

The Effect Of Summer Vacation On Multiple Intelligence Types And Science Learning Processes

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The Effect of Summer Vacation on Students

Summer vacation is a period eagerly awaited by students, especially due to the hot weather conditions. Summer holiday durations vary from country to country. In Northern European countries, holiday durations are generally limited to 4-6 weeks and are planned over certain periods throughout the year (Cooper, 2003). In contrast, in Mediterranean countries such as Türkiye, Greece, Italy and Spain, summer vacation lasts from mid-June to mid-September (Kerry and Davies, 1998). The origin of the long summer vacation practice dates back to the period when agriculture was the dominant economic activity. In agricultural societies, summer vacations were long because children had to join the workforce during harvest periods (Gierczyk and Hornby, 2023). Therefore, the duration and timing of summer vacation in the education system have been affected by historical and economic factors and have continued to the present day. These different vacation durations and practices can have various effects on education policies and student success. While shorter and more frequent vacations are thought to help students maintain continuity in learning, long vacations are thought to provide students with the opportunity to rest and engage in different activities.

The learning losses that students experience during the summer vacation can negatively affect their academic success and make it difficult to achieve their educational goals (Hastings and LaBriola, 2023). These learning losses that occur during the summer period are considered an important factor in the emergence of academic achievement differences among students (Allington and McGill-Franzen, 2003). Research shows that these losses during the summer vacation play a critical role in the emergence of achievement differences among students. In this context, educational research has long been interested in the effects of summer vacation on learning, and this situation has an important place in the education policies of countries with the aim of reducing academic achievement differences (Coley et al., 2020). Learning losses during the summer period have become a subject of increasing interest in national and international education research (Coley et al., 2020; Arı, 2005; Stewart et al., 2018). These studies are important in understanding how the length of the summer vacation and students' learning opportunities are affected during this period. Various studies show that students experience significant learning losses in their academic success during the summer vacation period. A study conducted in Turkey by Arı (2005) revealed

that fourth-grade primary school students experienced significant learning losses in Mathematics and Turkish during the summer vacation period. Similarly, it was stated that third-grade primary school students experienced significant learning losses in Mathematics and Life Sciences during the summer vacation period (Şen, 2009). However, no clear findings were presented regarding the loss in the Turkish course. The striking point in these studies is that the losses in the mathematics course are more pronounced than in the other courses examined. Studies conducted in countries other than Turkey have also revealed that students experience learning losses during the long summer vacation period. Studies conducted on primary school students have shown that learning loss varies according to the grade level. For example, it has been stated that there are significant losses in writing skills in second and third-grade primary school students and in mathematics skills in fourth and fifth-grade students (Atteberry and McEachin, 2021). The studies mentioned support the hypothesis that long summer vacations can negatively affect students' academic success. It has also been emphasized that learning loss does not vary by gender and race, but the amount of learning loss increases as the grade level increases (Cooper et al., 1996).

Intelligence

The concept of intelligence has been defined in various ways by many researchers since the time it was first investigated. This diversity stems from the fact that intelligence is a multidimensional and dynamic capacity (Tura and Akbaşlı, 2021). Intelligence can be defined as a process that includes reasoning, planning, problem solving, abstract thinking, comprehending complex thoughts, and learning quickly from experience (Wechsler, 1955). Studies aimed at determining the brain and its working structure in order to achieve meaningful and permanent learning have become an important area of interest. First, intelligence tests were put on the agenda to determine the extent to which the brain can use its functions (Bozbey-Esmeroğlu, 2016). Although researchers assumed that individuals' reaction times were related to their intelligence levels, the results often did not match this assumption. Initially, intelligence was considered as a single whole, but later it was realized that there was a non-one-to-one relationship between intelligence and creativity (Koroğlu and Yeşildere, 2004). Creative individuals are generally among those with good or even superior intelligence levels, but it shows that not everyone at this level is creative. This finding has led scientists to consider the possibility that there may be different types of intelligence (Oleron and Güngören, 1992). The common characteristics of the intelligence tests that scientists use to express intelligence quantitatively include fast thinking and being based on mathematical and verbal skills. However, there are also areas such as art, music or sports where success can be achieved without these skills. This situation shows that intelligence is not limited to mathematical and verbal abilities, but spreads over a wider spectrum. In this context, it is understood that intelligence is a multidimensional and dynamic capacity, and therefore also includes talents and skills in different areas. Research in the fields of education and psychology continues its studies to understand the different types of intelligence in individuals and how these types can be developed. This multidimensional structure shows that intelligence is a dynamic and developing capacity rather than a static characteristic. Therefore, intelligence research uses different perspectives and methodologies to understand and

improve the cognitive abilities of individuals.

Intelligence and Development Process

Intelligence refers to an individual's ability to learn, solve problems, think abstractly, and adapt to the environment (Şimşek, 2015). The development of intelligence is shaped by genetic factors and environmental influences (Horn, 1968). The period when intellectual development is most rapid in human life is early childhood. During this process, synaptic density increases and basic cognitive skills develop rapidly in the brain (Balkış Baymur, 2017).

- Ages 2-5: This is a critical period for children's brain development. Language, motor skills and basic cognitive abilities develop rapidly during this period. Environmental stimuli (e.g. play, social interaction) positively affect this development.

- Ages 6-12: Learning accelerates during this period. Children transition to abstract thinking and reach the capacity to solve more complex problems. Education is very effective during this period.

- Ages 12-18: This is the period when brain maturation continues and the prefrontal cortex (the region responsible for planning, decision-making and control skills) continues to develop. Although intelligence development slows down, learning continues.

Intelligence is shaped by environmental interactions and the level of brain usage, as well as genetic infrastructure (İnci, 2021). Active use of the brain and rich environmental experiences are critical to maximizing intelligence potential. For this reason, it is of great importance to support individuals with learning opportunities from an early age and to adopt lifestyle habits that protect brain health.

General Framework of Intelligence Theories

Studies on intelligence have led to the development of various theories to understand and measure this phenomenon. Although theories of intelligence adopt different approaches, they are generally interconnected and complementary.

Single Factor Theory: General Intelligence Factor

The Single Factor Theory is an approach that considers intelligence as a general factor affecting all cognitive abilities of an individual. The basic premise of this theory is that the performance of an individual in different types of cognitive tasks can be explained by a single general intelligence factor (g factor) (Baymur, 2017). This approach, first proposed by Charles Spearman, assumes a common mechanism underlying all cognitive processes (Spearman, 1904). In this theory, intelligence is defined as a general and abstract ability (Lövdén et al., 2020). Different psychologists have explained this general ability in various ways. Terman defines intelligence as the ability to think abstractly. Davis sees intelligence as the ability to solve problems and use existing knowledge effectively. Stern associates intelligence with the ability to adapt to new situations and respond to

events using the power of thinking (Yıldız, 2021). It assumes that there is a positive relationship between different cognitive skills in all individuals. For example, if a person is successful in verbal expression skills, it is predicted that he/she will also be successful in mathematical problem solving. Therefore, this theory offers a limited perspective in understanding the nature of intelligence and can be seen as inadequate, especially when compared to alternative models such as Gardner's theory of multiple intelligences and Sternberg's theory of trichotomous intelligences.

Spearman's Two-Factor Theory

The Dual Factor Theory, developed by Charles Spearman in 1904, explains intelligence as a structure consisting of two basic components. These components are general ability (g) and special abilities (s). This theory argues that both general and specific factors are effective together when evaluating an individual's cognitive abilities (Akt., Yıldız, 2020). According to Spearman, general ability is the individual's basic cognitive capacity that is effective in all mental processes. This factor forms the basis of mental skills such as abstract thinking, problem solving and understanding complex relationships. These abilities vary from individual to individual and only affect success in a certain area (Şahin, 2015). For example, a person may be successful in mathematics but not have the same level of musical ability. Spearman's Dual Factor Theory is an important approach that emphasizes that intelligence is a combination of both general and special abilities. Instead of reducing intelligence to a single factor, this theory has the potential to explain different components of individual performance. However, today more holistic approaches (for example, multiple intelligences or triads of intelligences) are more widely used to understand the nature of intelligence. Nevertheless, the dual-agent theory remains one of the fundamental building blocks of cognitive psychology.

Sternberg's Triarchic Theory of Intelligence

Robert J. Sternberg (1996) argued that intelligence is too complex to be reduced to a single dimension and developed the three-stage intelligence theory. This theory analyzes the cognitive processes of the individual and addresses intelligence in three basic components. These are divided into analytical intelligence, creative intelligence and practical intelligence. Sternberg argued that this approach offers a more comprehensive understanding of intelligence than traditional IQ tests and predicts individuals' success in work and school more accurately (Mert, 2015). He suggested that there are mental abilities that are necessary for an individual to adapt to their environment, to choose and reshape the environment. According to Sternberg, intelligence includes the individual's ability to perceive problems, create strategies for solution and implement solutions. These processes enable the individual to respond effectively to the challenges they encounter in both the abstract and practical world. He also emphasizes that these processes may differ depending on the cultural context and environmental conditions.

Thurstone's Group Factor Theory

Louis Thurstone argued that intelligence is not a single general ability and consists of more than one mental factor. According to him, different problems require different mental powers (Thorndike, 1920). From this perspective, Thurstone suggested that intelligence consists of a series of independent cognitive factors. Although he initially determined 12 factors that constitute the basic structure of intelligence, he later reduced this number to seven basic abilities (Baymur, 2017). These abilities are as follows; Verbal Comprehension: The ability to understand the meanings of words and interpret linguistic expressions. For example, reading and making sense of a text quickly and accurately. Verbal Fluency: The ability to remember and use words quickly and effectively. Numerical Ability: The capacity to perform mathematical operations quickly and accurately. For example, doing mental calculations or solving mathematical problems. Spatial Visualization: The ability to mentally visualize and manipulate spatial objects. For example, it is used in map reading, architectural design, or understanding three-dimensional shapes. Memory: The capacity to remember information for a short or long time. This ability is decisive in the learning and storage processes. Perceptual Speed: The ability to perceive and interpret visual and auditory information quickly. For example, quickly finding the wrong item in a list. Inductive Reasoning: The ability to derive general rules from data and apply these rules to new situations. For example, finding the correct answer by noticing a pattern in a series of problems.

According to Thorndike, evaluating these three dimensions together is necessary to understand the individual's intelligence capacity more comprehensively. Focusing on only one of these dimensions provides an incomplete approach to the assessment of intelligence (Uçar & Aliyev, 2017).

Multiple Intelligence Theory

The theory of multiple intelligences, which explains learning, which is a paradigm in the field of education, with mental, sensory, motor and visual intelligence, was developed by Howard Gardner. In the development process of the theory, data obtained from studies conducted on geniuses, gifted individuals, patients with brain damage, autistic people, normal children and adults, experts in various fields and people from different cultures were examined. As a result of these studies, Gardner proposed in his book "Frames of Mind: The Theory of Multiple Intelligences", which he published in 1986, that intelligence had seven aspects instead of the two aspects accepted at that time. According to Gardner, contrary to the traditional understanding of intelligence, intelligence is not limited to mathematical and linguistic achievements. Individuals who show themselves in areas such as sports, music, dance, painting, communication and self-awareness should also be considered intelligent (Ayaydin, 2017). This theory aims to reveal the interests, talents and potential of individuals and argues that each individual has different types of intelligence. The theory of multiple intelligences advocates supporting intelligence and intelligence development with individualized approaches in accordance with student-centered education. According to this theory, it is emphasized that each student has different types of intelligence and that education should be planned with methods that address these differences. The aim is to provide equal opportunities in

education by taking into account the talents and interests of each individual and to maximize the potential of students (Soylu, 2011). According to this theory, the types of intelligence are;

1. Verbal Intelligence

Verbal intelligence includes the ability to use language. Individuals with this intelligence have knowledge about the qualities of language. These individuals have the ability to persuade, present information and communicate effectively in different languages. Verbal intelligence; learns best by listening, speaking and seeing words (Berkant and Ekici, 2007). It is also an area where language skills are affected in the event of brain damage (Bornstein and Gardner, 1986).

2. Mathematical Intelligence

Also called logical-mathematical intelligence, this type of intelligence includes logical reasoning, numerical analysis, abstract thinking and problem solving skills. Individuals with mathematical intelligence can easily grasp cause-effect relationships. They can understand abstract concepts and organize complex thought structures (Bornstein and Gardner, 1986). Mathematical intelligence is a type of intelligence that includes individuals' logical, numerical and abstract thinking skills. This type of intelligence also affects the individual's daily life skills that require problem solving and analytical thinking (Karabay et al., 2011). With education and support, this type of intelligence can be strengthened even more and contribute to the individual's lifelong success.

3. Visual Intelligence

Also known as visual-spatial intelligence, it refers to an individual's ability to perceive, interpret and manipulate images, pictures, spaces and three-dimensional thought structures. This type of intelligence includes the ability of an individual to effectively process, organize and produce solutions to visual information (Gardner, 2011). Visual intelligence is a skill that allows an individual to effectively understand and use visual and spatial information. This type of intelligence, which is effective in a wide range from daily life to professional success, strengthens individuals' aesthetic and analytical thinking skills. It is thought that supporting education in the early stages is important in revealing individuals' creative and problem-solving potential.

4. Musical Intelligence

This type of intelligence refers to the individual's capacity to perceive, distinguish, remember and produce sounds, rhythms, tones and other elements in the musical structure. Individuals with musical intelligence usually easily understand and express complex relationships in the musical structure (Gardner, 2011). Musical intelligence is an important type of intelligence that develops the individual's musical sensitivity and creativity and supports learning processes. It is important for the individual to be noticed and supported in childhood so that they can develop a successful career in the field of music and contribute to other areas of learning through music (Yavuz, 2009).

5. Bodily Intelligence

It refers to the ability of an individual to use their own body effectively and manipulate physical objects. This type of intelligence is important both in terms of the individual's ability to control their body and to interact with the physical world around them. This type of intelligence is particularly associated with movement, coordination, balance, agility and tactile skills (Gardner, 2011). It is also an important type of intelligence that allows an individual to interact with the world by using their body as a tool and to successfully perform complex physical tasks. This type of intelligence is a fundamental element that increases creativity, learning and success in daily life, both at the individual and social level (Bümen, 2005). For this reason, it is important to support and develop the potential of individuals with this type of intelligence in education and life.

6. Social Intelligence

A type of intelligence that includes the ability of an individual to communicate effectively in social environments, manage human relations, understand others and cooperate (Gardner, 2000). This type of intelligence plays an important role in both individual and social contexts. Social intelligence is a skill set that allows an individual to take part in social life effectively and harmoniously. It increases the quality of both individual and social relationships thanks to its components such as communication, empathy and cooperation (Yavuz, 2009). This type of intelligence can be developed through learning and experience and can contribute to the success of the individual in all areas of life.

7. Intrapersonal Intelligence

Intrapersonal intelligence or personal intelligence is defined as the ability of an individual to focus on their inner world, understand themselves, identify and manage their emotions (Gardner, 2000). Intrapersonal intelligence is a powerful mechanism that guides an individual's life. It supports the individual in achieving their life goals by increasing their self-confidence and establishing more harmonious relationships with their social environment through skills such as emotional awareness, self-management and personal development (Yavuz, 2009).

8. Naturalist Intelligence

It refers to the individual's interaction with nature and the environment and their sensitivity in this area (Gardner, 2000). Naturalist intelligence includes the ability to recognize and classify living things in nature and understand the relationships between them. It also includes the curiosity and observation skills of individuals towards the environment and the awareness of protecting nature. It is the awareness and understanding capacity that an individual develops towards nature and the environment (Yavuz, 2009). Curiosity towards understanding the natural world, the ability to classify and sensitivity to the environment are the basic elements of this intelligence.

Variables Predicting Students' Summer Learning Loss: Family Education Level and Socio-Economic Factors

One of the critical factors affecting students' learning processes and academic success is the education level of the family. Learning losses observed in students, especially during the summer vacation period, are closely related to this factor. The education level of the family is one of the basic elements that shape learning motivation, academic performance and long-term continuity in education life throughout the school period (Erdoğan and Güvendir, 2019).

Summer vacations are a period that offers students the opportunity to rest and have fun, but also carries the risk of losing knowledge and skills. In educational research, the primary factor affecting learning loss is the level of education of families (Aslanargun et al., 2016). While a high level of education in families increases the likelihood that children will continue their learning processes during the summer vacation, a low level of education has a triggering effect on learning loss. In this context, it is important to analyze the effect of the level of education of families on students' academic success. Studies show that the level of education of mothers, in particular, is a critical factor in children's school attendance and dropout rates (Yam and Kumcağız, 2021). It has been observed that children in families with high levels of education attend school more regularly and have higher academic success (Sezgin et al., 2020). On the other hand, it has been stated that the mothers of the vast majority of students who drop out of school have low levels of education. Low levels of education in mothers can negatively affect children's motivation for education and limit educational support mechanisms within the family. The level of education of families is generally related to socioeconomic status. Families with low levels of education may not be able to provide resources for their children's education or develop awareness about this issue (Aslanargun et al., 2016). This situation is a risk factor that increases learning loss, especially during summer vacations. Families with high levels of education tend to direct their children to various programs and activities to ensure that they continue their learning activities during the summer vacation. According to the research of Slates et al. (2012), students who live with both parents, whose mothers are at least twenty years old when they are born and who are the first child of the family experience less learning loss during the summer vacation. This finding shows that stability within the family and the maturity level of the parent depending on their age contribute positively to the child's learning processes. It is thought that being the first child in particular may be related to parents generally allocating more attention and resources.

Summer Vacation Durations and Learning Loss

In some European countries, the duration of summer vacations is quite short compared to Turkey. Countries such as Germany, the Netherlands and the UK keep their summer vacations under seven weeks, while other European countries apply around ten weeks of summer vacation. Although the number of days of education and training in these countries is similar, shorter vacations are taken three or four times a year. In Turkey, the summer vacation lasts an average of 3 months and there is no other vacation period other than the semester break (Auld et al., 2019). This planning

in Turkey can be considered as a factor that can increase learning losses.

Professional musicians or athletes observe that their performance declines when they take a long break. Similarly, students have difficulty regaining their pre-holiday academic performance after long summer vacations (Baş, 2023). Observations and research in the field of education reveal that teachers notice declines in their students' learning levels during long vacations (Boulay and Fairchild, 2002). The uninterrupted nature of the educational process allows students to learn in the most effective way. Long summer vacations disrupt this continuity and cause the information learned to be forgotten. When students return to school in the fall, they have to spend a considerable amount of time and educational materials to compensate for this loss. This situation leads to a disruption of the educational rhythm and a significant loss of productivity at the beginning of the academic year. This problem becomes more pronounced and serious, especially for students with special educational needs. These students face greater difficulties in compensating for learning loss after long vacations, which can cause them to fall behind in education (Cooper, 2003). Summer vacation learning losses occur as a result of the interaction of individual and environmental factors. In addition to the family's socio-economic status and level of education, the family's structural characteristics and the child's mental competence are important variables that determine the severity of these losses. It is important for education policies to develop supportive programs during the summer period by taking these factors into account in order to minimize learning losses. Therefore, it is of great importance for education policies and calendars to be organized in a way that protects students' learning continuity in terms of academic success and equality in education.

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