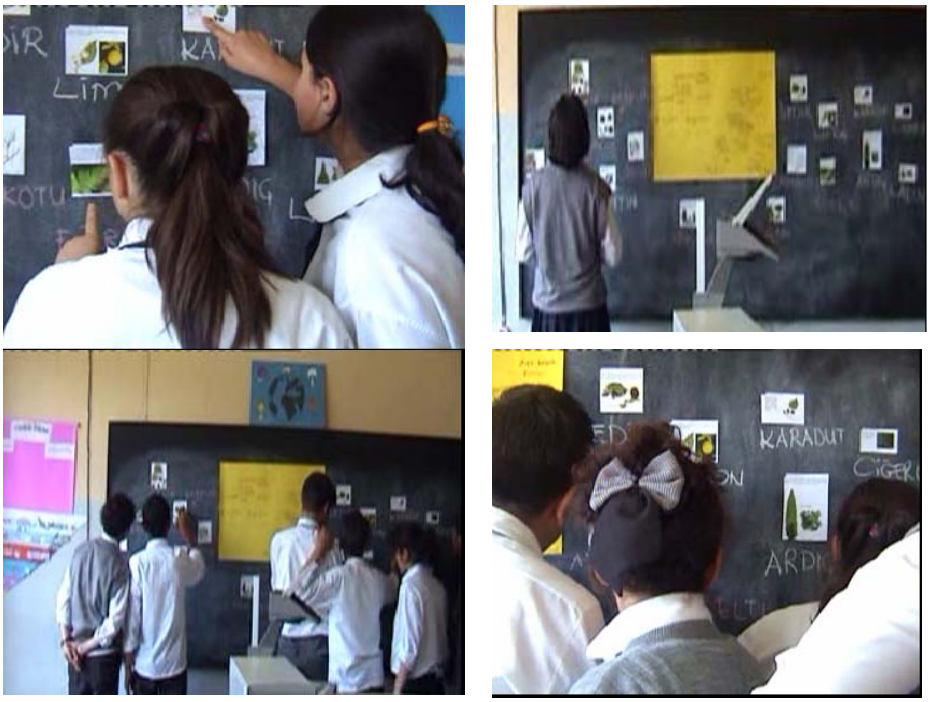


Figure L.3.9 Students looking at the plant pictures pasted on the black board in order to find which of them are included in their group

Figure L.3.10 A student preparing the plants' classification poster

Figure L.3.11 Posters prepared by the students

L.3.11 (continued)

Figure L.3.12 Students observing the protests under the microscobe

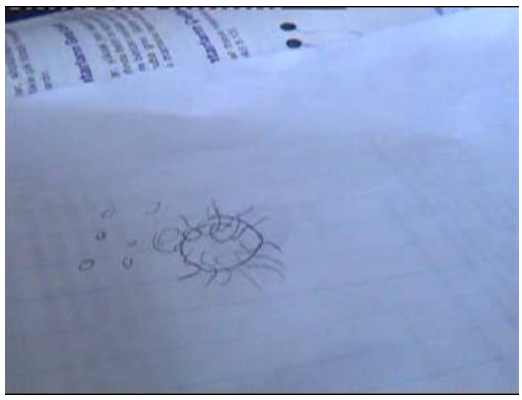


Figure L.3.13 Drawings of the protests seen with the microscobe

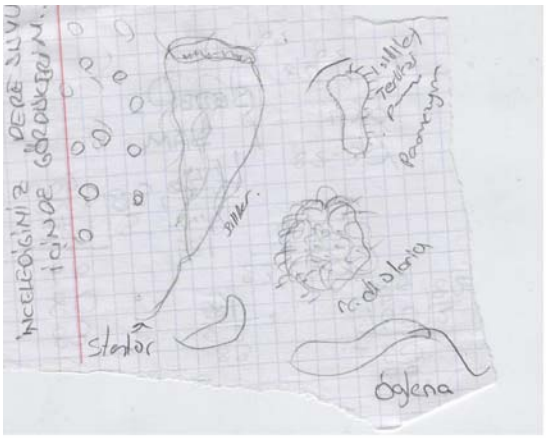


Figure L.3.13 (continued)

L.4 Lesson views about Musical Intelligence

Müzikal zekayla ilgili görüntüler

Figure L.4.1 Students saying the classification units in a rhythmic way when their eyes are closed

Figure L.4.2 A group of students singing the song of "You are a Little Bacteria" and their classmates listening to them

Figure L.4.3 Students and the teacher applausing the student after her song "Invertebrate"

L.5 Lesson views about Bodily/kinesthetic Intelligence

Bedensel kinestetik zekayla ilgili sınıf içi görüntüler

Figure L.5.1 A student pasting the animal pictures onto the correct classification unit on the Classification pyramid

Figure L.5.2 classification unit cards prepared by the students from smaller size to bigger size and sorting of the units typed on them from smallest to biggest

Figure L.5.3 Students role-playing about the investigation of the viruses

Figure L.5.4 Students role-playing about the utilities and harms of the bacteria

Figure L.5.5 The student presenting the conjugation model of the viruses he made

Figure L.5.6 A student showing her friends the shape of the protest she already has seen by using her body language

Figure L.5.7 Students pasting the plant pictures included in their group on to the posters

Figure L.5.7 (continued)

Figure L.5.8 Students standing up if the characteristics that the teacher are saying belonging to their group

Figure L.5.9 Students pasting the stickers

Figure L.5.10 Students preparing the information chains by adding each card to another with a pin

L.6 Lesson views about Social/interpersonal Intelligence

Sosyal-kişilerarası zekayla ilgili sınıf içi görüntüler

Figure L.6.1 Group members filling in the Classification table sheets

Figure L.6.2 Group members selecting the plant names included in their groups


Figure L.6.2 (continued)


Figure L.6.3 Group members trying to find out usage areas of plants in our daily life

L.7 Classroom views about Intrapersonal Intelligence

Özedönük zekayla ilgili sınıfiçi görüntüler

Figure L.7.1 Students writing what they KNOW and WANT to know about the animal kingdom

Figure L.7.2 Students filling in the classification table with the invertebrate animal names read in the “little mackerel story”

L.8 Lesson views about Naturalist Intelligence

Doğa zekasıyla ilgili sınıf içi görüntüler

Figure L.8.1 The river water brought by students into the classroom for the observation of the protests in it

Figure L.8.2 Students classifying the plants by pasting the stickers on their colorful papers

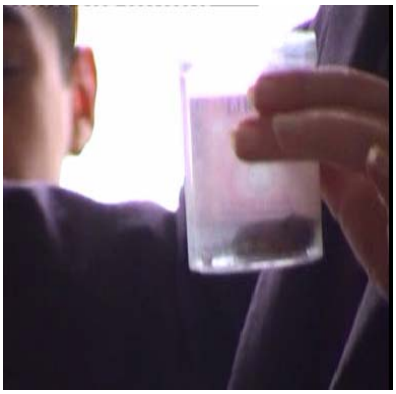


Figure L.8.3 Invertebrate animals brought into the classroom by a student

APPENDIX M

SOME OF THE STUDENT STUDIES

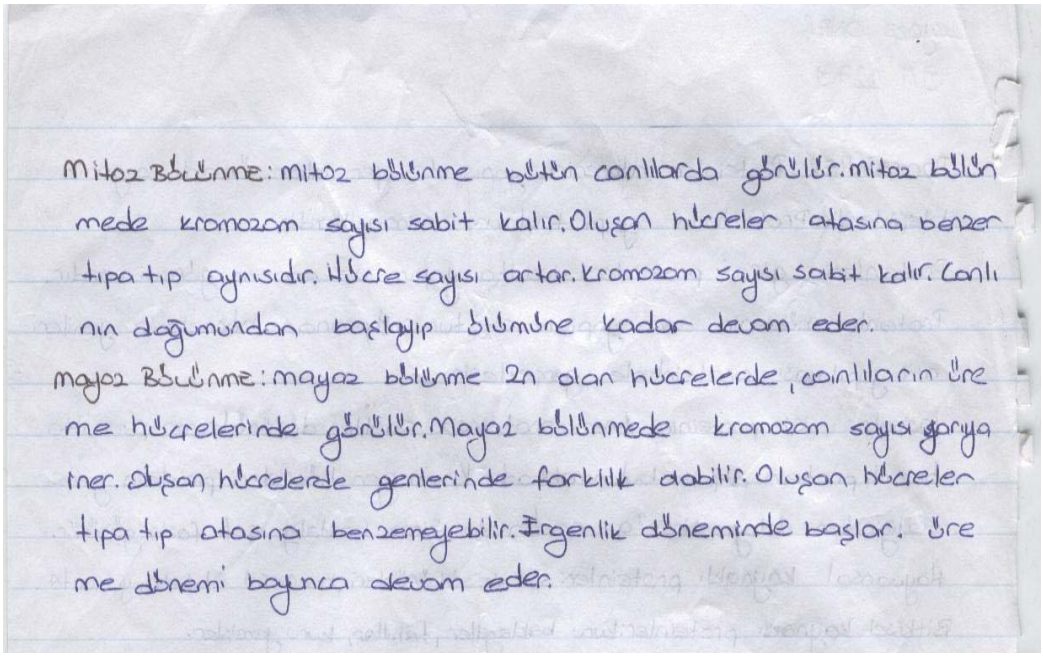
Öğrenci Çalışmalarından Bazı Örnekler

M.1 Students' studies related with Verbal/linguistic Intelligence

Sözel-dilsel Zeka ile ilgili çalışmalar

M.1.1 A student's brief notes for the "Speaker-Listener-observer" activity

"Sözcü-Dinleyici-Gözlemci" aktivitesi için bir öğrencinin çıkartmış olduğu özetler

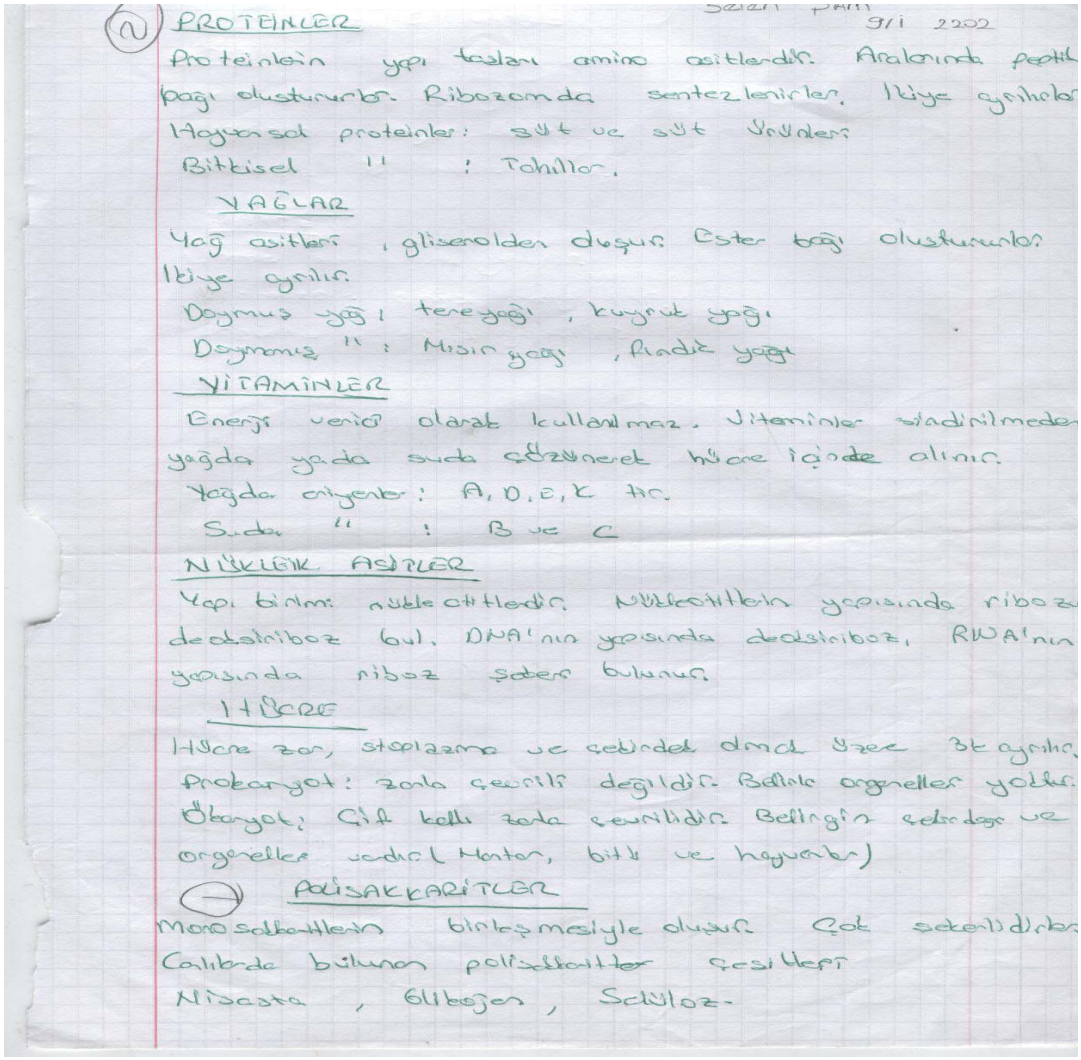


Mitoz Bölünme: mitoz bölünme bütün canlılarda görülür. mitoz bölünmede kromozom sayısı sabit kalır. Oluşan hücreler atasına benzer tıpa tıp aynısıdır. Hücre sayısı artar. kromozom sayısı sabit kalır. Canlının doğumundan başlayıp ölümüne kadar devam eder.

mayoz Bölünme: mayoz bölünme 2n olan hücrelerde, canlıların üreme hücrelerinde görülür. Mayoz bölünmede kromozom sayısı yarıya iner. oluşan hücrelerde genlerinde farklılık olabilir. Oluşan hücreler tıpa tıp atasına benzemeyebilir. Ergenlik döneminde başlar. üreme dönemi boyunca devam eder.

PROTEİNLER- Proteinler hücrenin yapısında yer alan önemli organik bileşiklerdir. Proteinlerin yapı taşları aminoasitlerdir.
Proteinlerin görevi: proteinler vücutta yapım ve onarım görevi vardır. Proteinler hücrenin esas yapısını oluşturur. Yıpranan hücrelerin yenilerinin yapılması proteinlerle gerçekleşir.
İnsanlar için proteinin önemi: proteinsiz canlılık düşünülemez, vücutta önemli protein deposu bulunmaktadır. Karaciğer hücreleri protein yeterliliğinden dolayı siroz'a neden olur. Siroz hastalığı çok fazla görülür.
Hayvansal kaynaklı proteinler: süt ve süt ürünleri, her çeşit et, balık, yumurta
Bitkisel kaynaklı proteinler: kuru baklagiller, tahıllar, kuru yemişler.
YAĞLAR: Organik moleküllerden yağlar lipidler olarak da bilinir. Yağlar suda çözünmeler yada çok az çözünürler. Trigliserit 3 molekül yağ asidi ve bir molekül gliserinin ester bağları ile birleşmesiyle oluşur. Yağlar vücudun enerji kaynağıdır. Yağlar iki çeşittir doymuş ve doymamış yağlar.
Doymuş yağ: yağ asidinin zincirinde karbon atomları arasında çift bağ yoksa doymuş yağdır.
doymamış yağ: karbon zincirinde bir yada daha fazla çift bağ varsa buna doymamış yağ denir.
VİTAMİNLER: metebolizmada düzenleyici ve direnç arttırıcı olarak kullanılırlar. Vitaminler iki çeşittir. suda çözünen ve çözünmeyen
Suda çözünenler, A, D, E, K vitaminleri;
Suda çözünmeyenler: B grubu vitaminleri; (B_1, B_2, B_3, B_5, B_6, B_7, B_9, B_{12})
Vitaminlerin görevleri: Vücudu hastalıklardan korur, direnç sağlar
Vücudu kanamadan ve kanserlikten korur. Büyüme gelişme, üremede etkilidir.
Nükleik asitler: Organik bileşiklerin bir başka grubudur. Nükleik asitler H, O, N, C, P elementlerinin birbirine düzenli şekilde bağlanması ile oluşur. Nükleik asitlerin yapı birimleri nükleotitlerdir.
Hücre: Canlıların yaşayan en küçük yapı birimidir.
Hücre duvarı: Bitkilerde bulunur.
Prokaryot hücre: Etrafı belirgin bir zarla çevrili olmayan organelle re sahip gelişmemiş hücredir. Bir tek hücre zarı bulunur.
Ökaryot hücre: Organellerinde hücre zarı bulunan gelişmiş hücre dir. Bütün organelleri zarla çevrilidir.

Another student's brief notes



(2) PROTEİNLER 9/1 2202

Proteinlerin yapı taşları amino asitlerdir. Aralarında peptit bağı oluştururlar. Ribozomda sentezlenirler. İkiye ayrılırlar

Hayvansal proteinler: Süt ve süt ürünleri

Bitkisel " : Tahiller.

YAĞLAR

Yağ asitleri, gliserolden oluşur. Ester bağı oluştururlar. İkiye ayrılır.

Doymuş yağ: tereyağı, kuyruk yağı

Doymamış " : Mısır yağı, Ayçiçek yağı

VİTAMİNLER

Enerji verici olarak kullanılmaz. Vitaminler sindirilmeden yağda yada suda çözünerek hücre içinde alınır.

Yağda eriyenler: A, D, E, K vb.

Suda " : B ve C

NÜKLEİK ASİTLER

Yapı birimi nükleotitlerdir. Nükleotitlerin yapısında riboz dedoksiriboz bul. DNA'nın yapısında dedoksiriboz, RNA'nın yapısında riboz şeker bulunur.

HÜCRE

Hücre zar, sitoplazma ve çekirdek olmak üzere 3'e ayrılır.

Prokaryot: zarla çevrili değildir. Belirli organeller yoktur. Ökaryot: Çift katlı zarla çevrilidir. Belirgin çekirdek ve organeller vardır. (Mantar, bitki ve hayvanlar)

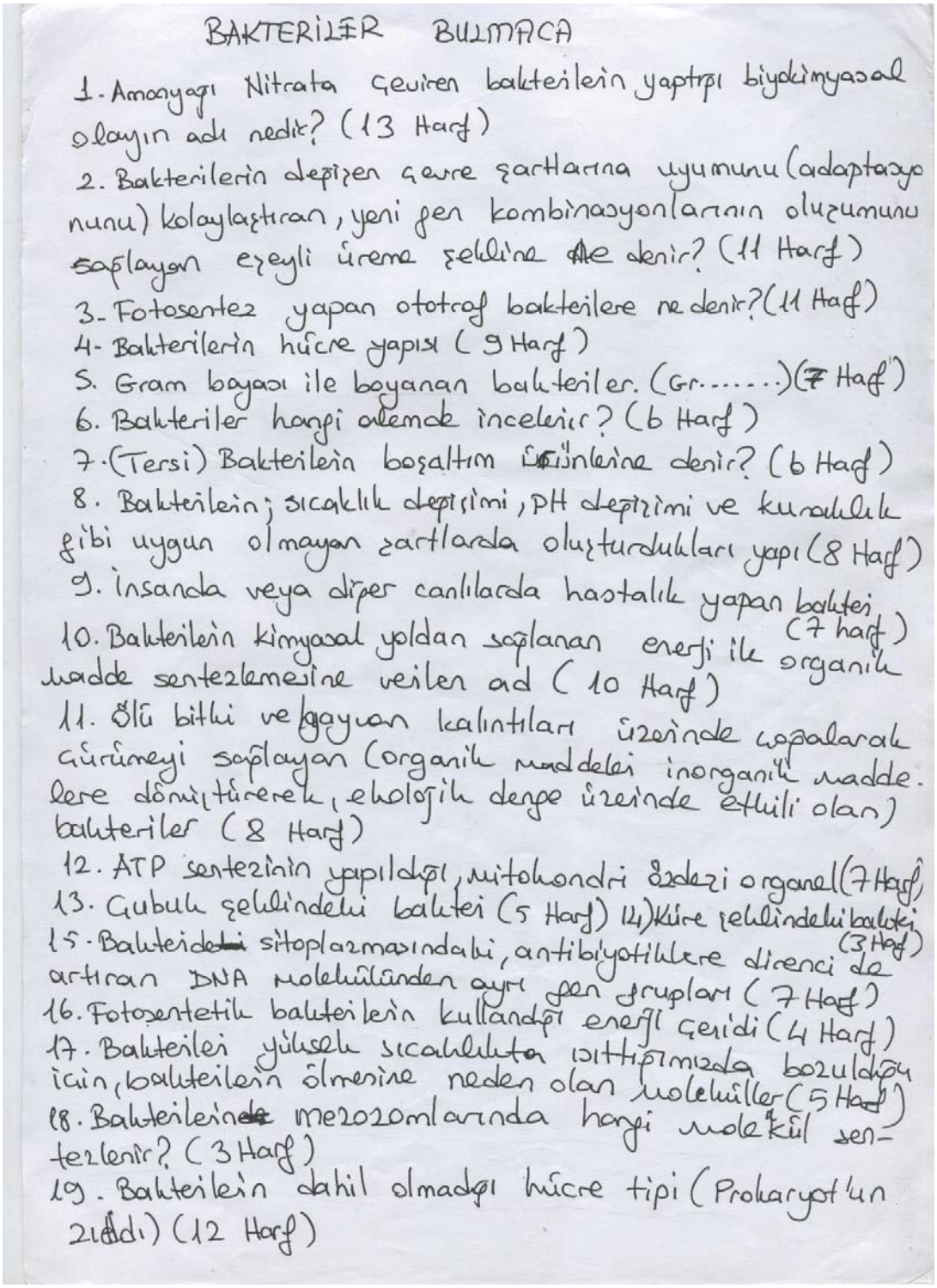
POLİSAKKARİTLER

Monosakkaritlerin birleşmesiyle oluşur. Çok şekerlidirler. Canlılarda bulunan polisakkaritler çeşitleri

Nişasta, Glikojen, Selüloz-

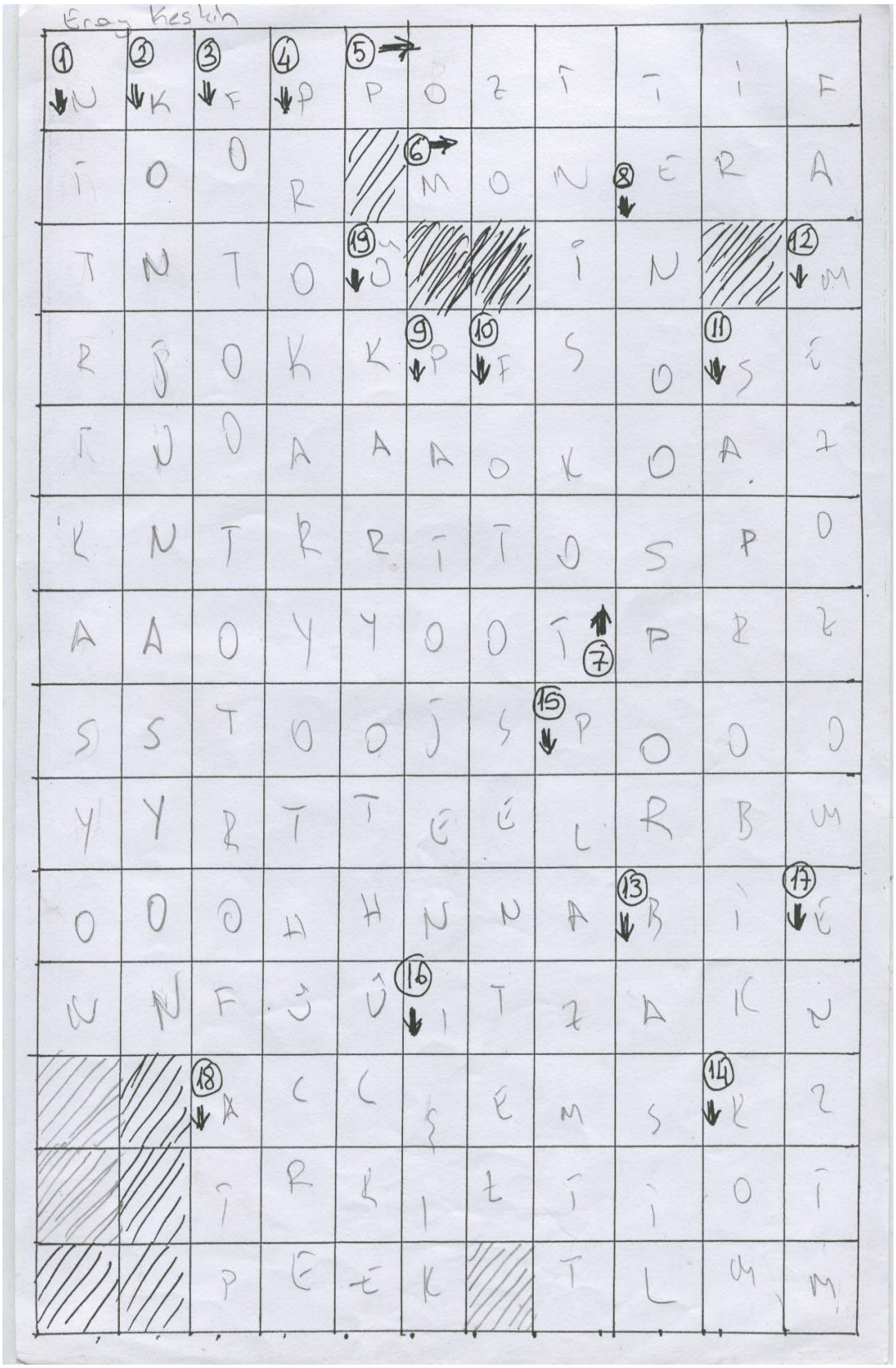
M.1.2 Puzzle prepared by one of the students in MIBG about the bacteria

Bir öğrenci tarafından Bakteriler konusunda hazırlanan Bulmaca



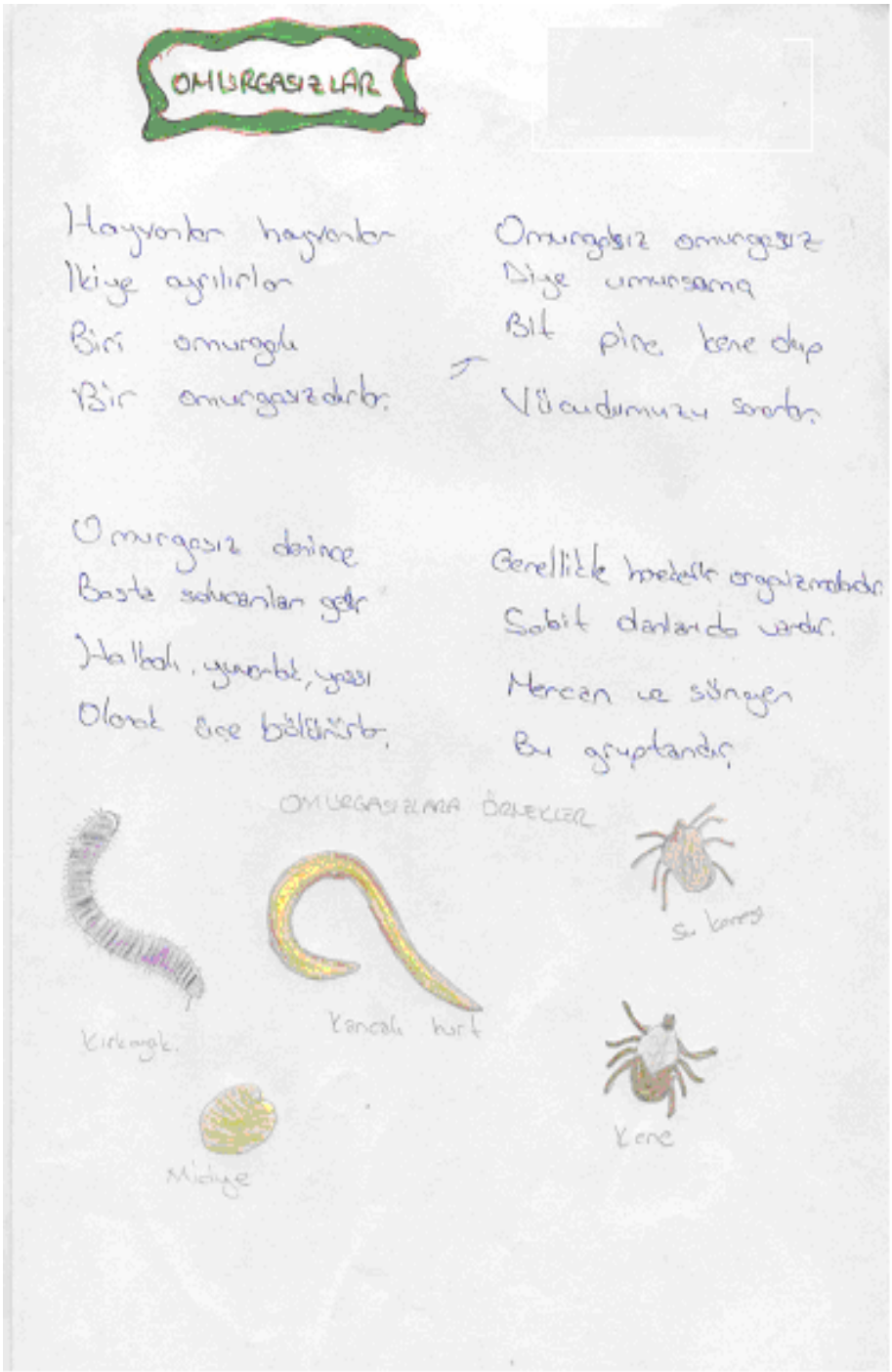
BAKTERİLER BULMACA

1. Amonyağı Nitrata çeviren bakterilerin yaptığı biyokimyasal olayın adı nedir? (13 Harf)
2. Bakterilerin değişen çevre şartlarına uyumunu (adaptasyonunu) kolaylaştıran, yeni gen kombinasyonlarının oluşumunu sağlayan eşeyli üreme şekline ne denir? (11 Harf)
3. Fotosentez yapan ototrof bakterilere ne denir? (11 Harf)
4. Bakterilerin hücre yapısı (9 Harf)
5. Gram boyası ile boyanan bakteriler. (Gr.....) (7 Harf)
6. Bakteriler hangi alemde incelenir? (6 Harf)
7. (Tersi) Bakterilerin boşaltım ürünlerine denir? (6 Harf)
8. Bakterilerin; sıcaklık değişimi, pH değişimi ve kuraklık gibi uygun olmayan şartlarda oluşturdukları yapı (8 Harf)
9. İnsanda veya diğer canlılarda hastalık yapan bakteri (7 harf)
10. Bakterilerin kimyasal yoldan sağlanan enerji ile organik madde sentezlemesine verilen ad (10 Harf)
11. Ölü bitki ve hayvan kalıntıları üzerinde yaşayarak çürümeyi sağlayan (organik maddeleri inorganik maddelere dönüştürerek, ekolojik denge üzerinde etkili olan) bakteriler (8 Harf)
12. ATP sentezinin yapıldığı, mitokondri benzeri organel (7 Harf)
13. Çubuk şeklindeki bakteri (5 Harf) 14) Küre şeklindeki bakteri (3 Harf)
15. Bakterideki sitoplazmasındaki, antibiyotiklere direnci de artıran DNA molekülünden ayrı gen grupları (7 Harf)
16. Fotosentetik bakterilerin kullandığı enerji çeşidi (4 Harf)
17. Bakterileri yüksek sıcaklıkta ısıtıldığımızda bozulduğu için, bakterilerin ölmesine neden olan moleküller (5 Harf)
18. Bakterilerinde mezozomlarında hangi molekül sentezlenir? (3 Harf)
19. Bakterilerin dahil olmadığı hücre tipi (Prokaryotların zıddı) (12 Harf)



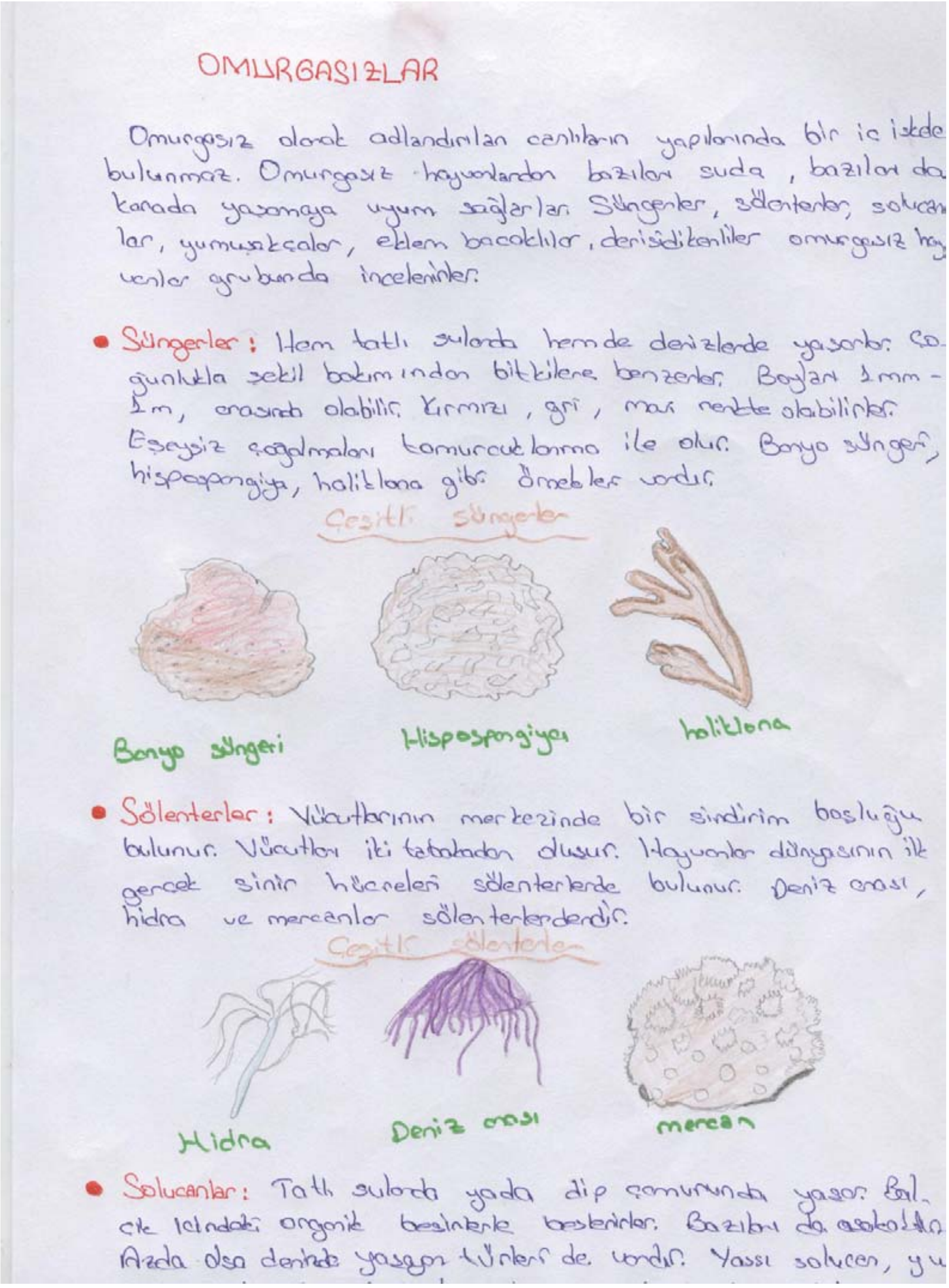
M.1.3 A poem written by an "Invertebrate group" member

Omurgasızlar gurup elemanı tarafından yazılan bir şiir



M.1.4 General characteristics of the invertebrate animals prepared by an "Invertebrate group member"

Omurgasızlar gurup elemanınca hazırlanan Omurgasız hayvanların genel özellikleri


OMURGASIZLAR

Omurgasız olarak adlandırılan canlıların yapılarında bir iç iskele bulunmaz. Omurgasız hayvanlardan bazıları suda, bazıları da karada yaşamaya uyum sağlarlar. Süngerler, sölenterler, solucanlar, yumuşakçalar, eklem bacaklılar, derisidikenliler omurgasız hayvanlar grubunda incelenirler.

• Süngerler: Hem tatlı sularda hem de denizlerde yaşarlar. Çoğunlukla şekil bakımından bitkilere benzerler. Boyları 1mm - 1m arasında olabilir. Kırmızı, gri, mor renkte olabilirler. Eşeysiz çoğalmaları tomurcuklanma ile olur. Banyo süngeri, hispospongiya, haliklona gibi örnekler vardır.

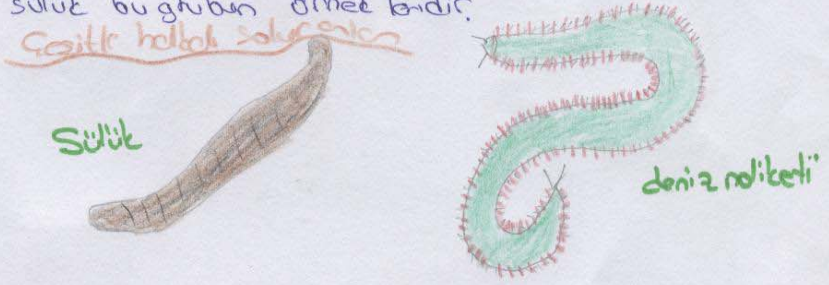
• Sölenterler: Vücutlarının merkezinde bir sindirim boşluğu bulunur. Vücutları iki tabakadan oluşur. Hayvanlar dünyasının ilk gerçek sinir hücreleri sölenterlerde bulunur. Deniz anası, hidra ve mercanlar sölenterlerdendir.

• Solucanlar: Tatlı sularda yada dip çamurunda yaşar. Balçık içindeki organik besinlerle beslenirler. Bazıları da asalaktır. Azda olsa denizde yaşayan türleri de vardır. Yassı solucan, yu

Yassı solucanlar: Vücutları yassı, oval ve uzundur. Anüs ve dolaşım sistemi yoktur. Parazit yaşayanlardan bazılarında parazit sistemi yoktur. Sinir ve üreme sistemleri vardır.

Yuvarlak solucanlar: Vücutları yuvarlak ve uzundur. Sindirim sistemlerinde ağız ve anüs olmak üzere iki açıklık vardır. Bitki ve hayvanlarda parazittirler. Bazılarında toprakta, suda serbest olarak yaşar. Kancalı kurt, filarya, kök solucanı örneklerdir.

Halkalı solucanlar: Vücutları çok sayıda halkanın sıralanması ile oluşmuştur. Baş bölgesi ayırt edilebilir. Sindirim kanalı özel bölümlere ayrılmıştır. Toprak solucanı, yelpaze solucanı, deniz nereidi, sülük bu gruba örnek verilir.

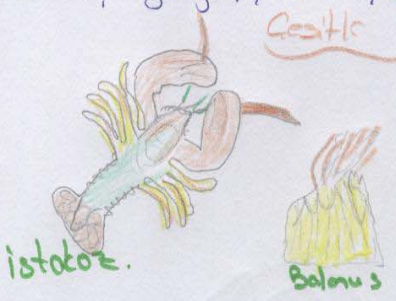


- Yumuşakçalar: Vücutları yumuşak ve kabukludur. Distan bölmesiz görülür. Solungaçları ile solunum yaparlar. Ahtapot, salyangoz, midye, kiton örneklerdir.

- Eklem bacaklılar: Vücutları baş, göğüs ve karından oluşmuştur. Karasal yaşama en iyi uyum yapmış omurgasızlardır. Açık dolaşım sistemi görülür. Ayrı eşeylidirler. Basit bir sinir ve solunum sistemi vardır.

Kabuklular: Sertleşmiş kabukları vardır. Tatlısu ve denizlerde ya-şarlar. Açık dolaşım sistemi görülür. Solungaç solunumu yaparlar. Kanides, yengeç, istakoz, balanus en tanımış örneklerindendir.

Çeşitli kabuklular



Örümcekler, akrepler, keneler: Eklemli dört çift bacak taşırlar. Su keneleri, örümcek, kene, atnalı yengeç, akrep örnek verilebilir.

Çeşitli örümcek, akrep, kene

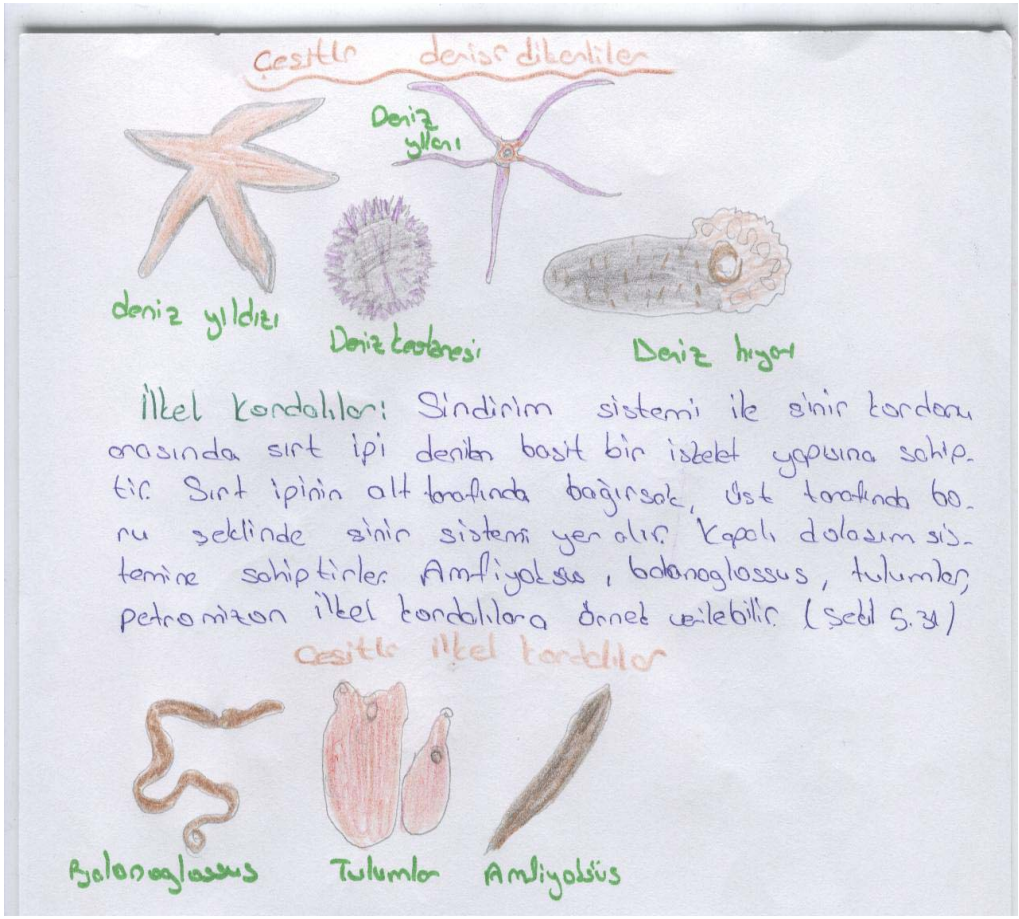
Çokayaklılar: Vücutları uzun ve segmentlidir. Her segmentte çift bulunur. Çiyan, kırkayak bu grubun örnekleridir.

Çeşitli çok ayaklılar

Böcekler: En geniş hayvan grubunu oluştururlar. Çoğu türleri karada yaşar. Açık dolaşım sistemi görülür. Bit, pire, tahta böceklere örnek verilebilir.

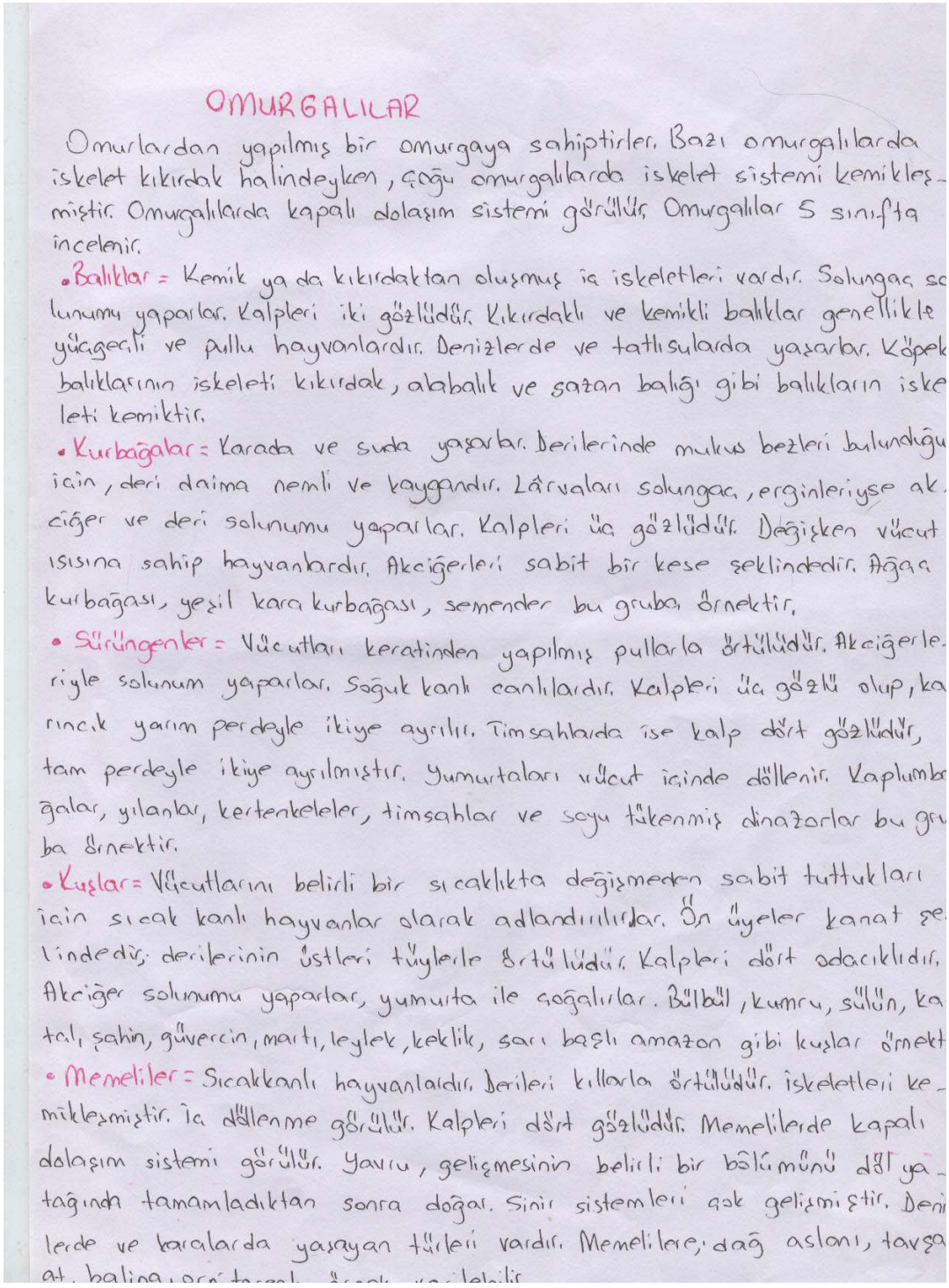
Çeşitli böcekler

- Derisi dikenliler: Hemen hemen hepsi denizlerde. Çoğunlukla zeminde sürünerek yaşar. İskelette tipik olarak dikenler bu


Çeşitli deniz dikenliler
Deniz yıldızı
deniz yıldızı
Deniz kestanesi
Deniz hıyarı
İlkel kordalılar: Sindirim sistemi ile sinir kordası arasında sırt ipi denilen basit bir iskelet yapısına sahiptir. Sırt ipinin alt tarafında bağırsak, üst tarafında boru şeklinde sinir sistemi yer alır. Kapalı dolaşım sistemine sahiptirler. Amfiyoksus, balanoglossus, tulumlar, petromizon ilkel kordalılara örnek verilebilir. (Şekil S.34)
Çeşitli ilkel kordalılar
Balanoglossus
Tulumlar
Amfiyoksüs

M.1.5 General characteristics of the vertebrate animals prepared by a "Vertebrate group" member

Omurgalılar gurup elemanınca hazırlanan Omurgalı hayvanların genel özellikleri



OMURGALILAR

Omurlardan yapılmış bir omurgaya sahiptirler. Bazı omurgalılarda iskelet kıkırdak halindeyken, çoğu omurgalılarda iskelet sistemi kemikleşmiştir. Omurgalılarda kapalı dolaşım sistemi görülür. Omurgalılar 5 sınıfta incelenir.

• Balıklar = Kemik ya da kıkırdaktan oluşmuş iç iskeletleri vardır. Solungaç solunumu yaparlar. Kalpleri iki gözlüdür. Kıkırdaklı ve kemikli balıklar genellikle yüzgeçli ve pullu hayvanlardır. Denizlerde ve tatlısularda yaşarlar. Köpek balıklarının iskeleti kıkırdak, alabalık ve sazan balığı gibi balıkların iskeleti kemiktir.

• Kurbağalar = Karada ve suda yaşarlar. Derilerinde mukus bezleri bulunduğu için, deri daima nemli ve kaygandır. Larvaları solungaç, erginleriyse akciğer ve deri solunumu yaparlar. Kalpleri üç gözlüdür. Değişken vücut ısısına sahip hayvanlardır. Akciğerleri sabit bir kese şeklindedir. Ağaç kurbağası, yeşil kara kurbağası, semender bu gruba örnektir.

• Sürüngenler = Vücutları keratinden yapılmış pullarla örtülüdür. Akciğerleriyle solunum yaparlar. Soğuk kanlı canlılardır. Kalpleri üç gözlü olup, karıncık yarım perdeyle ikiye ayrılır. Timsahlarda ise kalp dört gözlüdür, tam perdeyle ikiye ayrılmıştır. Yumurtaları vücut içinde döllenir. Kaplumbağalar, yılanlar, kertenkeleler, timsahlar ve soyu tükenmiş dinazorlar bu gruba örnektir.

• Kuşlar = Vücutlarını belirli bir sıcaklıkta değişmeden sabit tuttukları için sıcak kanlı hayvanlar olarak adlandırılırlar. Ön üyeler kanat şeklindedir; derilerinin üstleri tüylerle örtülüdür. Kalpleri dört odacıklıdır. Akciğer solunumu yaparlar, yumurta ile çoğalırlar. Bülbül, kumru, sülün, kartal, şahin, güvercin, martı, leylek, keklik, sarı başlı amazon gibi kuşlar örnektir.

• Memeliler = Sıcakkanlı hayvanlardır. Derileri kıllarla örtülüdür. İskeletleri kemikleşmiştir. İç döllenme görülür. Kalpleri dört gözlüdür. Memelilerde kapalı dolaşım sistemi görülür. Yavru, gelişmesinin belirli bir bölümünü dış yatağında tamamladıktan sonra doğar. Sinir sistemleri çok gelişmiştir. Denizlerde ve karalarda yaşayan türleri vardır. Memelilere; dağ aslanı, tavşan, at, balina, [illegible]

M.1.6 A news a student brought into the classroom about the "Seals"

Bir öğrencinin foklarla ilgili olarak getirdiği bir gazete yazısı

EN ÖNEMLİ İLAÇ, SEVGİ

Sevgi, şefkat ve fiziksel yakınlık sağlanmadan yavru foka yemek yedirebilmek mümkün olmuyor. Bütün bakıcılar "ağlayan foklar'ın" tedavisinde, "sevip okşama seansları" uygulayarak yavru foklarla konuşup, onlara sarılıp, sevip okşuyorlar. İşte o zaman minik yavru başını kaldırıp iri gözleriyle bakıcısının yüzüne öyle bir bakıyor ki bu manzara en taş kalpliler bile yumuşatıyor. Tabii acımasız fok avcılarını saymazsak.

Yavrular anne fokun yokluğunda herşeyi ya içgüdüleri ile ya da insanlardan öğreniyorlar. Bir fok ne zaman, bir insan yaklaşınca içgüdüsel olarak geriye çekilirse, kendi dünyasına dönmeye ve bazının cesaretine bakmaya hazır demektir. Beklenen gün geldiğinde büyük bir sandık içinde sahile götürülüyor ve sandığın kapağı uzaktan aralanıyor. Fok yavaşça yüzerek uzaklaşıp, açık denizlerin havasını koklayarak doğal ortamına doğru ilerlerken, yaşamını etkisine borçlu olduğun çok iyi biliyor. Atık maddelere karşı bağışıklık potansiyeli artmış olan fok, olağan üstü bir kimyevi kirlenme meydana gelmezse ortalama olarak 38 yıl yaşıyor. Bir zamanlar 85 cm boyunda, 8 kg ağırlığındaki yavru, artık 1.60 m boya ve 80-100 kg ağırlığa erişiyor ve saatte 35 km hızla yüzebiliyor. Tabii bir arada günde 7.5 kg kadar balık yiyerek profesyonel balıkçıların şikayetlerine de neden oluyor. Bazen de fok kendisini büyüten, anne-baba yerine koyduğu insanlardan ayrılmaya cesaret edemeyerek sahile geri dönüyor. Bu durumda, bir süre daha yuvada kalması sağlandıktan sonra, doğal ortamına dönmesi için bir şans daha veriliyor.

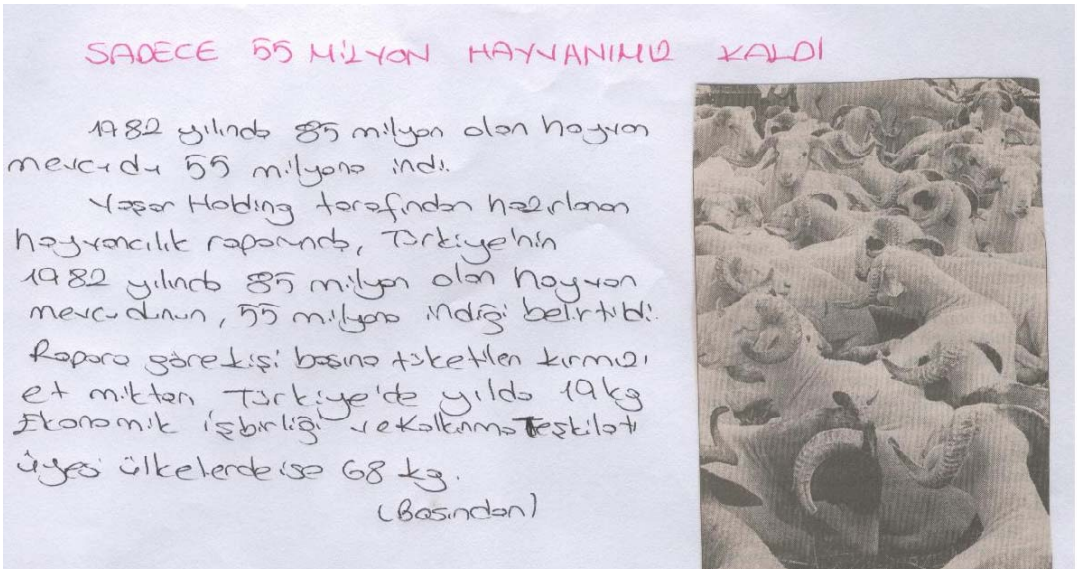
TÜRKİYE'DE FOKLAR: Ülkemizde Sinop'tan Şile'ye kadar uzanan sahil şeridinde Akdeniz fokları yaşamaktadır. 1987 yılı verilerine göre sayıları 100-150 olan foklarımızın, günümüzde 20-25 olduğu tahmin ediliyor.

Kıyılarımızda çok az sayıda bulunan foklarımızın en büyük düşmanı insanlardır. Derisinin altındaki kalın yağ tabakası için avlanan foklar, bazen de ağları yırttığı gerekçesiyle balıkçılar tarafından bilinçsizce yok edilmektedir.

(Basından)

M.1.7 A news about the biological diversity in Turkey

Türkiyede canlı sayısının azalmasıyla ilgili olarak "omurgalılar gurubu" üyesi bir öğrenci tarafından sınıfa getirilen bir haber



SADECE 55 MİLYON HAYVANIMIZ KALDI

1982 yılında 85 milyon olan hayvan mevcudu 55 milyona indi.

Yaşar Holding tarafından hazırlanan hayvancılık raporunda, Türkiye'nin 1982 yılında 85 milyon olan hayvan mevcudunun, 55 milyona indiği belirtildi. Rapora göre kişi başına tüketilen kırmızı et miktarı Türkiye'de yılda 19kg Ekonomik işbirliği ve kalkınma teşkilatı üyesi ülkelerde ise 68 kg.

(Basından)

M.1.8 A Writing about an animal that is close to be vanished

Nesli tükenmek üzere olan bir hayvan hakkında yazı

NESLİ TÜKENEN, TEK BAŞINA KALAN BİR SIRTLANIN PSİKOLOJİSİ

Yolladığın bir mesaja yanıt alamadığında binlerce hücren intihar eder. Yalnızlık yüzünden. Acaba kaç kişi Anadolu'da bir köyde tek başına yaşayan sırtlan kadar yalnız olabilir ki? Ait olduğu hiçbir grubu, eşi, yavrusu, ana babası olmayan, tek başına bir sırtlan kadar. Bir mutlak yalnızlık. İnsanın ve modern gelişmenin yok etme operasyonundan canını kurtarmayı başarmış türünün tek başına örneği!

Hiçbirşey olmadığında var, her zaman vardır. Yalnızlığın mutlaklığı olarak vardır. Hiçbir şeysiz var olmak, işte ıstırap buna denir. Belki Beydağları'nda tek kalmış bir sırtlan böyledir. Ölmek değil var olmak korkutur onu.

İnsanla hayvan arasında ortak duygular yok mudur? Istırap çekmenin aynı yüz hatları, aynı acılı sesleri, edaları. Doğanın en büyük iki yasasından biri hayatta kalmak, diğeri ise kendini çoğaltmaktır. Sırtlanımız için birincisi şimdilik devam ediyor ama ikincisi yok.

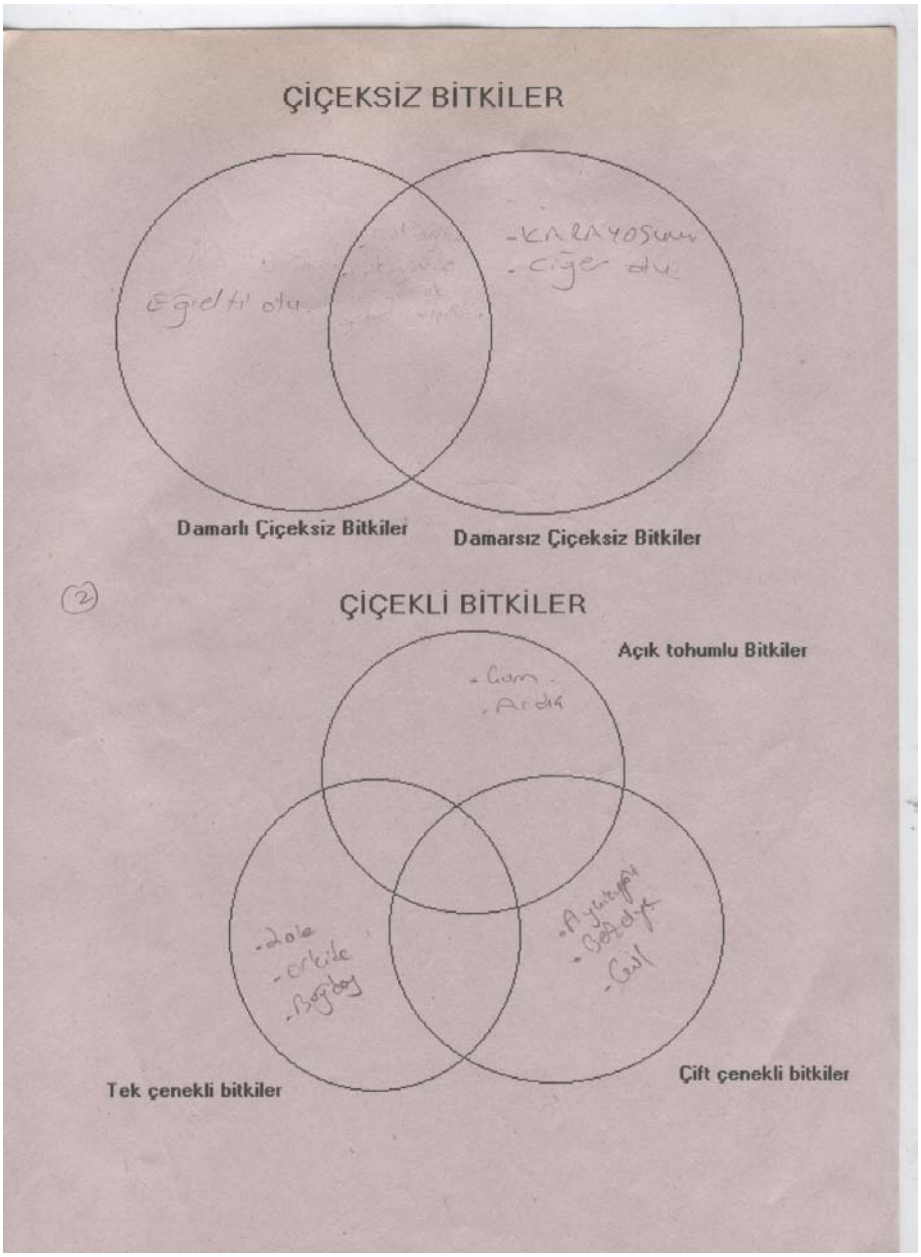
Eğer Beydağları'ndaki sırtlan neslinin son bireyi ise o kendisinin son birey olduğunu anlamayacaktır. Düşünsenize bugüne kadar neyin sonunu gördü ki? Hangi objenin karşısına son olarak çıktığını anlayabildi? Eş bulamayacak, bulamayınca da deliler gibi gezecek; belki de hayatında hiç gezmediği kadar. Kesinlikle bu arayış içinde kendinde olmayacak. Bir gün birinin karşısına çıkacak. O da onu kafasından vuracak. Peki avcı vurduğu sırtlanın son sırtlan olduğunu bilecek mi? Evet veya hayır. Bilse ne olacak ki zaten. O, sırtlanı vurduğu için mutlaka gurur duyacaktır.

M.2 Students' studies related with Logical/mathematical Intelligence

Matematiksel-mantıksal zekayla ilgili çalışmalar

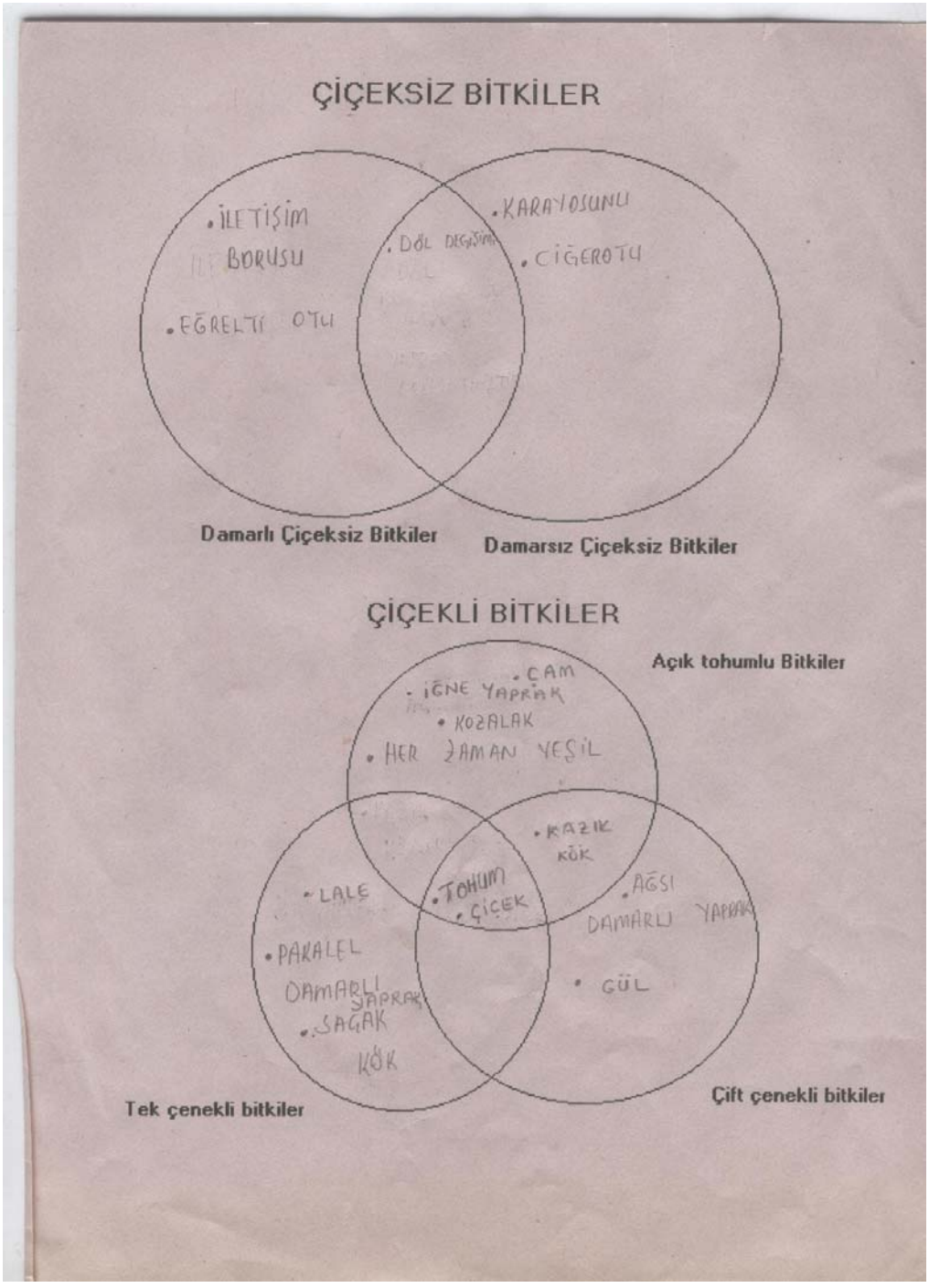
M.2.1 Venn Diagrams Used for the Plant Names by a Student

Bitki Örneklerinin Yerleştirilmesi için Kullanılan Ven Şemaları



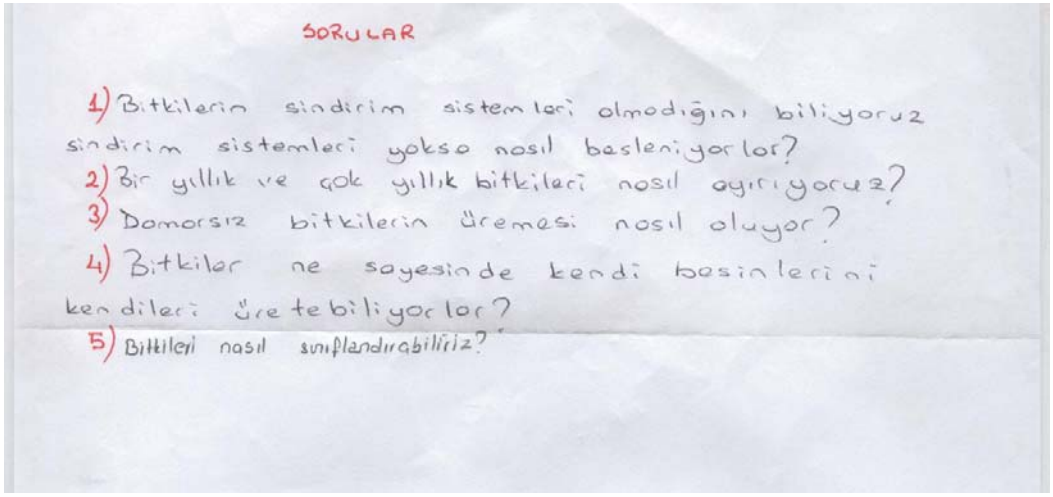
M.2.2 Venn diagrams used for the similarities and differences of different groups of plants

Farklı bitki guruplarının benzerlik ve farklılıklarının gösterilmesinde kullanılan Ven şemaları



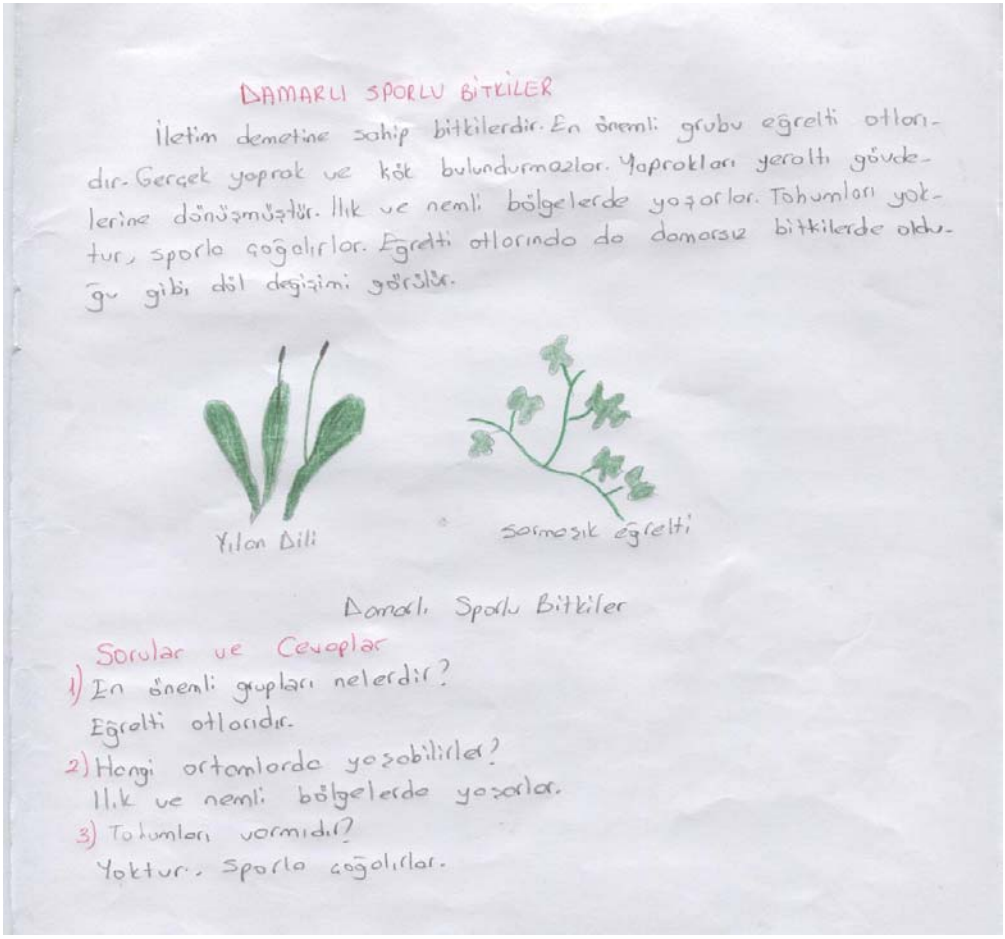
M.2.3 Questions prepared by the group members about their subjects

Gurup elemanlarınca konuları hakkında hazırlanan sorular



SORULAR

1) Bitkilerin sindirim sistemleri olmadığını biliyoruz sindirim sistemleri yokso nasıl besleniyorlar?
2) Bir yıllık ve çok yıllık bitkileri nasıl ayırıyoruz?
3) Domorsız bitkilerin üremesi nasıl oluyor?
4) Bitkiler ne sayesinde kendi besinlerini kendileri üretebiliyorlar?
5) Bitkileri nasıl sınıflandırabiliriz?



DAMARLI SPORLU BİTKİLER

İletim demetine sahip bitkilerdir. En önemli grubu eğrelti otlarıdır. Gerçek yaprak ve kök bulundurmazlar. Yaprakları yeraltı gövdelerine dönüşmüştür. Ilık ve nemli bölgelerde yaşarlar. Tohumları yoktur, sporla çoğalırlar. Eğrelti otlarında da domorsız bitkilerde olduğu gibi döl değişimi görülür.

Yılan Dili

Sarmaşık eğrelti

Damarlı Sporlu Bitkiler

Sorular ve Cevaplar

1) En önemli grupları nelerdir?
Eğrelti otlarıdır.
2) Hangi ortamlarda yaşabilirler?
Ilık ve nemli bölgelerde yaşarlar.
3) Tohumları varmıdır?
Yoktur, sporla çoğalırlar.

Yarasa Niçin Kuş Değildir?

Yarasa kuş değil memeli bir hayvandır. Bunun nedeni ise tüylerinin olmayışıdır. Gövdesi kıllakaplıdır ve kanatlarının üzerinde sert bir deri tabakası vardır.

Devekuşları Neden Uçamaz?

Devekuşlarının boyu yaklaşık 2,5 metredir. Ağırlıkları ise 150 kilograma kadar çıkabilir. Bu neredeyse iki yetişkin insanın ağırlığına eşittir. Ağırlığı nedeniyle uçamasa da devekuşu çok hızlı bir koşucudur.

Kaplanlar Neden Çizgilidir?

Hayvanat bahçesindeki bir kaplanı iri gövdesi ve canlı renkleriyle hemen göze çarpar. Doğada ise, ormanlarda ve yüksek otların arasında avlanan bir kaplanı çevresinden ayırt etmek o kadar kolay değildir. Üzerindeki çizgiler kaplanın görüntüsünü küçük parçalara bölerek onun gölgeler arasında görülmesini güçleştirir. Bu da kaplanın geyiklere ve diğer hayvanlara fark edilmeden yaklaşabilmesini sağlar.

Flamingoların Tüyleri Neden Pembedir?

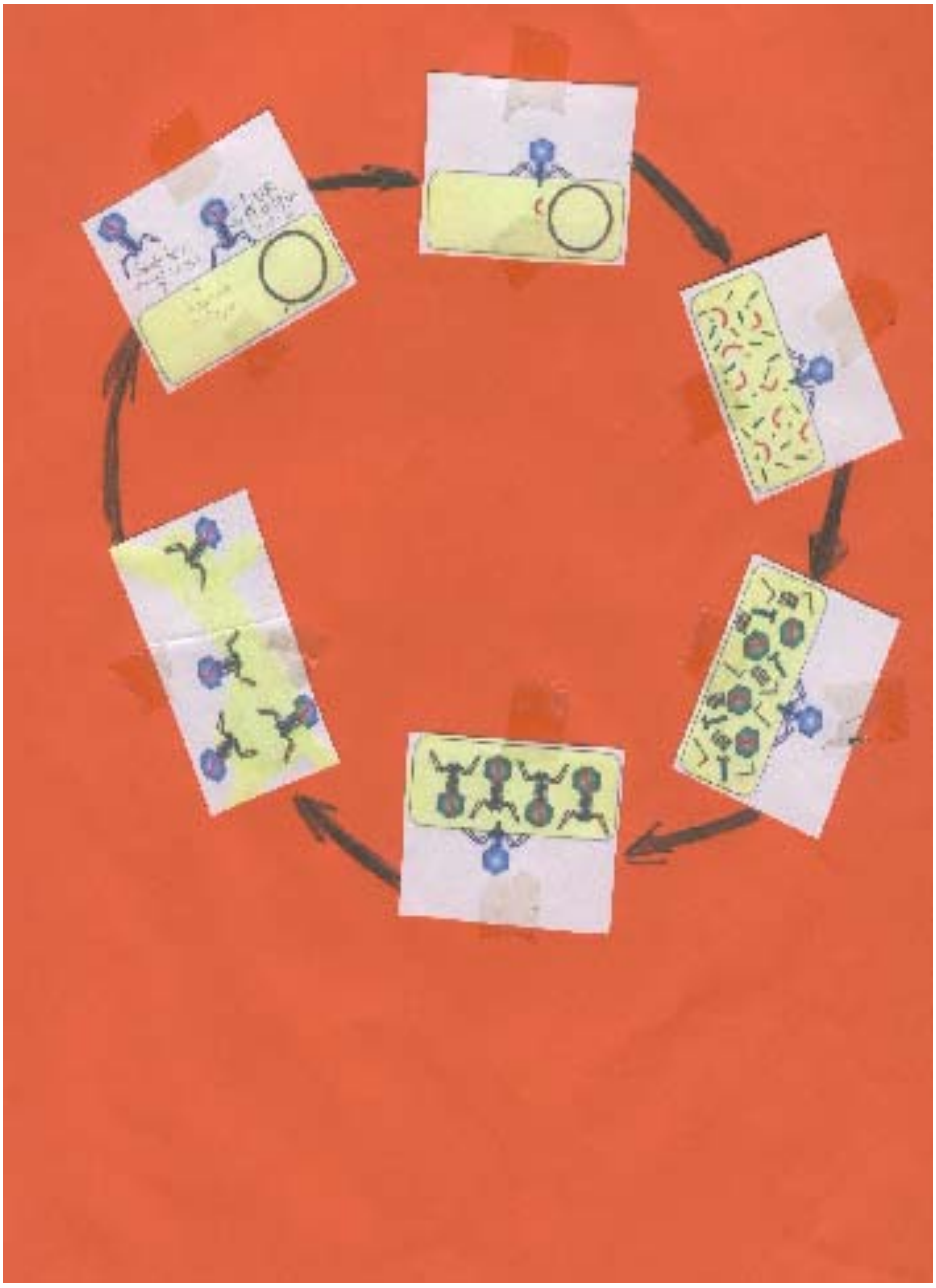
Flamingoların tüylerinin pembe oluşunun nedeni su bitkilerinde bulunan karoten adlı bir boya maddesidir. Flamingolar karoten içeren bitkilerle beslenen küçük su hayvancıklarını yedikleri için bu rengi alırlar. Hayvanat bahçelerindeki flamingolar çoğu zaman doğadakiler kadar pembe değildir. Bunun nedeni besinlerinde yeterince karoten bulunmamasıdır.

M.3 Students' studies related with Visual/spatial Intelligence

Görsel Zekayla İlgili Çalışmalar

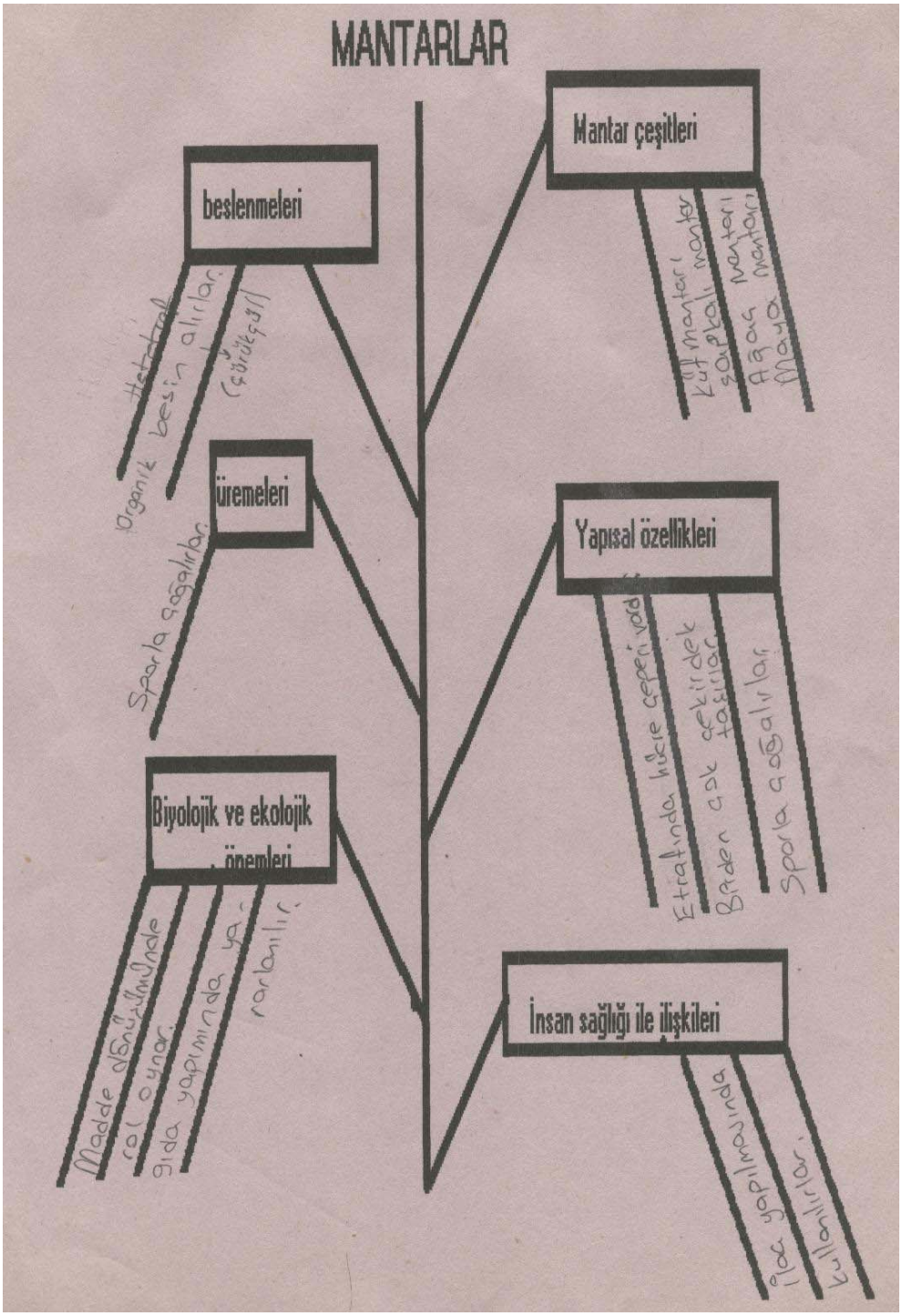
M.3.1 Reproduction of the Viruses

Virüslerin üremesi



M.3.2 Fungi Tree Diagram

Mantarlar Ağaç Şema

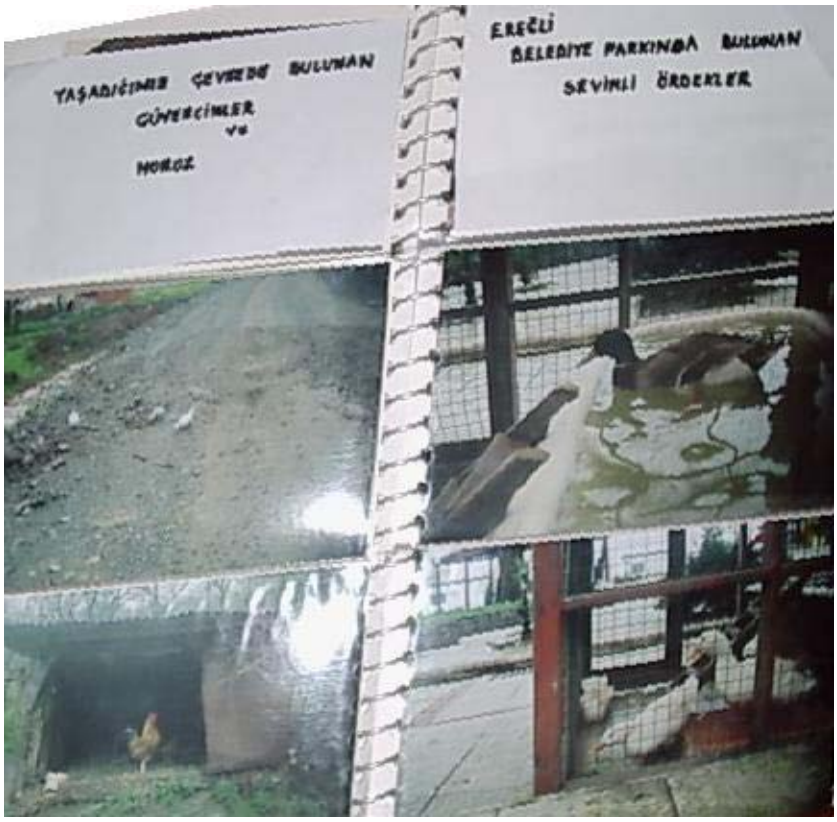


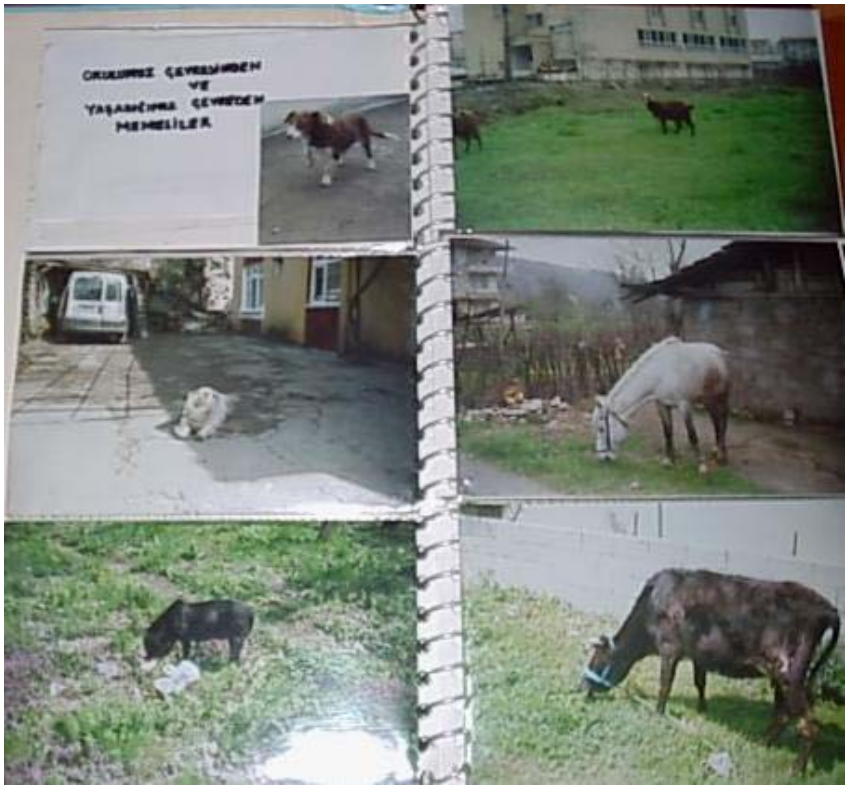
M.3.3 Photoes taken by the “Plants” group members

Bitkiler gurup üyesi tarafından çekilen fotoğraflar

M.3.4 Photoes taken by the “Vertebrate” group members

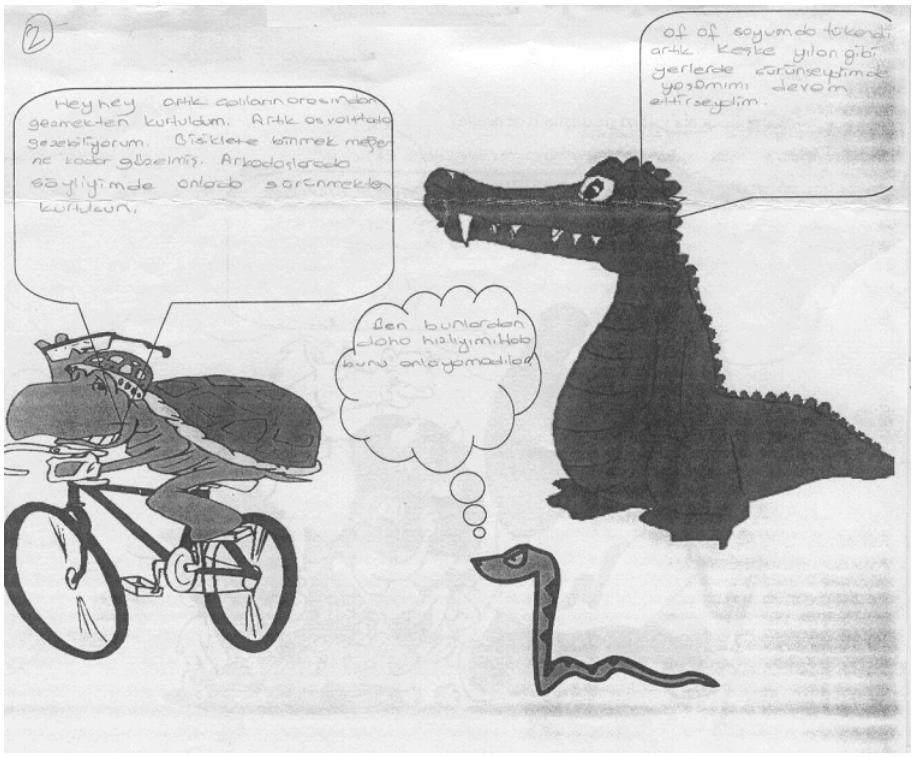
Omurgalı hayvanlar gurup elemanlarınca çekilen fotoğraflar

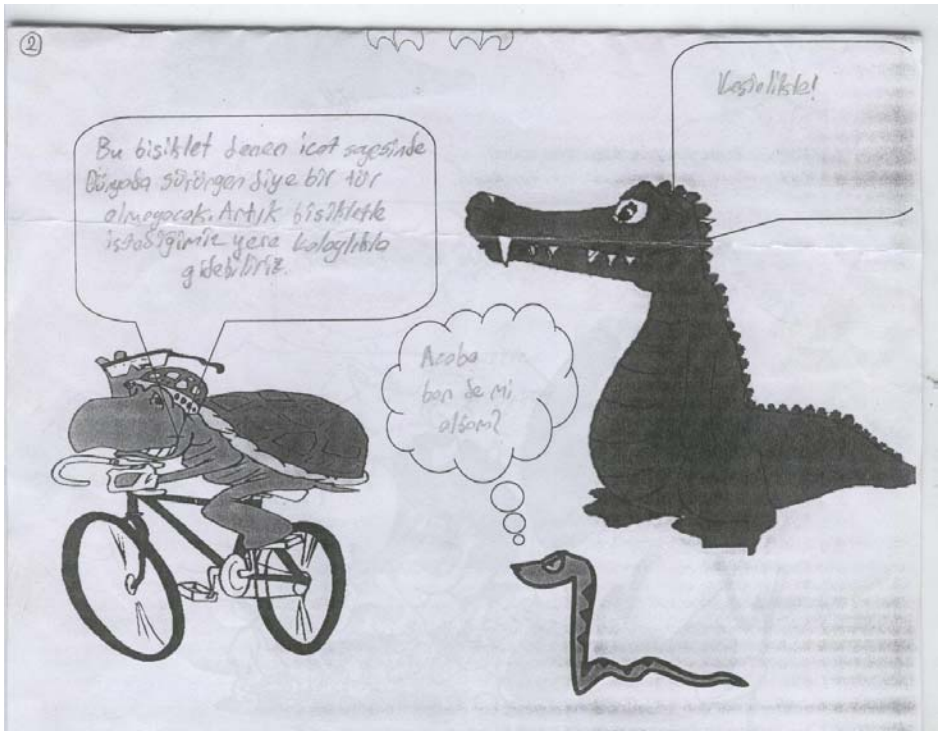

YAŞADIĞIMIZ ÇEVREDE BULUNAN
GÜVERCİNLER
VE
HOROZ
ERECLİ
BELEDİYE PARKINDA BULUNAN
SEVİMLİ ÖRDEKLER


OKULUMUZ ÇEVRESİNDEN
VE
YAŞADIĞIMIZ ÇEVREDEN
MEMELİLER

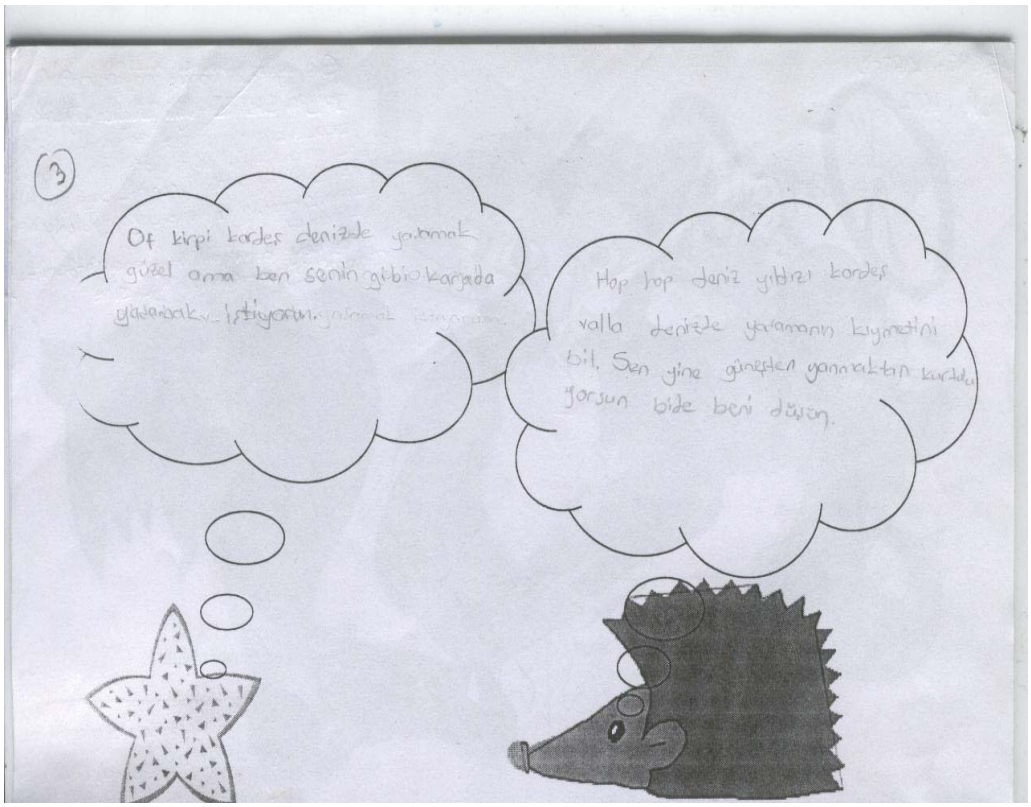
M.3.5 Cartoons filled by the students

Öğrenciler tarafından doldurulan karikatürler






3
İkimizinde dikenleri olması ne tuhaf. O karada yaşıyor bense denizlerde o omurgalı ben ise omurgasızım!!!
Ben hiçbir şey anlamadım. Bir tek dikenlerimiz ortak. Çok karışık...


3
Of kirpi kardeş denizde yaşamak güzel ama ben senin gibi karada yaşamak istiyorum.
Hop hop deniz yıldızı kardeş valla denizde yaşamanın kıymetini bil. Sen yine güneşten yanmaktan kurtuldun sorun bide beni düşün.

M.4 Students' Studies related with Musical Intelligence

Öğrencilerin Müzikal Zeka ile İlgili Çalışmaları

M.4.1 "The Little Bacteria" Song Lyrics

"Miniminicik Baktericik" şarkı sözleri

MİNİMİNİCİK BAKTERİCİK

Bir küçücük baktericik varmış
Monera aleminde yaşarmış
Besin olan her yerde onlarda varmış
Miniminicik baktericik
Miniminicik baktericik
Yuvarlak, çubuk, virgül, spiral
bunlar gibi bakteriler varmış
Eşeyli, eşeysiz ürer durumuş
Miniminicik baktericik
Miniminicik baktericik
Ototrof, hetetrof beslenirlermiş
Uzun uzun kamçılara sahiplermiş
Yararları zararları da varmış
Miniminicik baktericik
Miniminicik baktericik
Oksijen seven aeorobtur
Oksijen sevmeyen aneorobtur, anaeorobtur
Miniminicik baktericik
Miniminicik baktericik
Gram boyasıyla boyanan pozitiftir
Gram boyasıyla boyanmayan negatiftir/ negatiftir
Miniminicik baktericik
Miniminicik baktericik

M.4.2 The Caterpillar Song Lyrics

"Tırtıl" Şarkı Sözleri

TIRTIL

Tırtıl
Tırtılın sonu pırpır kelebek
Tırtıl sürünüyor
Bırak uçsun göklerde
Omurgasızlar çok çeşitlidirler
Süngerler, sölenterler……..
Solucanlar, üçe böülünürler:
Yassı, yuvarlak, halkalıdırlar,
3 guruptan oluşandır bunlar
Midye, salyangoz ve ahtapotlar
Omurgasızlara örnek olurlar
Eklembacaklıları unutma
Karasal yaşama en iyi uyum sağlayanlar
Tırtıl
Tırtılın sonu pırpır kelebek
Tırtıl sürünüyor
Bırak uçsun göklerde

M.5 Students' Studies related with Bodily/kinesthetic Intelligence

Bedensel Kinestetik Zeka ile ilgili Çalışmalar

M.5.1 Virus Models Made By the MIBG Students

Öğrenciler tarafından yapılan virüs modelleri

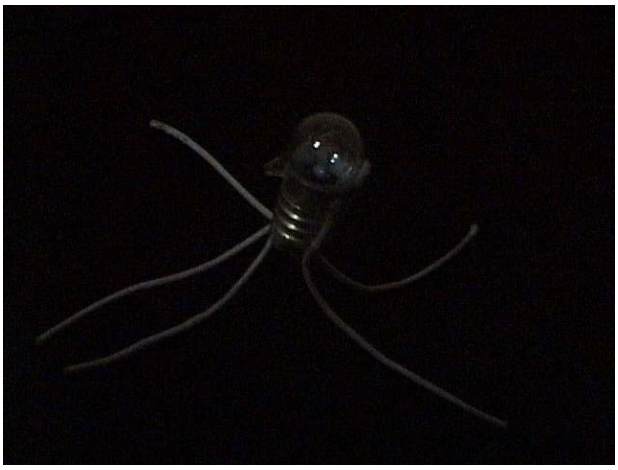


Figure M.5.1.1 A virus model made by using a little lamp and a wire

Figure M.5.1.2 A virus model made by using a lamp, a handwork paper, and a nylon

Figure M.5.1.3 A virus model by using a table tennis ball, and a medicine box

Figure M.5.1.4 A virus model by using a bottle, cardboard, and hairclips

Figure M.5.1.5 A virus model by using a plastic bottle, and a notebook paper

M.5.2 Bacteria's Sexual reproduction Model made by a Student

Bir öğrencinin yaptığı Bakterilerde Eşeyli üreme Modeli

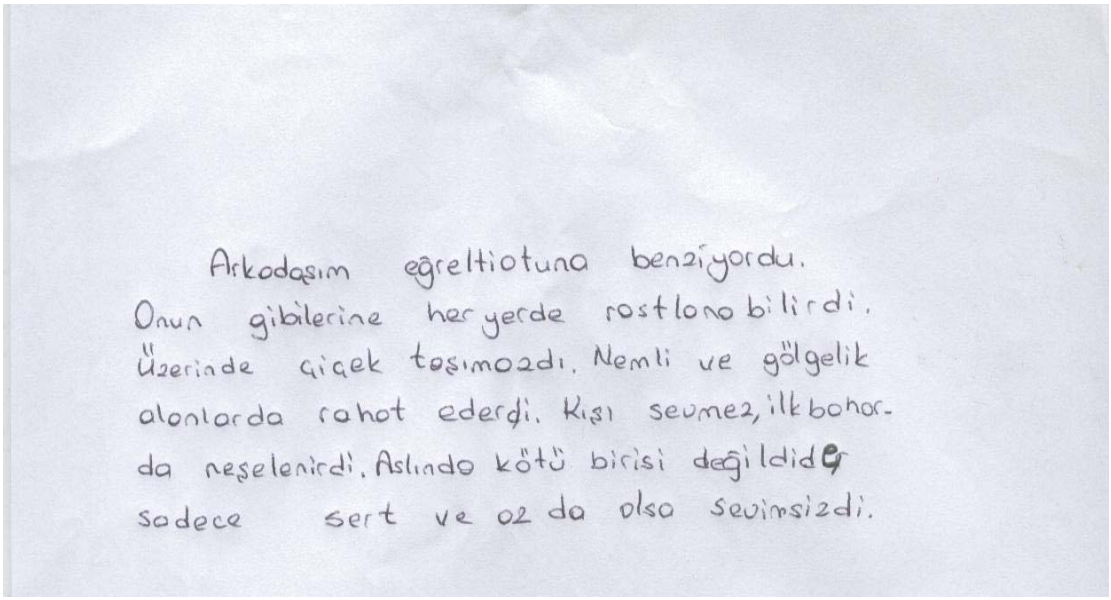
Figure M.5.2.1 A sexual reproduction model by using two plastic bottles, a transparent pipe, and two colorful strings

M.6. Students' studies related with Social/Interpersonal Intelligence

Sosyal Dışa Dönük Zeka ile ilgili çalışmalar

M.6.1 Explanation of a student who thinks one of her friends resembles a fern

Arkadaşını bir eğreltiotuna benzeten öğrencinin açıklaması

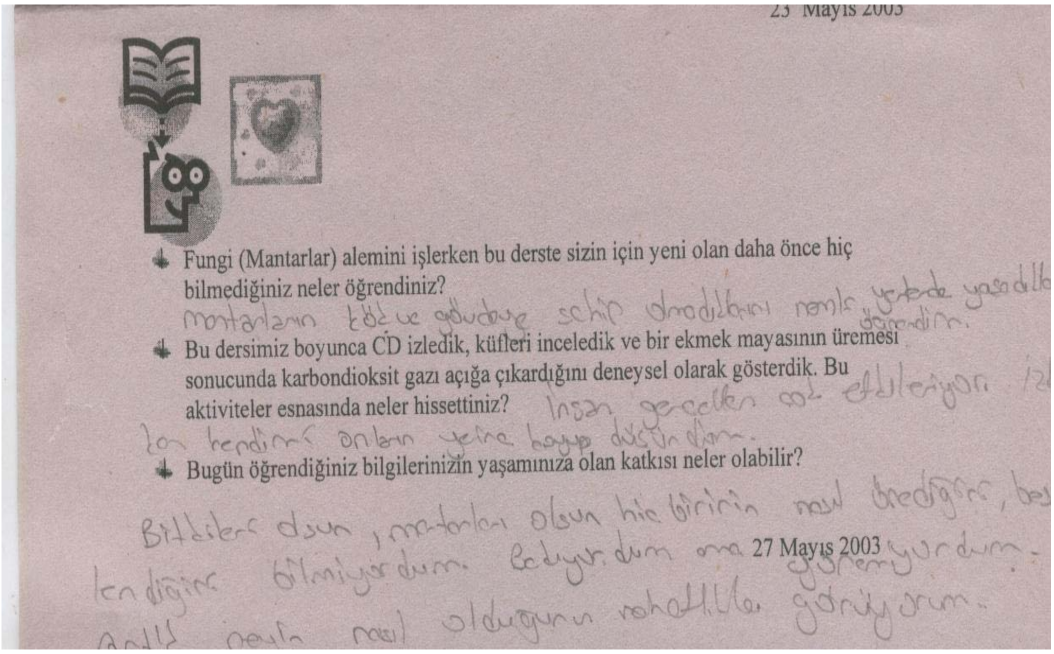

Arkadaşım eğreltiotuna benziyordu.
Onun gibilerine her yerde rastlanabilirdi.
Üzerinde çiçek taşımazdı. Nemli ve gölgelik
alanlarda rahat ederdi. Kışı sevmez, ilkbahar-
da neşelenirdi. Aslında kötü birisi değildi
sadece sert ve az da olsa sevimsizdi.

M.7 Students' Studies related with Intrapersonal Intelligence

Özedönük Zeka ile ilgili Çalışmalar

M.7.1 A little diary about what they learned and how they felt themselves

O gün ne öğrendiklerini ve kendilerini nasıl hissettiklerini yazmalarını sağlayan değerlendirme formu


23 Mayıs 2003

- Fungi (Mantarlar) alemini işlerken bu derste sizin için yeni olan daha önce hiç bilmediğiniz neler öğrendiniz?
  Mantarların kök ve gövdeye sahip olmadıklarını renkli yerlerde yaşadıklarını öğrendim.
- Bu dersimiz boyunca CD izledik, küfleri inceledik ve bir ekmek mayasının üremesi sonucunda karbondioksit gazı açığa çıkardığını deneysel olarak gösterdik. Bu aktiviteler esnasında neler hissettiniz? İnsan gerçekten çok etkileniyor. İzlerken kendimi onların yerine koyup düşündüm.
- Bugün öğrendiğiniz bilgilerinizin yaşamınıza olan katkısı neler olabilir?
  Bitkiler olsun, mantarlar olsun hiç birinin nasıl ürediğini, beslendiğini bilmiyordum. Bakıyordum ama göremiyordum. Artık onların nasıl olduğunu rahatlıkla görüyorum.

27 Mayıs 2003

23 Mayıs 2003

- Fungi (Mantarlar) alemini işlerken bu derste sizin için yeni olan daha önce hiç bilmediğiniz neler öğrendiniz?
Mantarlarla bu dönemde önemli yere sahip olduklarını, olmasaydı hayvan ve bitki kalıntılarının yığılıp kalacağını öğrendim.
- Bu dersimiz boyunca CD izledik, küfleri inceledik ve bir ekmek mayasının üremesi sonucunda karbondioksit gazı açığa çıkardığını deneysel olarak gösterdik. Bu aktiviteler esnasında neler hissettiniz?
Çok ilginç bir deneydi. Çok beğendim.
- Bugün öğrendiğiniz bilgilerinizin yaşamınıza olan katkısı neler olabilir?
Ekmek'in küflendiği zaman zehirli olduğunu, yenmemesi gerektiğini.

27 Mayıs 2003

23 Mayıs 2003

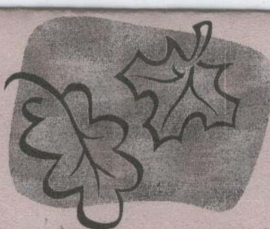
- Fungi (Mantarlar) alemini işlerken bu derste sizin için yeni olan daha önce hiç bilmediğiniz neler öğrendiniz? Küf mantarının hayatımızda ne kadar önemli olduğunu öğrendim.
- Bu dersimiz boyunca CD izledik, küfleri inceledik ve bir ekmek mayasının üremesi sonucunda karbondioksit gazı açığa çıkardığını deneysel olarak gösterdik. Bu aktiviteler esnasında neler hissettiniz? Balonun karbondioksit gazıyla şişmesine şaşırdım. Ama bu aktivite çok güzeldi.
- Bugün öğrendiğiniz bilgilerinizin yaşamınıza olan katkısı neler olabilir? Ekmeğin küflenmesinde küf mantarıyla olduğunu öğrendim.

25 Mayıs 2003

- Fungi (Mantarlar) alemini işlerken bu derste sizin için yeni olan daha önce hiç bilmediğiniz neler öğrendiniz? - Mantarların daha çok çeşidi olduğunu
- Bu dersimiz boyunca CD izledik, küfleri inceledik ve bir ekmek mayasının üremesi sonucunda karbondioksit gazı açığa çıkardığını deneysel olarak gösterdik. Bu aktiviteler esnasında neler hissettiniz? Heyecanlandım çünkü sonucu çok merak ediyordum.
- Bugün öğrendiğiniz bilgilerinizin yaşamınıza olan katkısı neler olabilir?

☆ Bundan sonra küflü bir şeye elimi sürmeyeceğim.
☆ Hamura maya katmayı unutmayacağım
☆ Her çeşit mantarı da yemiyeceğim (zehirlenebilirim)

27 Mayıs 2003

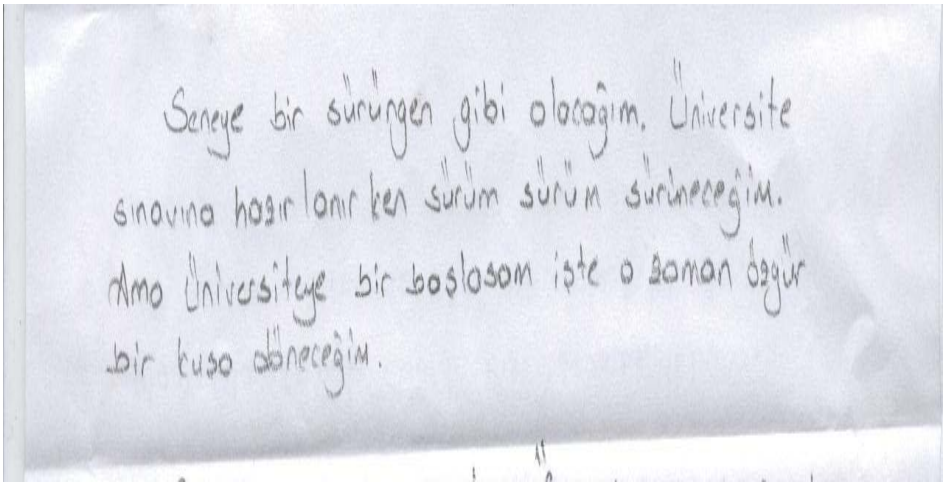


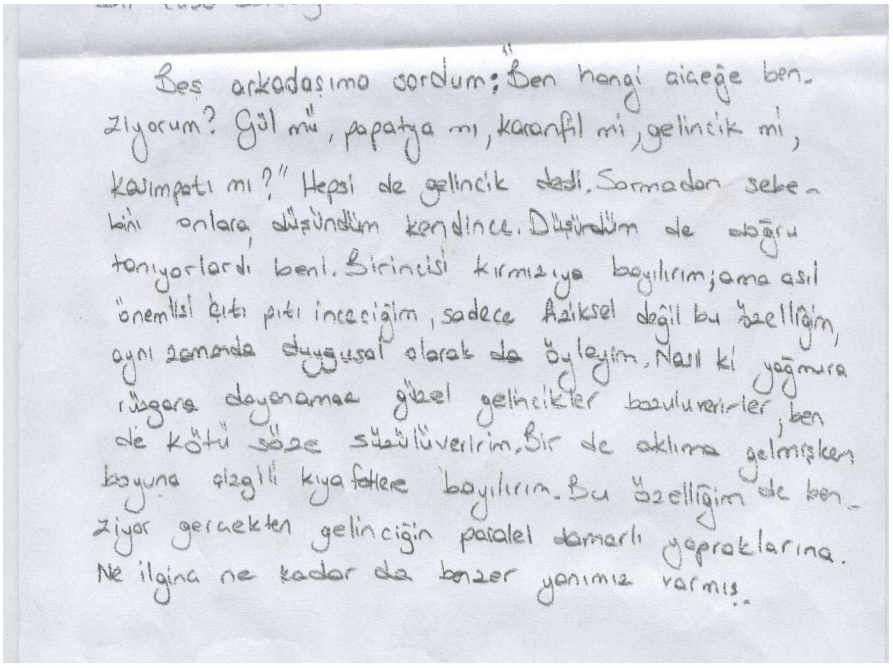
- Bu derste fark ettim ki...mantarlar yer yüzünde madde döngüsünde de rol oynarlar
- Bu derste...Mantarların genel özellikleri...konusunu çok iyi anladığımı düşünüyorum.

- Bu derste...Mantar çeşitlerini anlamak...benim için çok zor oldu.
- Bu derste...Mantar çeşitleri...konusunu çok iyi anlayamadım. Bu konudaki eksikliklerimi...ağaç semayı doldurmak...ile giderebileceğimi sanıyorum.
- Bu dersi ...Tiyatro veya CD izlemek...olsaydı daha iyi anlayabilirdim.

M.7.2 Explanations of students about to which organism they look like

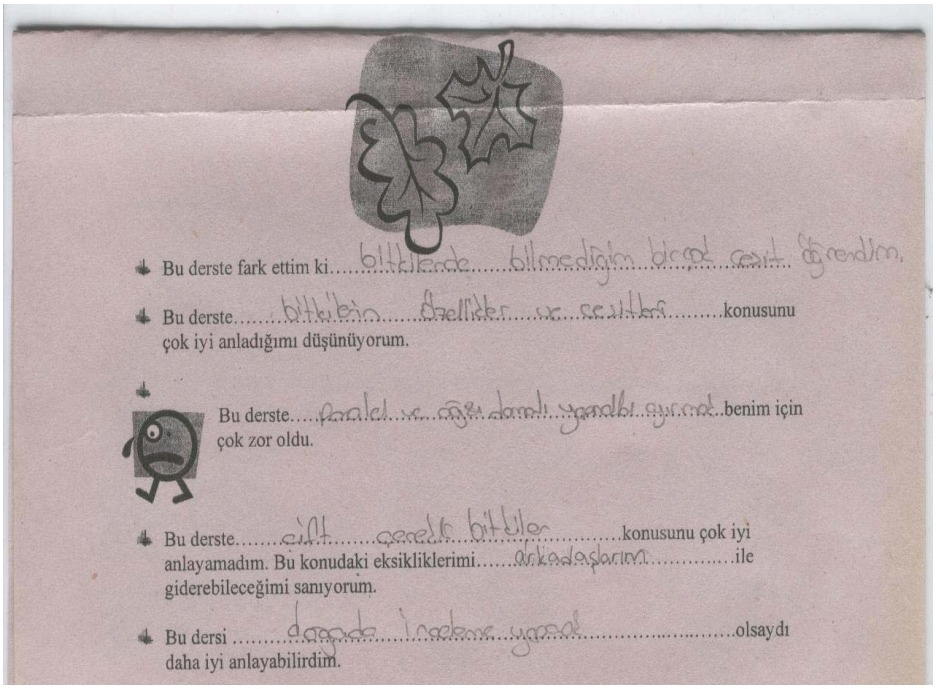
Öğrencilerin kendilerini hangi canlıya benzettiklerine dair açıklamaları


Seneye bir sürüngen gibi olacağım. Üniversite sınavına hazırlanırken sürüm sürüm sürüneceğim. Ama Üniversiteye bir başlasam işte o zaman özgür bir kuşa dönüşeceğim.

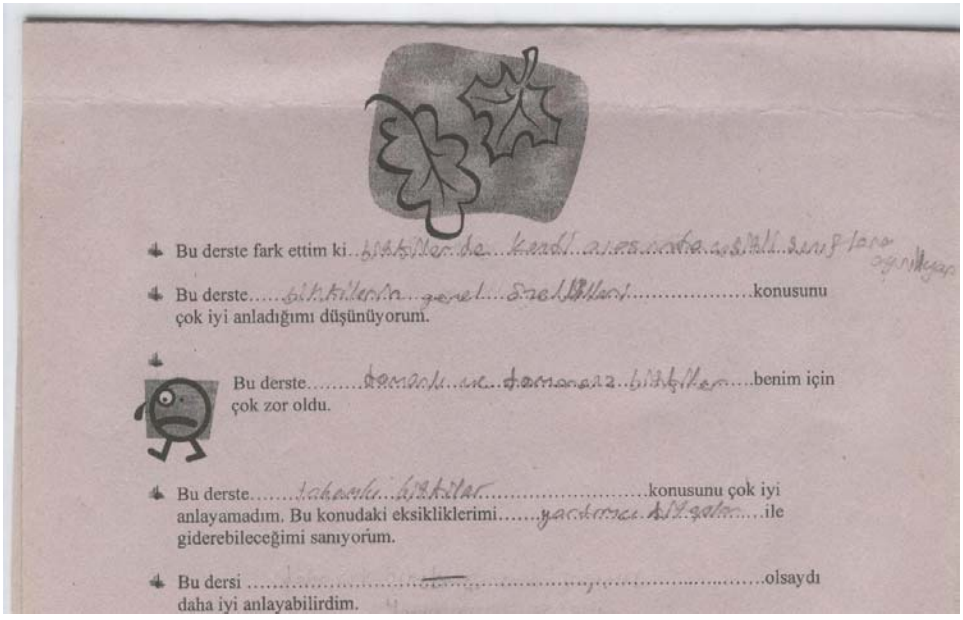

Beş arkadaşıma sordum: "Ben hangi çiçeğe benziyorum? Gül mü, papatya mı, karanfil mi, gelincik mi, kalmpatı mı?" Hepsi de gelincik dedi. Sormadan sebebini onlara düşündüm kendimce. Düşündüm de doğru tanıyorlardı beni. Birincisi kırmızıya bayılırım; ama asıl önemlisi ince ince çiçeğim, sadece fiziksel değil bu özelliğim, aynı zamanda duygusal olarak da öyleyim. Nasıl ki yağmura rüzgara dayanamaz gibi gelincikler bayılıverirler, ben de kötü söze süzülüverirm. Bir de aklıma gelmişken boyuna çizgili kıyafetlere bayılırım. Bu özelliğim de benziyor gerçekten gelinciğin paralel damarlı yapraklarına. Ne ilginç ne kadar da benzer yanımız varmış.

M.7.3 Self assessment about the subject of Plants

Bitkiler konusuyla İlgili Özdeğerlendirme



- Bu derste fark ettim ki... bitkilerde bilmediğim birçok şeyi öğrendim.
- Bu derste... bitkilerin özellikleri ve çeşitleri ...konusunu çok iyi anladığımı düşünüyorum.
- Bu derste... paralel ve ağsı damarlı yaprakları ayırmak ...benim için çok zor oldu.
- Bu derste... çiçeksiz çiçekli bitkiler ...konusunu çok iyi anlayamadım. Bu konudaki eksikliklerimi... arkadaşlarım ...ile giderebileceğimi sanıyorum.
- Bu dersi ... dışarıda inceleme yapmak ...olsaydı daha iyi anlayabilirdim.



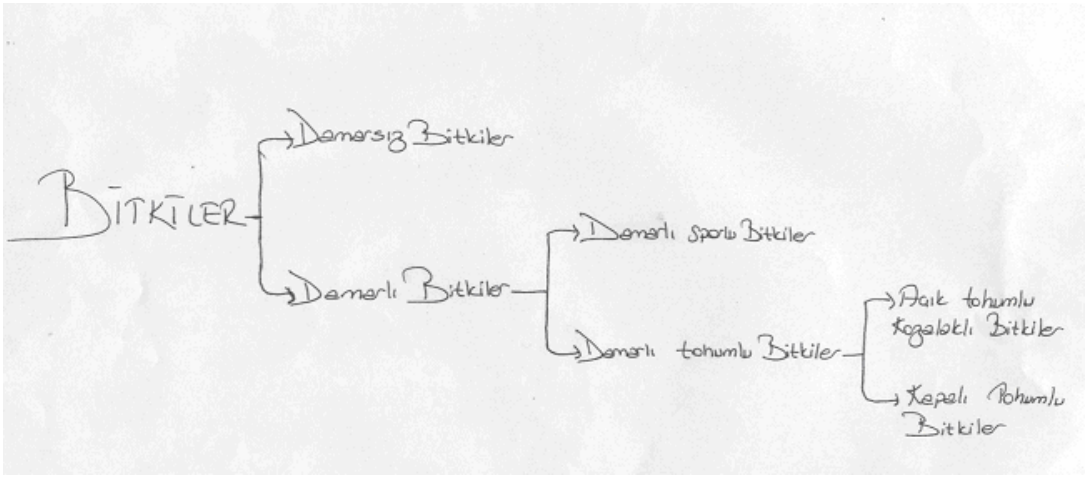
- Bu derste fark ettim ki... bitkiler de kendi aralarında sınıflara ayrılıyor
- Bu derste... bitkilerin genel özellikleri ...konusunu çok iyi anladığımı düşünüyorum.
- Bu derste... damarlı ve damarsız bitkiler ...benim için çok zor oldu.
- Bu derste... tohumlu bitkiler ...konusunu çok iyi anlayamadım. Bu konudaki eksikliklerimi... yaprakları ayırmak ...ile giderebileceğimi sanıyorum.
- Bu dersi ... — ...olsaydı daha iyi anlayabilirdim.

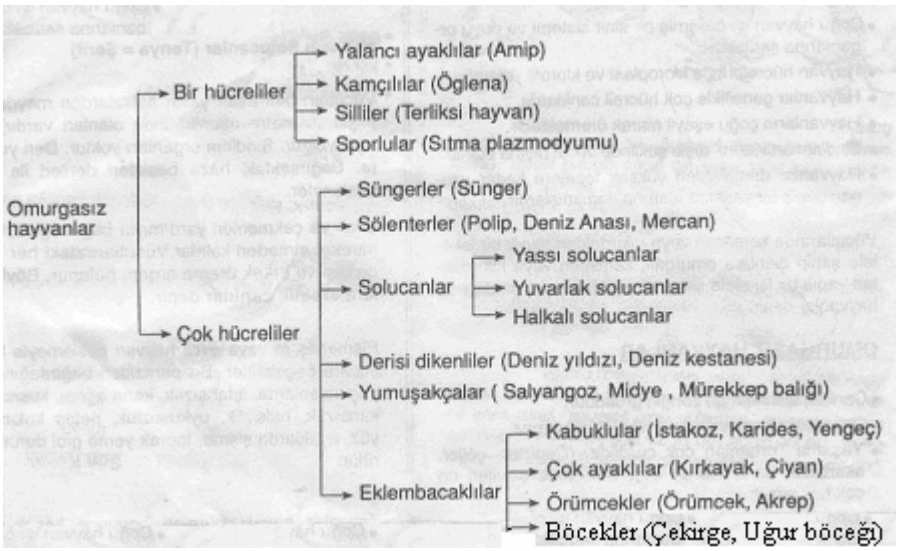
M.8 Students' studies related with Naturalist Intelligence

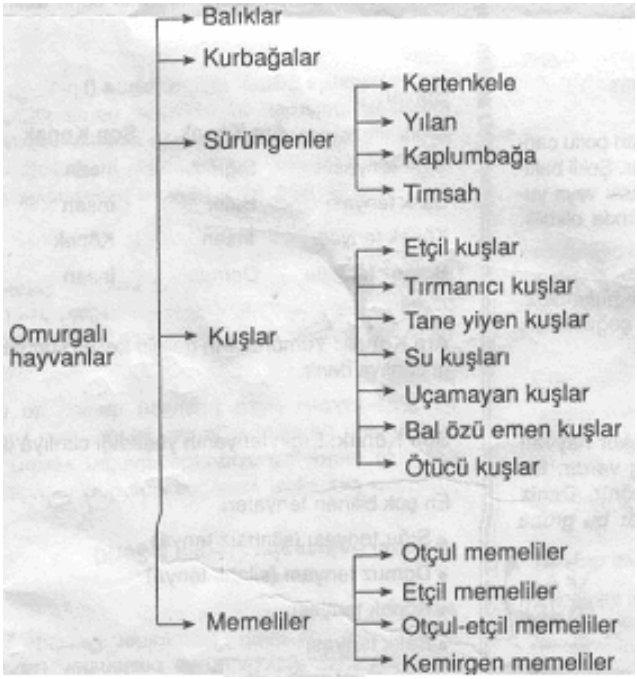
Doğa Zekası ile ilgili çalışmalar

M.8.1 Classification tables that were put in to the group files by group members

Grup üyelerince grup dosyalarına yerleştirilmiş sınıflandırma dosyaları

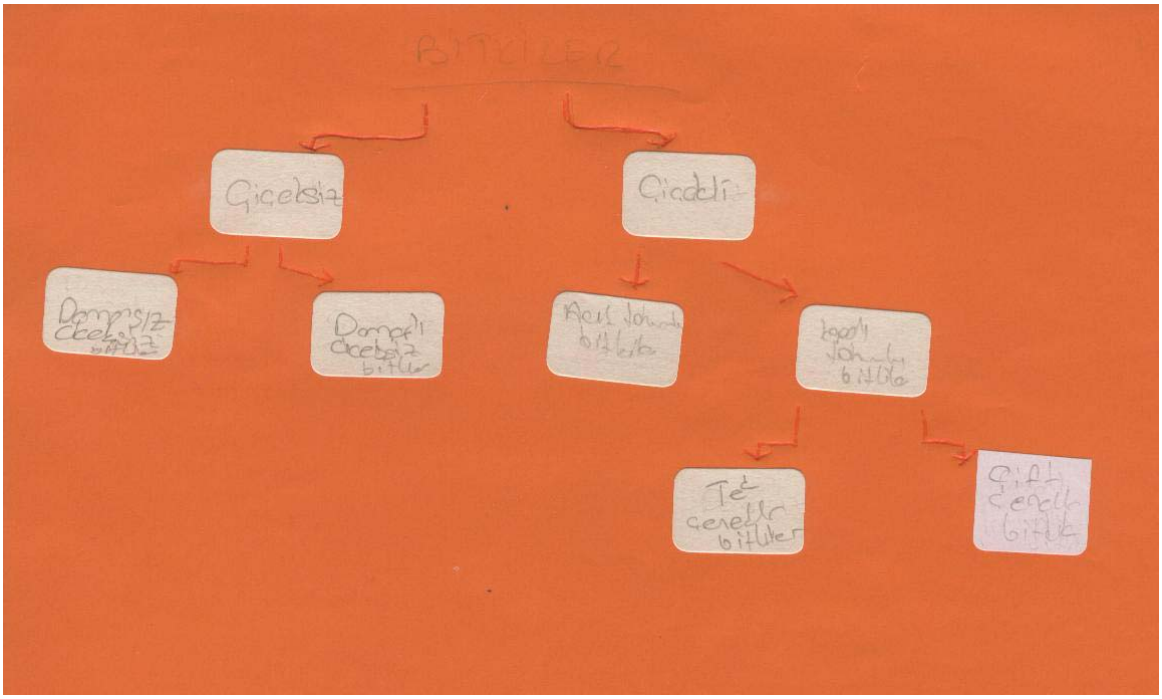






M.8.2 The classification table of the plants prepared by using stickers

Etiket kullanarak oluşturulan bitkilerin sınıflandırma tablosu



M.8.3 The Classification units table filled with the animal names by students

Öğrenciler tarafından doldurulan sınıflandırma birimleri tablosu

Sınıflandırma birimleri:

Çita (Felis cheetah)
Etçiller (Carnivora)
Kedigiller (Feliedae)
Memeliler (Mammalia)
Hayvanlar (Animalia)
Aslanlar (Felis)
Omurgalılar (Chordata)

Canlı organizmalar:

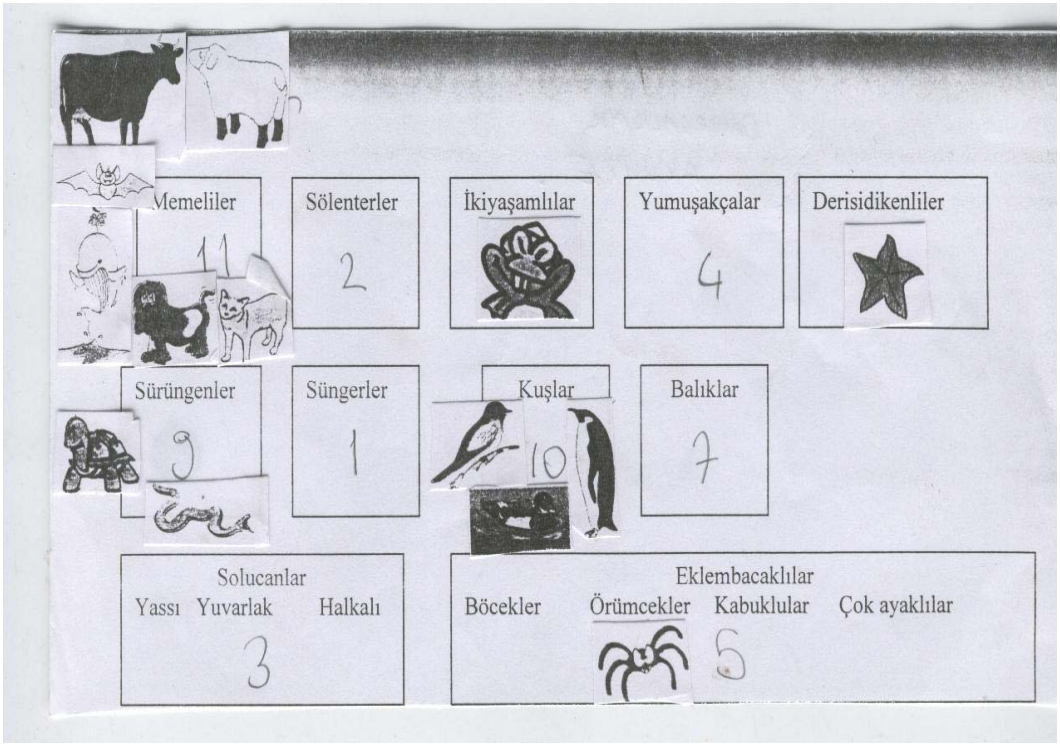
Yengeç, balina, kedi, horoz, aslan, kurt, alabalık, çita, fil, kanguru, deniz yıldızı, timsah, köpek

Açıklama: Yukarıda verilen sınıflandırma birimlerini tabloda türden aleme doğru uygun sırayla yerleştirerek her bir birime giren canlı organizmaların isimlerini yazınız.

	SINIFLANDIRMA BİRİMLERİ	CANLI ORGANİZMALAR
ALEM	Hayvanlar	Çita, aslan, kedi, köpek, kurt, kanguru, fil, balina, timsah, horoz, dobalık, yengeç, denizyıldı
ŞUBE	Omurgalılar	Çita, aslan, kedi, köpek, kurt, kanguru, fil, balina, timsah, horoz, dobalık
SINIF	Memeliler	Çita, aslan, kedi, köpek, kurt, kanguru, fil, balina
TAKIM	Etçiller	Çita, aslan, kedi, köpek, kurt, kanguru
AİLE	Kedigiller	çita, aslan, kedi
CİNS	Çita	çita, aslan
TÜR	Çita (Felis cheetah)	Çita

M.8.4 Cutting and pasting the animal pictures into the right places

Hayvan resimlerinin kesilerek uygun yerlere yapıştırılması



APPENDIX N

PICTURES OF THE TEACHER IN MULTIPLE INTELLIGENCES CLASSROOM

N.1 Teacher helping her students

Figure N.1.1 The teacher helping group members to prepare the classification posters of the plants

Figure N.1.2 The teacher helping her student to paste the animal Picture

N.2 The teacher checking the classroom activities

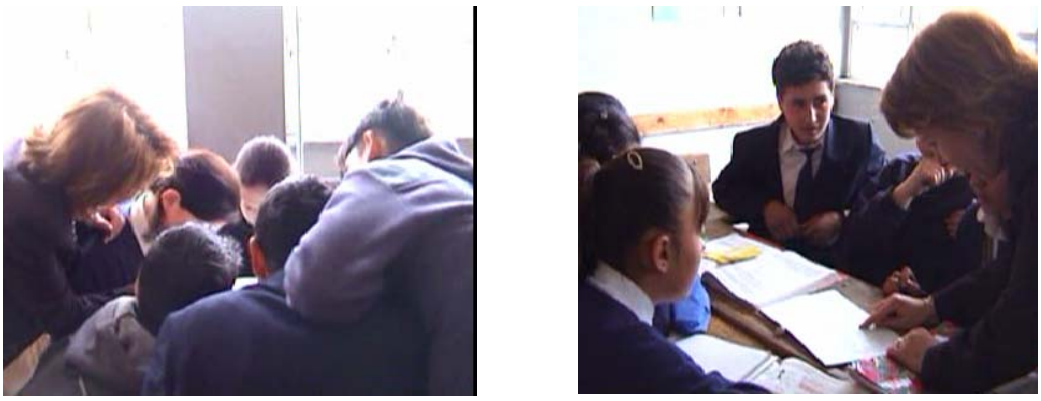


Figure N.2.1 The teacher checking the group activity related with the classification units

Figure N.2.2 The teacher checking the group activity about selecting the plants included in their groups

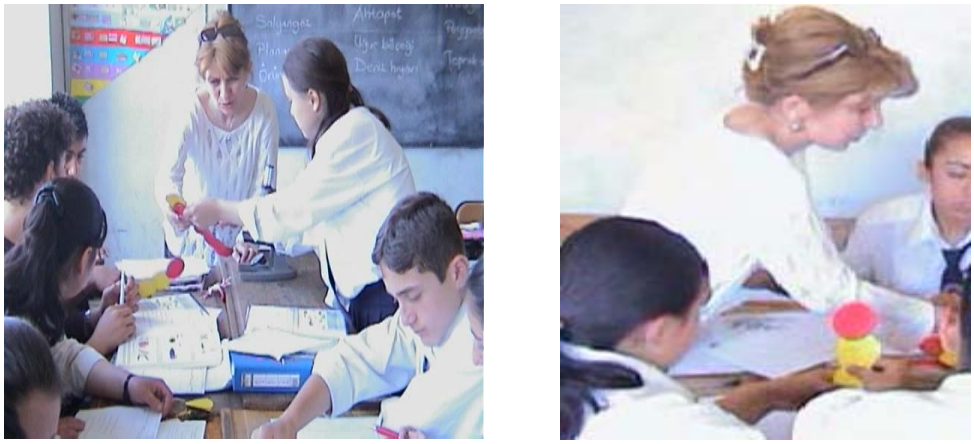


Figure N.2.3 The teacher checking the “Information chains” about the invertebrate animals

Figure N.2.4 The teacher correcting the missing point on a sample sheet made by a student

Figure N.3 The teacher guiding the students about selecting the plants included in their group.

N.4 The teacher summarizing the subjects

Figure N.4.1 The teacher summarizing the reproduction of a bacteriophage by using a sheet prepared by a student

Figure N.4.2 The teacher summarizing the structure of the viruses by using a model prepared by one of her students

Figure N.4.3 The teacher summarizing how the classification units include the others by using the venn diagrams on the black board

N.5 The teacher using the materials prepared by the students

Figure N.5.1 Spider map including the classification of the Invertebrate animal prepared by the “Invertebrate” group members

Figure N.5.2 The teacher using the classification related with the vertebrate animals prepared by the “vertebrate” group members

APPENDIX O

THE WRITINGS, SHORT STORIES ABOUT DIFFERENT TYPES OF LIVING ORGANISMS USED FOR THE POSTERS

Panoda kullanılan bazı yazılar ve hikayeler

HAYATIMIZDA YER ALAN CANLI ORGANİZMALARDAN PROTİSTALAR hakkında BUNLARI BİLİYOR MUYDUNUZ?

Kırmızı su yosunlarının hücre duvarının yapısında yer alan agarın, dondurma gibi gıda maddelerinin yoğunlaştırılmasında ve bakterilerin laboratuarda özel üreme ortamlarının hazırlanmasında kullanıldığını biliyor muydunuz?

Protistaların parazit bir türünün 1845-1847 yılları arasında İrlanda'nın patates ürününün tamamını tahrip ettiğini biliyor muydunuz?

Amipli dizanteriye tropik bölgelerde yaşayan bir amip türünün sebep olduğunu biliyor muydunuz?

Bu 3 örnekten yola çıkarak protistaların hayatımızdaki biyolojik, ekonomik önemlerini ve insan sağlığıyla ilişkilerini görmemek mümkün değil değil mi?

BAŞTANKARALAR

Sonbaharda ağaçlar yapraklarını döküp, gökyüzü dönmeye, böcekler birer birer ölmeye başladığında ve baştankara cinsi bir kuş olan parus yumurtalarını kışın soğuğuna dayanabilmek için fındık, fıstık zamanı geldiğinde de yumurtalarını tam olarak nereye hatırlamak zorundadır. Biz insanlar için bile geriye saklamak, toplama ve gömdüğünü anahtarlarımızı, gözlüğümüzü, hatırlamak gerçekten sorun olanak vermediği için olabildiğince baştankaraların beyinleride olarakta basit olmak zorundadır. beyinlerine daha fazla nöron

cüzdanımızı nereye koyduğumuzu olabilir. Gövdeleri uçmalarına küçük ve hafif olan oldukça küçük ve bunun sonucu Baştankaralar için bu sorun eklenmesiyle çözümlenmiştir. Kuşun hipokampüsü beynin hafıza depolamak ve uzamsal öğrenmeyi gerçekleştirmek de etkili olan bölümü- her ekim ayında şişer. Bir önceki yılın belleğine ait eski nöronlar ölür ve yeni nöronlar gelişir. Bu karalamalarla dolu eski bir not defterinin atılıp yeni yılın notlarını yazmak için yeni bir not defteri almaya benzer. Baştankara yeni bellekler yaratabilen tek kuş değildir.

Kanarya gibi ötücü kuşlarda tipik şarkılarının mevsime uygun son versiyonunu öğrenmek için eski nöronlarını atıp yenilerini üretirler. Baştankaralar ve ötücü kuşlar, yetişkin hayvanların yeni nöronlar üretmediği düşünülürse istisnai örneklerdir. İnsan beyni bile yeni nöronlar üretemediklerinden belleklerimizin şu anki durumlarından hoşnut olmak durumundayız.
(Veggeberg, 1999).

BİRLİK BOZULUNCA

Avcının biri kuş yakalamak için gölün kenarına ağ kurmuş. Ağın içine kuşların sevdiği yiyeceklerden koymuş. O gün hava çok güzelmiş. Ördek, kaz, kara tavuk, kuğu gibi pek çok kuş, yemlerini yemek için ağın içine girmiş. Avcı kuşları yakalamak için koşmuş. Fakat kuşlar, çok oldukları için ağla birlikte havalanmışlar. Avcı uçan kuşların peşi sıra koşmaya başlamış.

Bu sırada bir çiftçi tarlasını sürüyormuş. Avcının nefes nefese koştuğunu görünce gülmüş:

_ Havada uçan kuşlara mı yetişeceksin? Boş yere kendini yorma, demiş.

Avcı:

_Elbette yetişirim. Ağın içerisinde değişik cinsten kuşlar var. Az sonra her kuş kendi yuvasına doğru uçunca hepsi yere düşer. Ben de onları yakalarım demiş.

Gerçektende kuşlar ilk şaşkınlık ve korku ile aynı yöne doğru uçmuş, çok geçmedende kendi yuvalarına gitmek için sağa sola doğru uçmaya başlamış. Böylece birlik bozulmuş ve ağ yere düşmüş. Avcı, hepsini yakalayarak eve götürmüş.

Dr. Mehmet Hengirmen

KUŞLAR

Eskiden bu adaya, bu zamanda kuşlar uğrardı. Cıvıl cıvıl öterlerdi. Küme küme bir ağaçtan ötekine konarlardı. İki senedir gelmiyorlar.

Sonbahara doğru bir takım insanların çoluk çocuk ellerinde birbirine yapışmış acaip çomaklar vardı. Bunlarla bir yeşil meydanın kenarına varır, bunları bir ufacık ağacın altına çığırtkan kafesleriyle bırakırlar, ağacın her dalına ökseleri bağlarlardı. Hür kuşlar, kafesteki çığırtkan kuşun feryadına dostluk, arkadaşlık, yalnızlık sesine doğru bir küme gelirlerdi. Çayırlıkta bir başka ağacın gölgesinde birikmiş çoluklu çocuklu kocaman adamlar bir müddet bekleşirler sonra kuşların ötüştüğü ağaca doğru yavaş yavaş yürürlerdi. Ökselerden 4 -5 kuşun bir başka ökseye doğru şimdilik uçup giderken birer damlacık birer tabiat harikası olan kuşları toplarlardı.

Eskiden bu adaya, bu zamanda kuşlar uğrardı. Cıvıl cıvıl öterlerdi. Küme küme bir ağaçtan ötekine konarlardı. İki senedir gelmiyorlar.

Sait Faik Abasıyanık

Ben İnsan Değilim!

Biliyorum, dünyanın nimetleri sırf benim için yaratılmadı, ben üstün değilim, ben farklı değilim. Duymak istiyorsan eğer, bunu da haykırabilirim. Ben insan değilim!

Ayrılıkların hepsi acı verir. Ama en acısı vedalaşmadan yaşanan ayrılıklardır. Kahredici bir şeydir akşam eve dönüp de, onun öldüğünü başkalarından öğrenmek. İşte ben böyle ayrılıklar yaşarım her doğaya çıktığımda. Sevdiğim bir derenin vadisi baraj oluverir, nadir bir bitkinin yaşadığı yer sürülür, tarlaya dönüşür. Biraz uzak kalsam İzmir'den, beton katlar karşılar beni; Gediz'de kuş gözlediğim yerlerde. Yollar geçer bozkırların ortasından, kesilir en ermiş ormanlar. Bunların öyküsünü orada yaşayan insanlardan öğrenirim, bir de kuşların artık orada olmayışından. İşte bu öğrenme anı, mutlak ayrılık anıdır, mutlak yalnızlık anı. O an, sevdiğim birini kaybetmiş kadar derin bir acı yaşarım. Başka yerlerde doğanın yaşadığını düşünür, örtmeye çalışırım kanayan yaramı.

Hayvanat bahçeleri insanların hayvan sevgisi aşılamak için kurdukları açık hava müzeleri. Buradaki hayvanlarda insanınkine benzeyen duyguları izlemek mümkün. Örneğin, ıstırap çekmenin aynı yüz hatlarını, aynı acılı sesleri, edaları. Dönüşte etrafımı seyrederek henüz can vermemiş doğal alanlar ararım. Hastane koridorlarında dolaşmak gibi bir şeydir bu yolculuk. Sırtı jiletlenmiş bir dağ, kollarını iş makinelerine kaptırmış bir nehir, karnı yarılarak kurutulmuş bir göl görürüm. Bu hüznün dışına çıkmak, yaşama sarılmak için bir gazete alırım elime.

Gazeteler bir daha kanıtlar. İnsan: Gelmiş geçmiş en tehlikeli yaratık. Sadece doğaya değil, birbirine de acımasız. Savaş haberlerini okurum, birbirini öldürenlerin cesetlerini görürüm, yine bir din, bir dil, bir gelenek aşağılanmaktadır. Dalga geçilmektedir bir insanla, kafesteki bir maymunla, bir kuşla.

Bugün bir insan öldürülür, yarın bir türün nesli tükenir. Hepsi aynı kayıtsızlığın meyvesi aslında. Türker'in yazdığı gibi bunların hepsi birer küçük kıyamet. Belki de gerçekten kıyamet kopmakta ama kimse bunu görmüyor ya da görmek istemiyor.

Yeşil Atlas'ın yazılarını okuyorum, onlarla yaşıyorum haftalardır. Yok olan doğayla bizler arasında köprü olmaya çalışan o hayat dolu satırlar. Her yazı bir tapınak inşa ediyor önce. Tuza direnerek yaşayan cesur bitkileri, orkidelerin renklerini, kurtların arasındaki büyüleyici bağları, yunusların derin seslerini, Anadolu'da binlerce yıldır dolaşan görkemli hayatları anlatıyorlar. Belli ki yetmiyor harfler, yetmiyor sözcüklerin kısır dünyası. Anlıyorum, yer ile hayat arasında tariflere sığmayan bir aşk, hayran hayran seyredilmesi, doya doya yaşanması gereken bir çeşitlilik var.

Derken `amalar' başlıyor. Birer birer yıkılıyor tapınaklar. Bu nasıl bir kıyım, nasıl bir şuursuzluk? Postları satılan parslar, kuşaklarını DDT' ye kurban veren kelaynaklar, her yıl milyonlarcası sökülen orkideler, zehirlenen kurtlar, evsiz bırakılan denizkaplumbağaları, birer birer vurulmuş toylar. Yerde mi kalacak kanları? Dicle'nin resmini çift sayfa açmış Şükrü. İçim cız ediyor.

Bakamıyorum camdan ekrana. Bir gün gerçeği yok olur, geriye sadece bu boya izleri kalırsa diye.

Toros orkidesi (*Ophyrs lycia*) **insanın doğayı yok etmesi yüzünden nesli yok almak üzere olan canlılardan sadece biri. Dünya üzerinde 40-200**

birey kaldığı tahmin ediliyor.

Yaşamak ne kadar kutsal oysa ki. Nasıl da mükemmel şu an. Ellerimin klavye üzerinde gezindiği şu biricik anda, öylece yaşıyorum. Bir gün bir hastane köşesinde doğduğumu söylüyor annem. Bir gün bir yerlerde öleceğimi anlatıyor doğa. Çok şey yaşamış olmalıyım, her canlı gibi. Direnmiş ve çok şeyi kabullenmiş olmalıyım, her hücre gibi. Ancak kabul edemediğim, kafamın almadığı şeyler de var. Hem de çok var. Dicle'nin göz göre göre yok edilmesi, bin yıllık Gediz Deltası'nın satılması gibi. Dünyanın dört bir yanında süren toplu cinayetler gibi.

İnsanın insanı yok ettiği bir dünyada insanlığa yer yoktur. İnsanın doğa anayı yok ettiği bir dünya, dünya olmaktan çıkmıştır artık. Orası düpedüz cehennem yeridir. Öte yandan biliyorum, cenneti cehenneme çeviren insan, bunun tersini de yapabilir. Neslimiz, bu derin uykudan yavaş yavaş uyanarak cennetin kapılarını yeniden aralayabilir. Bunun gerçekleştiği o uzak günlerin birinde, o maymunla tekrar yüz yüze gelmek ve dertleşmek isterdim:

Biliyorum, korkuyorsun benden. Gözlerinden okuyorum, güvenmiyorsun bana. Adım kötüye çıkmış bir kere. Çünkü ben gelmiş geçmiş en tehlikeli canlıyım. Savaşı, hırsı, öfkeyi ve toplu kıyımı ben getirdim bu dünyaya. Fakat bir de senin pek bilmediğin yanlarım var. Doğaya âşık dolaştığım günler, söylediğim yanık ağıtlar, çizdiğim rengârenk resimler var. Karanlık suretimi atıp bir tarafa, bu en saf halimle çıksam karşına, ne düşünürsün? İnanır mısın bundan böyle tövbekâr olduğuma?

Bana yeniden güvenmen için, sırf bunun için, adımı bile değiştirebilirim. Binlerce yıllık geçmişimi fırtlatıp bir yana, türümden istifa edebilirim. İnan bana, ben artık öldüren değilim. Ben, bütün canlıları mutlak yalnızlığa sürükleyen bir serseri değilim. Kırmızı boşluğun içinde tümüyle yok olmadan, anladım yanlış yolda olduğumu. Biliyorum, dünyanın nimetleri sırf benim için yaratılmadı, ben üstün değilim, ben farklı değilim.Duymak istiyorsan eğer, bunu da haykırabilirim: BEN İNSAN DEĞİLİM!

Güven EKEN

Bu yazı http://www.yesilatlas.com/yesil_atlasta_buay/00052/ internet adresinden alınmıştır.

ANADOLU SEVDASI

Anadolu'yu orkideleri ile sevmeye başlayan bir Belçikalı ailenin hikayesi.

Onu, Hasselt Yabancı Diller Okulu'ndaki Türkçe derslerimden tanıyordum. Top sakallarının arasında daha da belirginleşen sıcak, yumuşacık bakışları, iri ve sallapati görünümünün etkisini bir anda alıp götürüyordu. Derslerime kayınbiraderi Yvon'la geliyordu. Her biri iş güç sahibi yetişkin insanlardan oluşan sınıfımda diğer öğrencilerim gibi Paul'le de kısa sürede dost olmuştuk. PTT de çalışan bir teknisyendi. Bir gün elinde sarı renkli çiçek resimleri bulunan fotokopilerle çıkageldi. Bunlar, bir Amerikan dergisinden kopyalanmıştı. Araştırma, Doğu Anadolu ve Kafkaslarda yetişen orkide türleri üzerineydi.

Paul, benden bu resimleri Karslı, Ağrı ve Iğdırlı tanıdıklarıma göstermemi ve çobanların köylülerin bu çiçeğe ne ad verdiğini öğrenmemi istiyordu.

Yıllardır tatillerde soluğu Türkiye'de aldıklarını biliyordum. Karavanla Anadolu'da dolaşmadıkları dağ, ova, kent, köy, oymak bırakmamışlardı. Ama onun orkide meraklısı olduğunu bilmiyordum. Batılıların Anadolu değerlerini aşırmayı pek sevdiklerini bildiğim için bu çiçekle neden ilgilendiğini sordum. Evinde orkide serasının olduğunu, bu yaz Doğu Anadolu'ya gideceğini, orada çiçeğin adını çobanlara söylerse, çiçeği daha kolay bulabileceğini anlattı. Sordum soruşturdum. Hiçbir vatandaşımızdan özel bir ad alamadım. Sarı çiçek işte, deyip geçtiler. Ama Paul'le dostluğumuz ilerledi. Bana orkide serasını göstermek istiyordu. Yvon'dan ve diğer ortak tanıdıklardan Paul'un evi ile ilgili özel şeyler duyduğum için ben de epeyce meraklanmıştım:

28 Numara... Burası olmalı, diyor eşim. Dik çatılı , küçük pencereli, garajlı, çevresindeki evlerden pek farkı olmayan tipik bir Flaman evi. Paul ve Gerda bizi bahçe girişinde karşılıyorlar. Küçük; ama bakımlı bahçeyi birlikte geçiyoruz. Ailenin kızları Anita ve Cristel kapıda bizi bekliyor. Anita, yakası iğne oyalı bürümcük bluz ve Adana şalvarı giymiş. Cristel'in ayağında da Bodrum sandaletleri.

- Şalvar sana çok yakışmış, diye takılıyorum.
- Çok rahat, diyor Anita.

Bizi içeriye buyur ediyorlar. Hole girer girmez ayaklarımızın altındaki alı al, moru mor yörük kilimiyle duvardaki Zakkum çiçekli Pamukkale tablosu bizi, sisli, yağmurlu Limburg ikliminden çıkarıp Anadolu'nun ışıltılı, sıcak kucağına bırakıveriyor. Salona geçince eşim şaşkınlığını gizleyemiyor:

- Aman Allah'ım! Burcu burcu Anadolu kokuyor bu ev, diye fısıldıyor kulağıma.

Görebildiğimiz kadarıyla üç bölümden oluşan salon, baştan sona Bünyan, Uşak, Yağcıbedir, Isparta, Milas halılarıyla döşenmiş. Duvarlarda Anadolu'dan esinlenerek yapılmış tablolar...

- Kusura bakmayın, heyecanlandım. Oturmadan evinizi gezmek istesem, hoş karşılar

mısınız? diye soruyor eşim, Ev sahipleri, evlerinin beğenilmesinden gururlanıyor.

Eşim, köy kızlarının sevdalarını, özlemlerini ilmik ilmik dokudukları kök boyalı kilimleri, halıları okşarken Ben usta işi olmayan; ama burum buram sevinç yansıtan tabloları inceliyorum. İnsan öğesiyle buluşturulmaya çalışılan doğa resimleri bunlar: Ağrı'dan Göreme'den, Yedi Göller'den, Tuz Gölü'nden ...Salonun köşelerine bakır, pirinç, seramik vazolar yerleştirilmiş. Paul, bakır vazoların Erzincan ve Gaziantep, seramik vazoların Kütahya işi olduğunu, Pirinç vazoyu ise Ankara'dan aldığını anlatıyor.

Salonun değişik yerlerine usta bir dekoratör eliyle yerleştirilmiş izlenimi veren orkidelerin gerçek olduklarını fark ediyorum.

- Evin bu serin kokusu orkidelerden, desenize...

- Anadolu orkideleri güzel kokar, diyor Gerda. O sırada Cristel, salonun güneye bakan duvarındaki perdeyi açıyor. Cennet gibi bir orkide serası gözler önüne seriliyor.

- Güney Amerika'dan, Afrika'dan, hatta Japonya'dan getirttiğimiz orkideler de var bu serada. Ama ben, en çok Anadolu orkidelerini severim, Toroslar'dan Kars'a, Bergama'dan Bingöl Yaylaları'na... Ellerimle topladım onları. Çobanlardan adlarını öğrendim, kokularının izlerini sürdüm onların. - Bizim Anadolu sevdamız bu orkideler sayesinde başladı, diyor Gerda. Paul'un, bir dergide Anadolu orkideleri üzerine okuduğu bir bir yazıyla başladı her şey. Bu yazı üzerine Türkiye'ye gittik. Orada hayal edemeyeceğimiz güzellikler

bulduk. Sevdik Türkiye'yi. Bu sevgiyi akrabalarımıza, dostlarımıza aşıladık. Şimdi onlar da tatillerde Türkiye'ye giderler.

- Doğru, diyerek söze giriyor Cristel. Ben şimdi uygarlık tarihi okuyorum. Bu seçimimde Anadolu Uygarlıklarının etkisi çok büyük. Ben Anadolu'da insanlık tarihini adım adım izleyebiliyorum. Tarihi yaşayarak öğreniyorum, dersem inanın.

- Denizleri, insanları... Orada her şey beni resim yapmaya itiyor. Konya Ovası'nda harman bekleyen çocuklarla yıldız saymak, Toroslar'da yörük çadırlarında uyanmak... İşte benim resmimim kaynağı, diye anlatıyor Anita.

Paul içine düştüğümüz duygusallığı dağıtmak için Gerda'ya takılıyor:

- Gerda'nın bizim peşimize takılmasının sebebi var. Çünkü o, Antep baklavasıyla Maraş dondurmasını birlikte yemeyi çok sever. Ben onun baklava yemesine karışmam, ama Maraş dondurması yemesine kızarım. Biliyorsunuz, Maraş dondurması orkide soğanlarından elde edilen saleple yapılır. Soğanı kazılan orkideler bir daha hiç yeşermezler.

- Sen de orkide nesli tükenecek diye korkarsın tabii, diyor kızlar.

- Eh, öyle, diyor Paul.

Sesinde umarsızlığın kırılganlığı. Keşke kendimizi savunabilecek bir şeylerim olsa. Onu yüreklendirecek bir şeyler söyleyebilsem. Başımızı öne eğiyoruz. Bir süre çıt çıkmıyor salonda.

Gerda :

- Anadolu bereketli, merak etmeyin hiçbir şey olmaz, diyerek ağır havayı dağıtmaya çalışırken kendi pişirdiği Türk kahvesini sunuyor. Kahvelerimizi içerken Anadolu ile ilgili çok özel anılarını paylaşıyorlar bizimle. Yurdumuzdan binlerce kilometre uzakta, bir Flaman evinde Anadolu orkidelerinin yaşaması için tek başına da olsa eylem yapan bu koca adama duğduğum saygı dakika dakika artarken içimde kendime karşı tarifsiz bir kırıklık derinleşiyor.

Hamdi Topçu

* Bu yazı, http://www.yesilatlas.com/bukalemun/00067/ internet adresinden alınmıştır.

YENGEÇ

2006 yılı baharının ilk aylarına ait iç açıcı bir günün akşamı, Karadeniz'in en büyük liman kenti Samsun'un Atakum sahillerinde, iki üniversiteli nişanlı genç el ele geziniyorlardı. Kendilerinin bile farkında olmadıkları ve muhtemelen yıllar sonra çok özleyecekleri kadar mutlu oldukları günlerden biriydi o gün. Fazla konuşmadan, gerçeklerden ayrı, temas halindeki ellerinden birbirine geçen elektriği dinlemeye odaklanmış vaziyette, yönsüz bir gezintiye çıkmışlardı. Konuştukları şeyler belki de dünyada en çok konuşulmuş konulardı. Dersler, arkadaşlarının yaptıkları, yakın çevre entrikaları, aile şikayetleri vb. Dolayısıyla konuşulanların pek de önemi yoktu. Önemli olan sadece birlikte olmaktı.

Uzunca bir süredir yürüyorlardı. Yorulduğunu farkeden ve "acaba dinlensek mi?" diye aklından geçirmeye başlayan genç erkeğin elinden tutan nişanlısı, birden kumların arasında değişik bir şey gördü. Biraz daha dikkatli bakınca, bunun irice bir yengeç olduğunu farketti. Daha önce defalarca buralarda dolaşmış ve irili ufaklı yengeçlerin ölülerinden düzinelercesinin karaya vurduğunu görmüşlerdi fakat bu yengeç hem büyüklük, hem de renk olarak biraz farklıydı sanki. Kız merakla yengece yöneldi ve bir yandan da nişanlısını hafifçe kolundan çekerek:

- "Vaay şuna baksana!"

Erkek ilgisizce döndü ve görüntüyü algıladığı anda onun da ilgisi yerde yatan bu güzel hayvana yöneldi. Sırt üstü devrilmiş ve hareketsiz yatıyordu. Bacaklarının rengi gerçekten de buradaki sıradan yengeçlerden biraz farklıydı. Ama sonuçta bir yengeçti işte. Ölmüştü anlaşılan. Genç kız alaycı bir tavırla başını eğip, eliyle yengeci işaret ederek sordu:

- "Söyle bakalım bay biyolog, bunun türü nedir?"

Erkek iki yıl önce Samsun Ondokuz Mayıs Üniversitesi Biyoloji bölümüne kaydolmuştu ve nişanlısıyla da burada tanışmıştı. Kızcağız matematik bölümünde olduğundan, böyle soruları sormasını yadırgamazdı. Hayvan türleri ve sınıflandırılmaları ile ilgili hiç bir dersleri olmadığından, bu mahlukların hepsinin isimlerinin ezbere çekilmesinin "sıradan" bir öğrenci için neredeyse imkansız olduğunu bilemezdi. Dudaklarını bükerek yanıtladı:

- "Eeee... Bu şey.. Osman!"

Kız gülerek, omzundan sertçe itekledi:

- "Osman da ben görmeyeli bayağı değişmiş!"

- "Ne bileyim türünü yaa.. yengeç işte. Hem de ölü yengeç!"

- "Ne kadar meraksızsın yaa? Ben olsam hepsini ezberlerdim!"

Çocuk "Tabii yaa.." diye geçirdi içinden. Aslında hiç de meraksız değildi. Sırf böyle hayvanları, belgeselleri sevdiği için, isteyerek biyolojiyi seçen nadir insanlardandı.

Fakat henüz her hayvan ve bitkinin isimlerini ezberleyivermek gibi bir yetenek geliştirememişti ve ders çalışması gerektiğinde bir kaola kadar tembelleşiyordu.

Eğildi ve yengeci eline aldı. Nişanlısının "Yaa hastalık falan vardır elleme yaa.." uyarılarına aldırmayarak incelemeye başladı. Ne kadar da güzeldi gerçekten. Kabuğun altına paketlenmiş o eklemli bacaklar, o kıskaç, o tuhaf gözler. Nasıl hareket ettiğini gözünde canlandırdı. Gerçekten seviyordu bu eklembacaklı taifesini. Kız arkadaşını gitmek istediğini belirten bir takım hareketlerde bulunurken, farkında olmadan elindeki yengeçle o yana seğirtti. Bu arada kızcağıza bu hayvan grubunun (yani eklembacaklıların) genel özelliklerini anlatmaya kalktıysa da, dinleyicinin çok ilgilenmediğini görünce vazgeçti.

Yürüyerek az ilerideki beton bir platforma yaklaştılar. Bu platform, yağmur sularının denize döküldüğü kanalı plajdan aşırıp denize taşıyan, bir metre yükseklikteki iki beton duvarın arasında, iskeleye benzer biçimde bir yapıdan ibaretti. Duvarın yanından geçerken genç çocuk elindeki yengeci dikkatlice betonun üstteki en uç köşesine, yine sırt üstü vaziyette yerleştirdi. Nedense o güzelim yengeci tekrar yere atmaya kıyamamıştı. Sorumluluk hissediyordu onu yerinden alıp buraya kadar taşıdığı için. İnsanların, yengeci onun bıraktığı yerde ayaklarıyla çiğnemesini istemiyordu sanki. Gerçi insanlar, özellikle akşamları bu kanalın üzerinde de geziniyorlardı ama yapacak daha iyi bir şeyi yoktu.

Nişanlısı ilgisizce bakarken, yerleştirdiği yengece daha güvenli bir konum sağlamak istercesine biraz daha içeriye iterek, son durumuna bir an baktı ve yine nişanlısının elinden tuttu. Sahilin doğusuna doğru konuşarak yürümeyi sürdürdüler.

Yaklaşık yüz elli metrelik bir yürüyüşten sonra, yengeç tamamen aklından çıkmıştı. Yeni konuları, denizanalarının neden karaya vurdukları ve neden şeffaf oldukları idi.

OLASILIK 1

Genç üniversite öğrencisinin yengeci beton platformun üzerine yerleştirdiği günün akşamüstü saatlerinde, bir anne ve küçük kızı, sahildeki beton platforma çıkmışlar ve denize doğru el ele yürüyorlardı. Daha önceleri de akşam gezintileri sırasında buraya sık sık uğradıklarından, küçük kız, denize yaklaştıkça yüksekliği artan platformun kenarına fazlaca yaklaşmaması gerektiğini öğrenmişti. Annesinin elini tutmak ona ayrı bir güven veriyordu. Yine yavaşça platformun ucuna doğru yaklaştılar. Yarım saat kadar sonra batacak olan güneşin gölgeleri uzatan son ışıkları altında, küçük kız bir şey farketti. Platformun yürüdükleri taraftaki ucunda, tam köşede bir şey vardı. Uzaktan ne olduğunu göremiyordu ama, şeklinden böceğe benzer bir şey olduğu anlaşılıyordu. Bomboş beton zemin üzerinde ilgisini çeken bu yegane nesneye dikkatle bakarak, annesiyle beraber yavaş yavaş oraya ilerlediler. uca yaklaşınca, kız bunun garip bir hayvan olduğunu gördü. Annesinin elini çekiştirip, diğer eliyle yengeci işaret ederek:

- "Anne bak, o ne?" diye sordu.

O tarafa bakan annesi, platformun hemen köşesinde sırt üstü yatan ölü yengeci gördü. Hala elinden tuttuğu kızının yanına çömeldi:

- "O bir yengeç, kızım. Denizde yaşayan bir hayvan. Ama galiba ölmüş..."

Kızın ilgisi daha da arttı. Denizde yaşayan böyle bir yaratığın nasıl olup da platforma tırmandığını ve niye öldüğünü anlamaya çalışıyordu. Belki de çok yorulmuştu. Sonra birden aklına geldi:

- "Isırır di mi anne?"

Annesi gülümsedi. Yavaşça o tarafa uzanarak yengeci eline aldı ve kızına doğru yaklaştırdı.

- "Hayır güzelim, ısırmaz. Hem bak zaten ölmüş. Ama ölü olmasa da ısırmazdı. Unutma, sen hayvanları rahatsız etmezsen, onlar da sana bir şey yapmaz. Hem bak o sana göre ne kadar da küçücük değil mi?" Son cümlesini söylerken sesi acıklı bir hal almıştı ve avucundaki yengeci de elinde hafifçe tartar gibi bir aşağı bir yukarı oynatıyordu.

Kız şimdi büyümüş gözlerle, gözlerinden 20 santimetre uzaklıktaki bu büyüleyici hayvana bakıyordu. Dokunmak için elini uzatırken, bir an soru dolu bakışlarını annesine çevirdi. Gülümsemeyi ve onaylar bakışları görünce yavaşça dokundu. "Ne kadar sert" diye geçirdi içinden. Bu arada annesi, dokunduğu yerlerini anlatıyordu:

- "Bak bunlar bacakları. Kaç tane var? Sekiz değil mi? Burası ise kıskaçları. Bunlarla yemeklerini yakalayıp yiyor. Biz nasıl ellerimizi kullanıyoruz, aynen öyle..."

Annesinin ses tonu, onun hayvana olan ilgisini daha da artırdı. Sorduğu birkaç sorudan sonra, yengeci annesinin ellerinden almış, kendi kendine oynamaya başlamıştı bile. Artık etraftan tamamen kopmuş, sadece bu küçük hayvanla ilgileniyordu. Sırtını çevirip o sert kabuğunu okşadı, üzerindeki renklere dikkatlice baktı, ayaklarını parmaklarıyla itekleyerek oynattı. Çok sevmişti bu yaratığı.

- "Anne, eve götürebilir miyim onu?"

Annesi bir an düşündü. Sonra kızına dönerek;

- "Evet ama böyle sürekli elinde oynayamazsın. Onu bir güzel güneşe koyar, kuruturuz ve ondan sonra odandaki kitaplığın üzerine koyarız tamam mı? Ama sonra eline almak yok, çünkü kırılıp darmadağın olur."

Kızın küçük yüzü, geniş bir gülümsemeyle bir anda aydınlandı. Az sonra yengeçler ve benzer hayvanlar hakkında konuşarak eve doğru ilerliyorlardı.

Küçük kız bir yıl boyunca bu yengeci odasında sakladı. Annesi görmeden gizlice her yerini inceledi. Bir çok resmini çizdi. Zarar vermemek için çok büyük özen gösterdiyse de, iki ay kadar sonra arka bacaklarından biri düşmüş, o da zamkla

yerine yapıştırmıştı. Bu arada başka yengeçlerin yanında böceklerle de ilgilenmeye başladı. O günden sonra, bacakları eklemli olan tüm canlılar onun ilgi alanına girmeye başlamıştı. Artık o bir eklembacaklı aşığıydı.

Yengecinin arka bacağının kopmasının üzerinden geçen 35 yılda, lisenin ardından başladığı tıp eğitimini yarım bırakarak, her zaman ilgisini çeken hayvanlar alemine yönelmek üzere Biyoloji öğrenimine başlamış, diplomasını aldıktan sonra üstün gayretlerini paylaşan bir hocanın yanında asistan olarak üniversiteye girmiş, yıllar sonra değişik uluslararası projelere katılarak, deniz eklembacaklıları konusunda saygın bir bilimci olup çıkmıştı. Kendisine verilen akademik payelerin bir çoğunun farkına varmayacak denli yoğun bir çalışma temposu ile geçen bilimsel kariyerinin doruk noktasına, Güney Amerika'ya özel bir yengeç türünün davranışları ve hormonları üzerinde yaptığı çalışmalarla ulaşmıştı. Bu çalışmayı bu kadar önemli kılan esas unsur, çiftleşme döneminde bu yengeçlerin dişilerinin salgıladıkları bir maddenin sentetik olarak elde edilebilmesine yol açan moleküler alandaki girişimleriydi.

Bu madde, bulunmasından 10 yıl kadar sonra, bir başka bilimci grubu tarafından kanser deneylerinde kullanılmaya başlandı ve oldukça şaşırtıcı sonuçlar elde edildi. Yirmi yıl kadar sonra ise, artık birçok kanser türünün tedavisi için vazgeçilmez bir ilaç olarak, tüm dünyada büyük bir taleple tüketilmeye başlanmıştı. Kanserden ölüm oranları, gazetelerin birinci sayfa manşetlerine taşınacak kadar düşmüştü. Artık insanlığın elinde, bu amansız hastalığa karşı çok önemli bir silah vardı ve özellikle muzdarip hastalar, kendilerinde mucizevi iyileşme yaratan bu ilacın bulunmasına katkıda bulunan "herkese" dua ediyorlardı. Hem de büyük bir içtenlikle...

Bir zamanlar o yengeci duvarın üzerine bırakan genç üniversite öğrencisi ise, yıllar sonra, çalıştığı işten emekli olmuş ve bir sabah, gazetesinin başlığında gördüğü kanserle ilgili bir habere şöyle bir göz gezdirmekle yetinmişti. Kansere karşı çok etkili bir ilaç bulunduğunu ve bu ilacın da bir yengeçten elde edildiği yazıyordu gazetede.

"Yengeç ha!" diye düşündü...

İlginçti gerçekten.

OLASILIK 2

Genç üniversite öğrencisinin yengeci beton platformun üzerine yerleştirdiği günün akşamüstü saatlerinde, bir anne ve küçük kızı, sahildeki beton platforma çıkmışlar ve denize doğru el ele yürüyorlardı. Daha önceleri de akşam gezintileri sırasında buraya sık sık uğradıklarından, küçük kız, denize yaklaştıkça yüksekliği artan platformun kenarına fazlaca yaklaşmaması gerektiğini öğrenmişti. Annesinin elini tutmak ona ayrı bir güven veriyordu. Yine yavaşça platformun ucuna doğru yaklaştılar. Yarım saat kadar sonra batacak olan güneşin gölgeleri uzatan son ışıkları altında, küçük kız bir şey farketti. Platformun yürüdükleri taraftaki ucunda, tam köşede bir şey vardı. Uzaktan ne olduğunu göremiyordu ama, şeklinden böceğe

benzer bir şey olduğu anlaşılıyordu. Bomboş beton zemin üzerinde ilgisini çeken bu yegane nesneye dikkatle bakarak, annesiyle beraber yavaş yavaş oraya ilerlediler. Bu garip nesneye iyice yaklaştığında, kız bunun garip bir hayvan olduğunu gördü. Artık ayağının hemen ucundaydı. O sırada sahilde koşan bir atı ve binicisini ilgiyle seyretmekte olan annesinin elini çekiştirip, diğer eliyle yengeci işaret ederek:

- "Anne bak, o ne?" diye sordu.

O tarafa bakan annesi, kısa bir duraklamanın hemen ardında hafif bir çığlık atıp kızını aceleyle diğer yana çekiştirerek:

- "Aman dur, elleme! yengeç o. Isırır falan şimdi..."

Kız uzaklaşmak istemiyor, annesinin korktuğu bu tuhaf yaratığa daha yakından bakmak istiyordu.

- "Ama anne ölü galiba, bak hiç kıpırdamıyor. Bi bakiim noolur.."

Annesi onu kendisince güvenli bir uzaklığa çektikten sonra yanına çömelerek sert bir ses tonuyla:

- "Olmaz!" dedi. "parmağını bir koparırsa görürsün o zaman!"

Kız şaşırdı. Gözlerini kırpıştırarak;

- "Gerçekten koparır mı?"

- "Tabii. Selime Teyze'ni hatırlıyor musun? Hani şu eski evdeki?". Kız, kuşkulu ve meraklı bakışlarla "evet" anlamında başını salladı. "İşte onun kızının iki parmağını da yengeçler yemiş."

Anlattığı şeyin yalan olduğunu kendi de biliyordu. Bahsettiği kızın parmaklarının üzerine beton bir logar kapağı devrilmişti küçükken. Ama uydurduğu bu hikaye, muhtemelen pis ve mikroplu olan bu yengeç ölüsünden kızını uzak tutabilirdi. Bu ve buna benzer tüm hayvan leşlerinden belki de.

Küçük kız Selime Teyze'nin kızının parmaklarını düşündü. Elindeki parmaklardan ikisinin uçları yoktu. Gerçekten her gördüğünde içi bir tuhaf olurdu. Sonra yengece baktı. Kocaman kıskaçlarını o zaman farketti. Annesi ne kadar da haklıydı. Zaten o korktuğuna göre bildiği bir şey olmalıydı. Ne de olsa anneydi o.

Yıllar geçtikce, annesinin eklembacaklı korkusu ona da bulaştı. Gerçi annesi her hayvandan korkuyordu ama, bu böceksi yaratıklardan ödü kopuyordu. Küçük kız da yetiştiği ortam gereği, bunları tehlikeli şeyler olduğunu öğrenmişti. Zaten beton binalarda yaşıyorlardı ve yengeçler onlara ulaşamazlardı. Ama deniz kenarında veya ormanda dikkatli olmalıydı. Her an bir böcek veya benzeri yaratık bir yerlerden çıkarak kendisine zarar verebilirdi. 8 yaşındayken, odasında gördüğü hamamböceği yüzünden bir hafta odasına girememiş, annesi ve babasıyla beraber yatmıştı.

Annesinin, hamamböceğinin bir şey yapmayacağına ilişkin telkinleri de işe yaramamış, hatta annesinin kendisini kandırmaya çalıştığını düşünmesine sebep olarak, ona olan güveninin sarsılmasına bile neden olmuştu.

Yıllar sonra küçük kız büyümüş ve evlenmişti. İlk çocuğuna altı aylık hamile iken, kocası ve kayınvalidesi ile bir Karadeniz turuna çıktılar. Samsun'dan başladıkları gezide ilk molalarını Ünye'de verdiler. Buradaki bir çay bahçesinde bir şeyler atıştırdıktan sonra, sahil boyunca kısa bir yürüyüşe çıktılar. Yürüdükleri kordon yolu ile deniz arasında, iri kayalardan oluşan bir dolgu bölgesi vardı. Biraz yürüdükten sonra, denize daha yakından bakabilmek için kayaların üzerinde yürümeye başladılar. Oldukça neşeliydiler. Bir ara, deniz yüzeyine yakın kayalardan birinin üzerine çıkmaya çalışan genç kadın, eli ile yandaki kayadan destek almaya çalıştı. Fakat tam o sırada elinin altında kımıldayan bir şey hissetti. Hafifçe dönüp baktığında elinin irice bir yengecin üzerinde olduğunu gördü ve tamamen refleks bir hareketle, çığlık atarak kendisini geriye, denize doğru attı. Bu hareketi sonucunda dengesini kaybederek, arkasındaki kayaların üzerine sertçe yuvarlandı. Çok kötü düşmüş ve iki kayanın arasına sıkışan boyun omurlarından ikisi kırılmıştı.

Hemen hastaneye kaldırılan genç anne adayı, solunumu durmuş bir şekilde yoğun bakıma alındı ve suni solunumla yaşatılmaya başlandı. Yapılan kontroller sonucu bebeğin yaşadığı ve sağlıklı olduğu anlaşıldı. Anne, uzun sayılabilecek bir süre solunumsuz kalmış olmasına rağmen, bebek halen hayattaydı. Anneyi yirmi gün kadar solunum cihazına bağlı olarak bitkisel hayatta tutmayı başardılar. Fakat bu süre sonunda beyin ölümü gerçekleştiği için, aileden alınan izin doğrultusunda bebeği sezaryen ile alıp, anneyi yoğun bakımdan çıkardılar. Genç kadın çoktan ölmüş olsa da, zayıf fakat sağlıklı bir erkek çocuğu olmuştu.

Aradan geçen yıllar, bu bebeğin genç bir delikanlı oluşuna kadar fazla sorunlu değildi. Küçüklüğünde aşırı aktiflik bulguları gösteren çocuk, büyüdükçe psikolojik anormallikler göstermeye başladı. Babasının arkadaşı olan bir doktor, doğmadan hemen önceki o tatsız olayların çocuğun anne karnındaki beyin gelişimini etkileyebileceğini ve buna bağlı olarak bu tip anormalliklerin ortaya çıkabileceğini düşünüyordu. Babasına, çocuğun gözetim altında tutulmasını önerdi; çünkü saldırgan bir kişilik sahibi olmaya başlamıştı. Babası ise kendisinin göz-kulak olabileceğini söyleyerek bu teklifi geri çevirdi.

Bir yıl kadar sonra bir gün bu genç, arkadaşlarıyla parkta şamatalı bir eğlenceye dalmışken, yaşlı bir adamın yaptıkları gürültüyü kesmelerini söylemesine çok sinirlendi. Bu aksi ihtiyara iyi bir ders vermesi gerektiği fikri hemen o anda, zaten yanlış çalışmakta olan beyin devrelerinde dolaşmaya başladı. Bu düşüncesinin her türlü engeli yıkarak tüm benliğine hakim olması için fazla bir çaba harcamasına gerek de yoktu. Biraz sonra yaşlı adamın kalktığını gördü ve arkadaşlarından bir bahane ile ayrılarak adamı takip etmeye başladı. Nihayet, uzun bir takip sonucu tenha bir köşede adamın önünü keserek, cebinde taşıdığı çakıyı çıkarıp, yaşlı adama defalarca sapladı. Kendini tam anlamıyla kaybetmişti. Adamın çığlıkları ve çevreden gelen bağrışmalar üzerine kendine geldi ve kaçarak olay yerinden uzaklaştı.

Adam hastaneye kaldırıldığında, özellikle kasığındaki yaradan çok şiddetli kanaması vardı. Yoğun bakıma alındığında artık bilincini kaybetmeye başlıyordu. Neredeyse

yetmiş yıllık yaşantısı adeta bir film gibi gözlerinin önünde tekrarlanıyordu şimdi. Parça parça ve kronolojik sıra gözetmeyen sahnelerdi bunlar. Doğumu, ilkokulu, burnunu kırdığı gün... Geri dönülmez noktadaydı. Ölüyordu; bunu anlamıştı. Kendini bıraktı. "Anıların keyfini çıkarayım" diye düşündü yarım-yamalak bir bilinçlilikle. Bir an gözlerinin önüne, gençliğinde, o zamanki kız arkadaşıyla Samsun sahillerinde yaptığı gezintiler ve onlardan birinde bulduğu o iri yengeç de geldi. Yengeci alıp yüksek bir yere koymuştu galiba. Neden bunu hatırladığını bilemedi, hatta bu anıya dikkat bile edemedi ama ölmeden önce gördüğü son vizyon da bu oldu.

OLASILIK 3

Genç adamın yengeci platformun üzerine bırakmasından sonraki bir kaç saatin ardından gece yavaşça kentin üstüne çöktü. Önce aileler çıktılar kordon boyunda ve sahilde dolaşmaya. Ardından gece ilerledi. Aileler evlerine dönerken, gençler sahili doldurmaya başladı. Eğlence onlar için yeni başlıyordu. Herkes kendi canibince takılıyordu; kimi gitar çalıp şarkı söylüyor, kimi muhabbet ediyordu güle oynaya.

Bu son durumda olan gençlerden ikisi, geceyarısını geçkin bir saatte platforma çıktılar. Ellerinde bir alış veriş poşeti olduğu halde beton yapının ucuna kadar yürüdüler. En uca gelince de ayaklarını sarkıtarak platformun kenarına oturdular. Torbayı taşıyan ve diğerinden biraz daha topluca olan çocuk, naylon poşeti açarak, kendisi gibi lise ikinci sınıfta okuyan, uzun bir süredir beraber takıldıkları ve kendisi gibi "metalci" olan arkadaşına kolasını uzattı. Çerez ve cipslerini de torbadan çıkartarak aralarına koydu. Sonra da kendi kolasını aldı.

Kutu kolasını gürültülü bir "pıssst" sesiyle açarak sol yanına betonun üzerine koydu. Fakat bıraktığı anda kola kutusu birden devrilmeye başladı. Dükülmeden son anda tutabildi. Kutunun dengesini bozan bir şey vardı hemen yanında. baktı: Ölü bir yengeç.

- "İğğk!" diyerek kola kutusunun gerisiyle yengeci platfromdan aşağıya itti ve kola kutusunu artık dengede durabileceği bir şekilde güvenle beton zemine koydu.

Yengeç ise suya düşerek dalgalara karıştı. Geldiği denizlere sessizce geri dönüyordu.

OLASILIK 4

Üniversiteli gencin sahilde bulduğu yengeci beton platformun üzerine yerleştirip uzaklaşmasından aylar sonra **siz**ler, sınıf panonuzda "*Yengeç*" adlı bir hikaye okudunuz.

Kiminize garip geldi, kiminize saçma, kiminize ise şaşırtıcı. Fakat hiç biriniz hikayeyi okuduktan sonra aynı kalmadınız. Geleceğinizde bir şeyler muhakkak değişti.

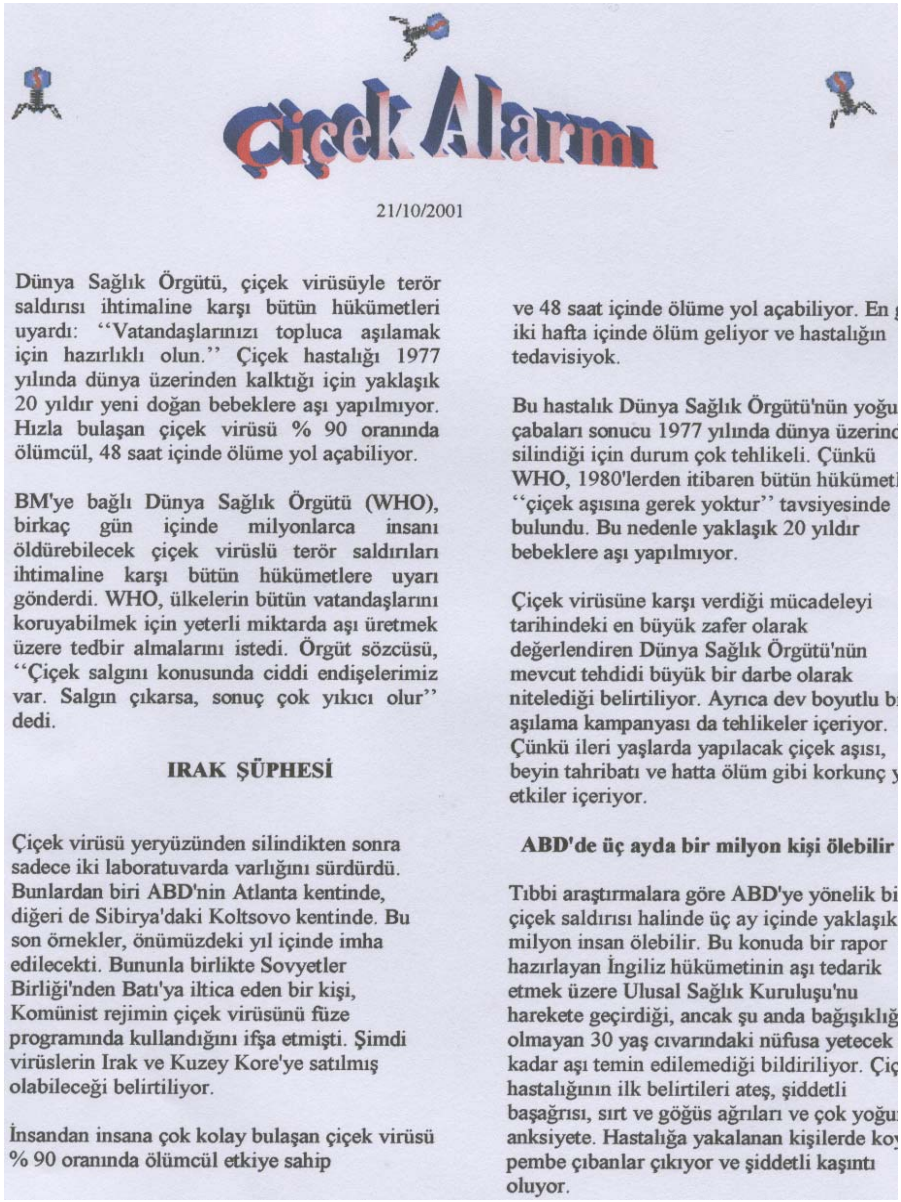
Kimbilir şimdi başınıza neler gelecek?

Bundan böyle, umarım, sebeplerini iyi bildiğinizi düşündüğünüz olaylarda, zararsız gibi görünse de tüm hareketlerinizde, geleceğinizi planlarken ve yeni kararlar verirken, bu küçük yengeci aklınızın bir köşesinde tutarsınız. Sinan Canan

APPENDIX P

NEWS COLLECTED FROM HURRIYET NEWSPAPER BY THE RESEARCHER FOR THE "NEWS" POSTER

Araştırmacı tarafından Hürriyet gazetesinden toplanan gazete yazıları



Çiçek Alarmı

21/10/2001

Dünya Sağlık Örgütü, çiçek virüsüyle terör saldırısı ihtimaline karşı bütün hükümetleri uyardı: ''Vatandaşlarınızı topluca aşılamak için hazırlıklı olun.'' Çiçek hastalığı 1977 yılında dünya üzerinden kalktığı için yaklaşık 20 yıldır yeni doğan bebeklere aşı yapılmıyor. Hızla bulaşan çiçek virüsü % 90 oranında ölümcül, 48 saat içinde ölüme yol açabiliyor.

BM'ye bağlı Dünya Sağlık Örgütü (WHO), birkaç gün içinde milyonlarca insanı öldürebilecek çiçek virüslü terör saldırıları ihtimaline karşı bütün hükümetlere uyarı gönderdi. WHO, ülkelerin bütün vatandaşlarını koruyabilmek için yeterli miktarda aşı üretmek üzere tedbir almalarını istedi. Örgüt sözcüsü, ''Çiçek salgını konusunda ciddi endişelerimiz var. Salgın çıkarsa, sonuç çok yıkıcı olur'' dedi.

IRAK ŞÜPHESİ

Çiçek virüsü yeryüzünden silindikten sonra sadece iki laboratuvarda varlığını sürdürdü. Bunlardan biri ABD'nin Atlanta kentinde, diğeri de Sibirya'daki Koltsovo kentinde. Bu son örnekler, önümüzdeki yıl içinde imha edilecekti. Bununla birlikte Sovyetler Birliği'nden Batı'ya iltica eden bir kişi, Komünist rejimin çiçek virüsünü füze programında kullandığını ifşa etmişti. Şimdi virüslerin Irak ve Kuzey Kore'ye satılmış olabileceği belirtiliyor.

İnsandan insana çok kolay bulaşan çiçek virüsü % 90 oranında ölümcül etkiye sahip ve 48 saat içinde ölüme yol açabiliyor. En
iki hafta içinde ölüm geliyor ve hastalığın tedavisiyok.

Bu hastalık Dünya Sağlık Örgütü'nün yoğu
çabaları sonucu 1977 yılında dünya üzerinc
silindiği için durum çok tehlikeli. Çünkü WHO, 1980'lerden itibaren bütün hükümetl
''çiçek aşısına gerek yoktur'' tavsiyesinde bulundu. Bu nedenle yaklaşık 20 yıldır bebeklere aşı yapılmıyor.

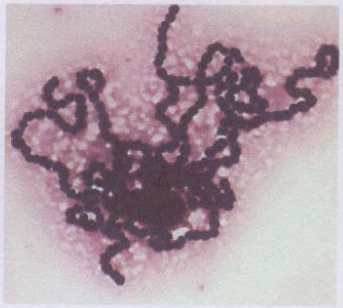
Çiçek virüsüne karşı verdiği mücadeleyi tarihindeki en büyük zafer olarak değerlendiren Dünya Sağlık Örgütü'nün mevcut tehdidi büyük bir darbe olarak nitelediği belirtiliyor. Ayrıca dev boyutlu b
aşılama kampanyası da tehlikeler içeriyor. Çünkü ileri yaşlarda yapılacak çiçek aşısı, beyin tahribatı ve hatta ölüm gibi korkunç y
etkiler içeriyor.

ABD'de üç ayda bir milyon kişi ölebilir

Tıbbi araştırmalara göre ABD'ye yönelik bi
çiçek saldırısı halinde üç ay içinde yaklaşık
milyon insan ölebilir. Bu konuda bir rapor hazırlayan İngiliz hükümetinin aşı tedarik etmek üzere Ulusal Sağlık Kuruluşu'nu harekete geçirdiği, ancak şu anda bağışıklığ
olmayan 30 yaş cıvarındaki nüfusa yetecek kadar aşı temin edilemediği bildiriliyor. Çiç
hastalığının ilk belirtileri ateş, şiddetli başağrısı, sırt ve göğüs ağrıları ve çok yoğu
anksiyete. Hastalığa yakalanan kişilerde ko
pembe çıbanlar çıkıyor ve şiddetli kaşıntı oluyor.

Diş fırçası tarih oluyor

12/02/2000,



BİLİM adamları, diş çürümesine neden olan laktik asiti üreten geni devre dışı bırakmayı başardı. ABD'de yayımlanan ''Infection and Immunity'' dergisinde yer alan habere göre, bilim adamlarının bulduğu gen, Streptococcus Mutans bakterisinin kökünde yer alıyor ve diş çürümesine neden olan laktik asiti üretiyor. Streptococcus Mutans, tükürükte bulunan bir bakteri. Bu bakteride bulunan gen, alınan besinlerin şekerini ayrıştırarak laktik asit oluşturuyor. Laktik asit ise diş minelerine zarar vererek, çürüklere neden oluyor.

Florida Üniversitesi'nde görevli Diş Doktoru Prof. Jeffery Hillman, laktik asit üretimine neden olan geni saf dışı etmeyi başardıklarını söyledi. Hillman, yapılan deneylerde, farelere şekerli yiyecekler verdiklerini, buna rağmen değişime uğratılmış bakteri kökünün, farelerin dişlerine zarar vermediğini açıkladı. Bakteri kökünün genetik olarak sağlam olduğunu kaydeden Hillman, yöntemin insanlarda da başarılı olacağını düşündüğünü belirtti. Hillman, bu sayede gelecekte hazırlanabilecek bakteri çözeltisinin, tek uygulamayla dişleri ömür boyu çürüklerden koruyacabileceğini söyledi.

Dünyanın en büyük bakterisi

Afrika'da Namibya açıklarında, denizin dibinde gözle görülebilen büyük bir bakteri bulundu. Science dergisinde yayınlanan, Amerikan, Alman ve İspanyol araştırmacıların raporuna göre, şimdiye kadar bilinenlerden yüz kat daha büyük olan dev bakteriler, inci şeklinde ve sülfür yiyorlar. Bakteriye ''Thiomargarita Namibiensis'' adı verildi. Azot ve bir kükürt bileşiği içinde yaşayan bakteriler, çürük yumurta kokusunda ve çürük deniz yosunlarıyla planktonlar tarafından üretiliyor. Raporda, bakterilerin bulundukları yerde, nitrata dönüştürebilecekleri maddeleri bulana kadar kımıldamadan aylarca bekleyebildiklerine de dikkat çekiliyor. Bakteriyi keşfeden bilim adamı Heide Schultz, denizden motora çıkardığı bakteriler üzerinde yaptığı araştırmadan sonra, dev bakterileri, ''sülfür yiyen bakteriler'' olarak tanımladı. Yeni bulunan bakterilerin büyüklüğünü, bir mavi balina ve yeni doğmuş bir fare yavrusu oranında düşünmek gerektiğine değinen bilim adamı, yeni bulunan bakterinin 3-4 mm. olduğunu belirtti.

İşte Mayın Yiyen Bakteri

12/01/2000

Amerikalı mikrobiyologlar, kara mayınlarını bulup karanlıkta ışık saçarak yerini gösteren ve imha eden bakteri üretmeyi başardılar.

Robert Burlage ve Martin Hunt adlı iki ABD'li bilim adamının ürettiği bakteriler, mayın tarlaları üzerine havadan helikopterle serpiştirilerek imha operasyonunu gerçekleştirecekler. Birkaç yüz hektarlık bir alan bir gece içinde mayından temizlenebilecek. Böylece bu büyük buluş sayesinde dünyanın dört bir yanındaki yaklaşık 120 milyon mayının hızlı, ucuz ve tehlikesiz bir şekilde imha edilmesi mümkün olabilecek.

Denizanası geni aşıladılar

Der Spiegel Dergisi'nin haberine göre bilim adamları mayınlardan toprağa sızan TNT'nin belirli türde mikropları beslediğini tespit ettiler. TNT yiyen ''Pseudomonas putida'' adlı mikrobu kobay olarak kullanan iki bilim adamı bu bakteriye fosforlu bir denizanası türünden gen nakli yaptılar. Yapılan deneyde, TNT'yi bulup yemeye başlayan bakteride denizanası geninin aktif hale geldiği ve bakterilerin üşüştüğü mayınlı bölgenin aydınlandığı görüldü.

Fosforlu bakteriler

Bakteri atılan bölgenin mayınlı olup olmadığı ancak karanlıkta anlaşılıyor. Lazer veya UV ışınıyla aydınlatılan alanda mayın varsa, bakterilerin TNT bulduğu bölgeler parlamaya başlıyor. Güney Carolina'daki Edgefield test alanında yapılan deney başarıyla sonuçlandı. Deneyden üç ay önce 10 cm derinliğe gizlenen kara mayını on milyar bakteri tarafından etkisiz hale getirildi. Dünyada kara mayınlarının en yoğun bulunduğu ülkeler Afganistan, Kamboçya, Kolombiya ve Kosova. Her ay yaklaşık 2000 kişi mayınlar yüzünden ölüyor ya da sakat kalıyor.

Ayda 2000 kurban

Dünyada kara mayınlarının en yoğun bulunduğu ülkeler Afganistan, Kamboçya, Kolombiya ve Kosova. Her ay yaklaşık 2000 çocuk ve kadın mayınlar yüzünden ölüyor ya da sakat kalıyor.

Işıl ışıl parlıyorlar

Test alanında, bakterilerin bulduğu mayınlar işte böyle ışıl ışıl parlayarak ortaya çıkıyor. Mayınların temizlenmesinde hâlâ özel yetiştirilmiş köpeklerden veya metal detektörlerinden yararlanılıyor. Ancak bu tür arama çalışmaları çok uzun sürüyor ve pahalıya patlıyor.

İşkembe gazından Mars'a atmosfer

27 Eylül 1999, Pazartesi

Sera etkisine neden olan sığırların ürettiği gazlar, Mars'ı gelecekte yaşanabilir bir gezegene dönüştürebilir. Amerikalı bilimadamı Tim Kral'a göre oksijene ihtiyaç duymadan sığırların işkembesinde yaşayan ve metan gazı üreten bakteriler sayesinde Mars'ta bir atmosfer oluşturulabilecek.

ÇEVRE kirliliği ve doğal afetler yüzünden dünyada yaşam giderek zorlaşırken, bilimadamları Mars'ta koloni kurmanın yolunu arıyor. Amerikalı uzmanlara göre, sığırların işkembesinde yaşayan ve metan gazı üretiminde etkili olan bir bakteri sayesinde hava sıcaklığının -60 dereceyi bulduğu Mars, gelecekte yaşanabilir bir gezegene dönüştürülebilir.

Arkansas Üniversitesi biyoloji profesörü **Tim Kral**'a göre sığırların işkembesinde ve bataklıkların metrelerce derinlerinde oksijen sevmeyen bir bakteri yaşıyor. Bu bakteri, sera etkisi yaratan metan gazının açığa çıkmasını sağlıyor. Bilimadamları, dünyayı güneşin kötü etkilerinden koruyan atmosferin gelişiminde bu bakterinin önemli rol oynamış olabileceğine inanıyor.

Uzmanlar, şimdi bu organizmanın tıpkı dünyada olduğu gibi kızıl gezegeni radyasyondan koruyan bir kalkan yaratabileceğini söylüyor. Prof **Kral** ve ekibi bu teorilerini Johnson Uzay Merkezi bilimadamlarıyla birlikte laboratuvarda test ediyorlar. Bilimadamları bunun için Hawai'de elde edilen volkanik küllerle deney tüpünde Mars gezegenini andıran bir doğal ortam yarattılar.

Sonra deney tüpüne karbondioksit gazı verildi ve oksijene ihtiyaç duymayan, demir, magnezyum ve kalsiyum gibi maddelerle beslenen bakteri ilave edildi. Bir süre sonra bakterinin oksijen olmadan Mars ortamında büyümesini sürdüğü tesbit edildi. Bilimadamları bu bakteri sayesinde Mars'ta bir zamanlar ya da hali hazırda hayatın olup olmadığının da kanıtlanmasının mümkün olduğunu söylüyorlar. Uzmanlara göre hava sıcaklığının -60 dereceyi bulduğu ve basıncın dünyanın yüz katı olduğu Mars'ın metrelerce derinliğinde bu tür bakteriler yaşıyor olabilir.

Marketlerde yoğrulan çiğ köfteye dikkat

Konu: Çiğ köfte.

Yer: İstanbul'un göbeğinde modern bir süpermarket. Görüntü: Bir satıcı önündeki tepsinin içindeki çiğ etle bulguru, ara sıra karışımın üstüne su serperek, yoğuruyor da yoğuruyor.

Hijyen diye anılan temizlik ve sağlık kuralları, hava gibi, su gibi, sağlık gibi, hukuk gibi, insan hakları gibi, herkese her zaman lazımdır.

Yerel yemeklere bayıldığımı söylesem, herhalde kimse şaşmaz. Bunu taşralı kökenime bağlamayı haksızlık sayarım. Anadolu halk mutfağının güzelliği, binlerce yıllık bir kültür birikimi üzerinde çiçek açmasında.

Bizim asıl sıkıntımız, bu botanik bahçesini herkese açamamamız. Anadolu'nun dört bir yanında küçük gizli bahçeler bunlar. Sadece oranın yerlilerine özgü. Bir de yolu oralara düşen şanslı insanlar var.

İstanbul'da son yıllarda bu kötü talih zinciri kırıldı. Önce göç edenlerin oluşturduğu talep, ardından da egzotik tatlara meraklılar tarafından çeşitli taşra yemekleri Türkiye'nin tek gerçek metropolünde de yapılır hale geldi. Bir avuç eski İstanbullu önce bu duruma şaştı, sonra da "viskiyle lahmacun yiyorlar" alayları başladı.

Bunlar geçiş dönemleriydi. Yalnız İstanbul değil, Türkiye'nin tümü 1950'lerdeki toplumsal değişimden payını aldı. İyi kötü herkes viskiyi de, lahmacunu da öğrendi. Yerel yemekler metropol insanının ağız tadına uyduruldu. Soğanlar, sarmısaklar feda edildi. Temizlik kavramıyla tanışıldı. Yemeklerin belli sağlık kuralları çerçevesinde yapılması gerektiği öğrenildi.

Beni bugün böyle bir yazı kaleme almaya yönelten olay ise, son cümledeki yargıyla ilgili. Konu: Çiğ köfte. Yer: İstanbul'un göbeğinde modern bir süpermarket. Görüntü: Facianın ta kendisi! Bir satıcı önündeki tepsinin içindeki çiğ etle bulguru, ara sıra karışımın üstüne su serperek, yoğuruyor da yoğuruyor. Yani Züğürt Ağa filmindeki Şener Şen'den bir farkı yok!

Muhtemelen adını vermediğim süpermarket de Türk halk mutfağına gösterdiği folklorik ilgiden ötürü alkış bekliyor. Böyle bir görüntü karşısında, işten biraz olsun anlayan birisi sıfatıyla dehşete düştüm. Türklerin, "Bize bi şey olmaz abi" tavrını bir kere daha hatırladım. Mutlaka bir şeyler olacağını bilmenin derin üzüntüsü ile süpermarketten kaçarcasına çıktım.

Sevgili dostlar: Hijyen diye anılan bu temizlik ve sağlık kuralları toplamı, hava gibi, su gibi, sağlık gibi, hukuk gibi, insan hakları gibi, herkese her zaman lazımdır. Lazım değil diyenler, gün gelir bunu anlar ve kafalarını duvarlara çarparlar, ama çoğunlukla artık geç kalınmıştır. Şu anda sağlıklı bir haldeyseniz, sizin için daha geç olmamış demek. Öyleyse uyarılara dikkat etmenizi öneririm. Bu konuda, yukarda yer alan dostum ve konunun uzmanı, USAŞ'ın hijyen ve kalite güvence müdürü Dr. Nezih Müftügil'in yazdığı mektubu okuyun. Alınacak o kadar çok ders var ki!

Üretilen çiğ köftenin yüzde 5-10'u riskli

Dr. Nezih Müftügil

Yemek kültürü toplum kültürünün önemli bir öğesi. Dolayısıyla çiğ köftenin son yıllarda diğer bölgelere yayılması şaşırtıcı değil ama tehlikeli. Gıda zehirlenmesine neden olan en belli başlı bakteriler (Salmonella, Clostridium perfirengens, E.coli 0157:H7, Listeria monocytogenes) ve bazı parazitler (Toxoplasma, Trichinella) çiğ ette bulunmaktadır. Gelişmiş ülkelerdeki araştırmalar çiğ etlerin yüzde 1-5'inde bu bakterilerin varlığının saptandığını belirtmektedir. Çiğ et üretimi ve depolanmasında hijyenik koşulların daha geri olduğu ülkemizde çiğ etin içerdiği zararlı bakteri yükünün daha fazla olduğunu söylemek yanıltıcı olmayacaktır. Bu zararlı bakteriler mide ve bağırsak rahatsızlıkları yanında, ateş, su kaybı, menenjit semptomları, hamile kadınlarda düşükler ve hatta ölümlere neden olmaktadır. Çiğ eti antibakteriyel etkisi olan bazı baharatlarla karıştırıp yoğurarak bu zararlı bakteri ve parazitlerin tümünün elimine edildiğini düşünmek doğru değildir. Dolayısıyla üretilen çiğ köftenin yüzde 5-10'unun potansiyel risk taşıdığını kabul etmeliyiz. Ülkemizde çiğ köfte için bir bölgede çok tüketiliyor ve sağlık sorunu yaratmıyor demek ne ölçüde doğrudur acaba? Ciddi araştırmalar çiğ köftenin yarattığı sağlık sorunlarını özellikle çocuklarda parazit oluşmasındaki rolünü ortaya çıkarabilecektir. Çiğ köftenin marketlerde satılmaya başlaması durumu daha tehlikeli hale getirmiştir. Soğuk zincir dışında satılan çiğ köfte daha çok sayıda insanın sağlığını tehdit eder duruma gelmiştir. Hiçbir gelişmiş ülkede bu yapıda bir gıda maddesinin bu şekilde ticari olarak satılmasına izin verilmez.

RİSK NASIL AZALIR

Çiğ köfte yapımında kullanılan et sağlıklı hayvandan elde edilmeli, kesim ve parçalama işlemleri hijyenik ortamda yapılmalıdır. Çiğ olarak yenecek et ne kadar az zararlı bakteri içerdiyse risk o ölçüde azalacaktır. Etin dondurulması parazitlerin ölmesine neden olduğu için çiğ köfte üretiminde mutlaka dondurulmuş et kullanılmalıdır. Hazırlık süresince ve tüketilinceye kadar çiğ köfte soğuk ortamda tutulmalı ve kısa süre içinde tüketilmelidir. Kullanılan baharatlar zararlı bakteri içermemelidir. Bu koşullar bile çiğ köftenin taşıdığı sağlık risklerini gidermez. Gene de bu konudaki en sağlıklı tutum bu koşulların sağlandığından emin olunmayan yerlerde üretilen çiğ köfteyi yememektir.

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Presley, Arzu İrfan
Nationality: Turkish (TC)
Date and Place of Birth: 23 October 1971 , Kdz Ereğli
Marital Status: Married

EDUCATION

Degree	Institution	Year of Graduation
MS	Hacettepe University –Applied and Natural Sciences Institute-Department of Biology-Biotechnology	1998
BS	Hacettepe University- Science Faculty-Department of Biology	1993
High School	Kdz Ereğli Anatolian High School	1989

WORK EXPERIENCE

Year	Place	Enrollment
December 1998-Present	ZKU Ereğli Education Faculty	Lecturer
September 1996-December 1998	Halil Naci Mıhçıoğlu Secondary School	Science Teacher
September 1995-September 1996	Elbistan High School	Biology Teacher

International conference papers and Poster Presentations in 6-8 September 2000 in Hacettepe University Science Education Conference

1. Evaluation of the achievement of Student Teachers at Different Taxonomic Levels (with D. Gürçay, F. Kaptan, G. Berberoğlu)
2. Factors affecting the Achievement of the Student Teachers (with D. Gürçay, F. Kaptan, G. Berberoğlu)
3. Effect of Inductive and Deductive Content Approach on the Achievement of Three Different Assessment Tools used in Chemistry teaching (Poster Presentation) (with B. Hazer, T. Şahin, B. Şahin)
4. Effects of Different Variables on Achievement in Chemistry Instruction (with T. Şahin, B. Hazer, H. Yeğen)

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1. Comparison of Inductive and Deductive Content Sequence on Students' Chemistry Achievement, Attitudes and Academic Self Concept (with N. Yörük, T. Şahin) Hacettepe University Journal of Education- p:177-185 (2000).

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2. Activities for Protecting Youth, Ereğli Education Faculty, May 2000
3. Applications of Multiple Intelligences, Ereğli Education Faculty, May 2002
4. Activities Based on Multiple Intelligences Theory, Ereğli Education Faculty, May 2003
5. Application of Multiple Intelligences Theory at Schools, Ereğli Industry Profession High School, September 2003
6. Preparation of Primary School Lesson Plans Based on Multiple Intelligences Theory, Erdemir Primary School, May 2004
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