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Education for Sustainable Development

Selin YILDIZ[1] , Raşit ZENGİN[2]

Introduction

Our world is facing rapidly changing dynamics and increasing global problems. Rapid urbanization and technological advances, which started with the industrial revolution, have increased the living standards of humanity, but have also led to the depletion of natural resources and damage to ecosystems. In this process, while aiming for economic growth, environmental costs have been ignored, social inequalities have deepened and the effects of the climate crisis have become inevitable. Population growth, depletion of natural resources, environmental destruction and social inequalities have made the need for humanity to build a sustainable future even more urgent. The concept of sustainable development aims to meet the needs of the present without jeopardizing the needs of future generations by addressing environmental, economic and social dimensions with an integrated approach. Sustainable development is a multifaceted strategy that not only focuses on economic growth but also includes environmental protection and social welfare. Efficient use of natural resources, transition to renewable energy, ensuring social equality and making economic development sustainable are the cornerstones of this strategy. Sustainable development is a holistic approach that aims to maintain environmental sustainability and social equity while ensuring economic growth. This concept not only meets the needs of today but also enables future generations to meet their own needs. The 'Sustainable Development Goals' set out by the United Nations draw path to a sustainable future by setting concrete targets in a wide range of areas from poverty eradication to climate action.

Global cooperation is of great importance to ensure sustainable development. Developed and developing countries need to act jointly, share technological innovations and support sustainability-oriented projects. However, local

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solutions play a critical role as much as global cooperation. Local governments' adoption of environmentally friendly policies, awareness-raising activities of non-governmental organizations and the private sector's transition to sustainable production processes are the building blocks of a successful sustainable development strategy. Individuals also have responsibilities for sustainable development to be successful. Encouraging recycling, ensuring energy efficiency, preferring sustainable transport methods and raising environmental awareness are important parts of individual contribution. At the same time, it is of great importance for educational institutions to create curricula that instill sustainability awareness to raise the conscious generations of the future.

Sustainable development is a holistic process that requires social awareness and participation and should not be limited to the efforts of states or organizations. Balancing economic growth with environmental protection and social justice is essential for long-term prosperity and a livable world. In this chapter, information on sustainability, historical development of sustainability, sustainable development, foundations of sustainable development and education for sustainable development are presented.

Sustainability

In the 18th century, the Industrial Revolution, ever-increasing world population, and production power led to excess consumption (Özkan, 2017). The concepts of sustainable development and sustainability have emerged to solve these problems (Torun, 2024). Sustainable development is defined as the realization of the stages carried out to improve the lifestyles of individuals without harming the system and natural life (Atmaca, 2018). 'Sustainability', which comes from the Latin word "sustinere", is defined as the ability to sustain life by providing continuity (Üzel et al., 2024). Although there are different definitions in the literature, main goal of sustainability is to transfer a healthy environment to future generations (Saraç & Alptekin, 2017). Another definition for sustainable development is defined by Türer (2010) as 'the balanced and sparing use of the resources used in terms of economic development without ignoring the environmental dimension, considering the future individuals'.

The concept of sustainability essentially refers to using existing resources without limiting the ability of future generations to meet their needs while meeting the needs of the present (Özkişi, 2024). Turgut (1997) stated that the definition of sustainability emphasizes justice between needs and future generations. The context of sustainability, in addition to the responsibility of the previous generation to future generations, it is of great importance to ensure fairness in the distribution of resources among countries with different levels of

development and communities with economic differences in the same country (Turgut, 1997). According to Bazin (2012) and Hofman (2015), concept of sustainability was formed due to the economic and social developments that occurred in the 20th century damaging the ecosystem. Önder & Özkan (2013) state that sustainability will occur with the protection of the environment, proper management of wastes and efficient use of resources; resources that are consumed faster than their production are not sustainable. Here, '3-R' (Reducing, Reusing and Recycling) is mentioned to ensure sustainability (Bener & Babaoğlu, 2008).

The consumption of natural resources has increased due to the increasing population of mankind, the desire for development and economic studies. The rapid consumption of natural resources has reminded people that resources are limited and people have searched for solutions to this situation. The search has revealed the concept of sustainability. The concept of sustainability has been used since 1970 (Duran & Bozok, 2021). In 1982, the concept was first used by the World Union for Conservation of Nature in the World Charter for Nature document, that the natural resources that people will benefit from should be managed sustainably in a way that does not endanger human life (Tosun, 2009). Yücel & Kurnaz (2021), sustainable solutions are required to overcome problems permanently. Permanent solutions will not only save the present but also the future. At this point, it is important to know and adopt the concept of 'sustainability' (Karademir et al., 2017).

Zoller (2015) argued that transformative paradigm shifts are required in environmental, science, technology, society, economics and policy education to enable 'sustainability thinking' from contemporary science and technology disciplines. The concepts of environment, economy, energy and society are interrelated in sustainability discussions. A superficial examination of these concepts may initially seem somewhat contradictory (Şeker & Aydinli, 2023). To explain, while economic and commercial activities increase welfare and well-being, they also harm the environment, which manifests itself in the form of loss of biodiversity. The critical concept of appropriate use of education can act as a catalyst for positive change by participating in human processes as part of a cogwheel. The concept of sustainable development emerged by integrating the above-mentioned concepts with consideration of human behavior. Education can help in this regard by expanding the reach of this expanding problem to all systems. Primary anthropogenic impacts such as increased waste products, careless use of chemicals, inadequate sanitation facilities, lack of clean drinking water, and the continuing depletion of natural resources in almost every industrial

process have resulted in a shift in focus towards efficient, greener, and cleaner production (McGrath & Powell, 2016).

Historical Development of Sustainability

Although sustainability is considered to be a new concept today, it is known as a concept that dates back to ancient times. In 1972, the concept of Sustainability was first mentioned in the study titled 'Limits to Growth' published by the Club of Rome. This quite comprehensive study is a report. In the study, it was argued that uncontrolled and unlimited growth is not sustainable. The report focused on 5 variables for sustainable growth; population, industrialization, pollution, food production and consumption of resources (Ataman, 2020).

With the Stockholm Conference held on 5-16 June 1972, environmental problems took their place as the first agenda items on the international agenda. At the conference, the Declaration on the Human Environment was adopted. In this accepted declaration, it was emphasized that it is possible to live in a better environment that meets the needs of both present and future generations and that scientific studies should be carried out for this purpose (Kayhan, 2013). Every year, 5 June is celebrated as Environment Day all over the world in memory of this conference (Ozmehmet, 2008). After the conference, interest in the environment increased and the United Nations Environment Programme (UNEP) was established within the United Nations. The structure of UNEP, which was established and determined in 1972, was determined 'To make necessary recommendations on environmental policies, to increase international cooperation on the environment and to provide guidance by providing unity on environmental issues within the United Nations' (Duru, 2016). In the Brundtland Report, it was stated that in the face of environmental problems that continue to increase day by day; a solution will be provided to humanity by making development 'sustainable' and establishing a relationship between environmental development and economic development (Bozlağan, 2005). The report, which analyses and explains the concept of sustainability in detail, states that human activities affect the whole world and the ecosystem at the global level and draws attention to the differences at the beginning and end of the twentieth century (Keleş, 2023).

In 1992, the "United Nations Conference on Environment and Development" was organized in "Rio De Janeiro", Brazil with participation of 178 states. At the Rio Conference, global environmental problems, resource depletion levels and climate crisis issues were discussed (Alada et al., 2012). One of the most important events of the Rio Conference was the adoption of Agenda 21 (Rio Declaration), which enabled the concept of sustainability to gain international

characteristics. With the conference, the concept of sustainability has expanded in meaning (Şen et al., 2018). Agenda 21, it was emphasized that developing countries should cooperate internationally for sustainable development. Agenda 21 also emphasized that resources should be protected and consumption should be controlled (Yapıcı, 2003). The Rio+5 Forum was organized by the "United Nations Development Program" in New York in 1997, five years after the Rio Conference in 1992, to move the concept of sustainability from the agenda to practice. At the Rio+5 Forum, the practices, management systems, strategies and political policies that will bring the concept of sustainability to life were discussed (Yaman & Gül, 2018). The Forum also aimed to make a global assessment of the 5 years after the Rio Conference in 1992 (Uçar, 2024).

In 2000, with the participation of the heads of state and government of 189 countries, the United Nations Millennium Declaration was signed "at the beginning of a new millennium" (Emrealp, 2005). The goals set at the summit were aimed to be realized by 2015. The "Millennium Development Goals" are at an important point because they include bringing together the political policies and programs of states and sustainable development goals, solving environmental problems, protecting biodiversity, and increasing access to healthy and clean drinking water (Yılmaz & Yücel, 2022).

On the 10th anniversary of the United Nations Conference, "World Conference on Sustainable Development" was organized in Johannesburg in 2002. A general assessment was made at this summit, which was the first global conference of the 21st century, where the title "Sustainable Development" was used as a name in a global conference for the first time (Nakiboğlu & Bozkaya, 2019). At the Johannesburg Summit, also referred to as Rio+10, the "Implementation Plan" and "Johannesburg Declaration on Sustainable Development" were adopted. The problems encountered in the implementation of the items in Agenda 21 were discussed (Günsoy, 2013). At the summit, the issues of changing unsustainable consumption and production patterns, ensuring economic and social development by protecting the natural resource base, environmental management, sustainable development and the globalizing world came to the fore (Yüksel & Barut, 2023).

In 2012, the Rio+20 Conference was organized by the "United Nations Development Commission" in Brazil. "The Future We Want" declaration was adopted. The declaration emphasized that economic, environmental and social sustainability should be promoted for future generations (Akpulat, 2019). In 2015, the "Agenda 2030: UN Sustainable Development Goals (SDGs)" consisting of 17 goals was adopted in New York (Kaya & Ek, 2021).

Sustainable Development

Sustainable development has become a buzzword in development discourse as it has been associated with different definitions, meanings and interpretations (Mensah, 2019). Taken literally, sustainable development simply means 'development that can be sustained over some time or indefinitely' (Dernbach, 1998, 2003; Stoddart et al., 2011). Structurally, the concept can be seen as a sentence consisting of two words, 'sustainable' and 'development'. Just as 'sustainable' and 'development', the two words that come together to form the concept of sustainable development, have each been defined differently from various perspectives, the concept of sustainable development has also been analyzed from various perspectives, which has led to a large number of definitions of the concept. Although there are many definitions of sustainable development, the most frequently cited definition of the concept is the one proposed in the Brundtland Commission Report (Schaefer & Crane, 2005)

Sustainable development is defined as an approach to development based on utilising resources in a way that ensures their continued existence for future generations (Mohieldin, 2017). Evers (2017) also links the concept to the organising principle of achieving human development goals while at the same time sustaining the ability of natural systems to provide the natural resources and ecosystem services on which the economy and society depend. From this perspective, sustainable development aims at social progress, environmental balance and economic growth (Gossling-Goidsmiths, 2018; Zhai & Chang, 2019).

It is argued that the importance of sustainable development is increasing day by day as the population continues to grow, but the natural resources that can be used to meet human needs and aspirations are not increasing (Mensah, 2019). Recognising this phenomenon, Hák et al. (2016) argue that there has always been a global concern about the wise use of available resources so that it is always possible to meet the needs of the current generation without jeopardising the ability of future generations to meet their needs. According to Kolk (2016), this can be achieved by integrating economic, environmental and social concerns into decision-making processes. However, it is common for people to treat sustainability and sustainable development as similar and synonymous, but the two concepts can be distinguished from each other. Gray (2010) supports this point, arguing that 'sustainability' refers to a state, while sustainable development refers to the process of achieving that state.

Sustainable Development Goals

The "Sustainable Development Goals", which are defined as new goals on the agenda of a globalizing world, emphasizing sustainability, which member countries are expected to adopt and which are expected to be achieved by 2030, are given as follows. Since January 1, 2016, 17 sustainable development goals are mandatory for the whole world, all states and all peoples (Figure 1) (Birleşmiş (UNDP, 2015).

Figure 1. Sustainable Development Goals (UNDP, 2015).

The 17 Sustainable Development Goals mainly aim to achieve the goals outlined below (UNDP, 2015).

- "End poverty in all its forms everywhere"
- "End hunger, achieve food security and better nutrition, and promote sustainable agriculture"
- "Ensure good health for all ages"
- "Ensure accessible quality education for all and promote lifelong learning"
- "Achieve gender equality and empower all women"
- "Ensure access to clean water, its sustainable provision, and sanitation"
- "Ensure affordable, reliable, sustainable and modern energy for all"
- "Promote sustainable and inclusive economic growth; Support full, productive and decent jobs"
- "Build resilient infrastructures, support inclusive and sustainable industrialization and nurture creativity"
- "Reduce inequality within and between countries"

- “Make cities and all settlements safe, resilient and sustainable for all”
- “Ensure sustainable production and consumption patterns”
- “Take urgent measures to combat climate change and its impacts”
- “Protect and sustainably use the oceans, seas and all marine resources for sustainable development”
- “Protect, restore and ensure sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and retreat from land loss and halt biodiversity loss”
- “Support peaceful and inclusive societies for sustainable development, ensure justice for all and create effective and accountable institutions at all levels”
- “Revitalize global partnerships for sustainable development and strengthen implementation methods” (Hylton, 2019; Saner et al. 2019).

2030 has five main themes encompassing 17 Sustainable Development Goals, known as the five Ps: planet, people, prosperity, partnerships and (Hylton, 2019; Guo, 2017; Zhai & Chang, 2019).

The Foundations of Sustainable Development

Taylor (2016), the three pillars of sustainable development are economic growth, environmental protection and social equity. Based on this, it can be argued that the concept of sustainable development is fundamentally based on three conceptual pillars. These pillars are "economic sustainability", "social sustainability" and "environmental sustainability".

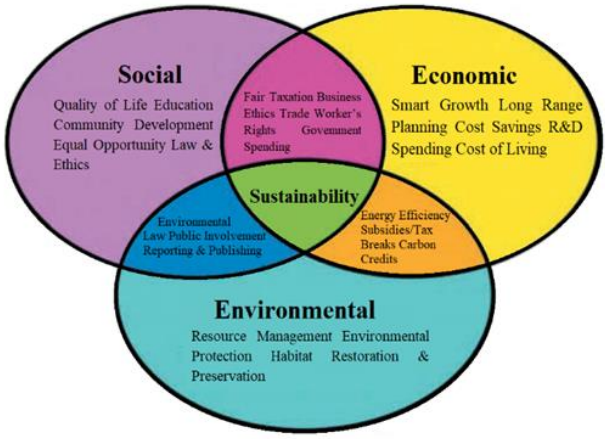

Figure 2. Relationships among social, economic and environmental sustainability (Wanamaker, 2018)

Environmental Sustainability

It covers the relationship of sustainability with the environment. It is not harming the ecosystem while using natural resources (Uçar, 2024). It includes components such as environmental protection and self-renewal of natural resources. To ensure environmental sustainability, biodiversity should be protected and natural resources should be used regularly. Environmental sustainability puts forward a philosophy for the solution of environmental problems. States need to work to raise people's awareness of environmental sustainability. With environmental sustainability, a livable and clean environment can be left to future generations (Moldan et al., 2012). The main items of environmental sustainability are as follows (Güner, 2020):

- Protection of biodiversity in nature
- Protection of natural resources and economical use of resources
- Sustainable use of renewable resources
- Reducing the use of non-renewable resources
- Minimizing the damage to living things in nature and the environment
- Protection of cultural and historical heritage

The environmental dimension of sustainable development, also known as ecological sustainability, is related to “harmony between humans, nature and natural resources” according to Pressoir (2008), while Morelli (2011) defines it as “meeting human needs without compromising the health of ecosystems”. Gürbüzer & Hayta (2020) explain environmental sustainability as “ensuring the continuity of natural resources against environmental risks and transferring them to future generations”. Environmental sustainability includes issues such as global warming, depletion of resources, depletion of the carrying capacity of the ecosystem, water and air pollution, in addition to the disadvantages brought about by the depletion of natural resources, waste landfills, rising sea levels, expanded greenhouse gas emissions, polluted water formation (Siraj-Blatchford et al., 2010) (Johnson & Lundvall, 2013). To achieve the desired result from environmental sustainability, five conditions must be fulfilled (Akgül, 2010). These are;

- Minimizing resource consumption,
- Obtaining material consumption entirely from post-consumer recycled materials or renewable resources,
- Ensuring 100% recycling of wastes,
- Protecting energy resources and basing them entirely on renewable, non-polluting alternatives,

- Applying methods that will not harm biological vitality and diversity in the development and structuring of the environment

It can be said that sustainable education can provide an understanding of the existing life order with social, economic and environmental dimensions, focus on the problems and solutions in the individual's life, and ensure that the individual is equipped by acting as a guide in the transfer of all these conditions to life (Uçar, 2024). The process of sustainable education is aimed at the individual to gain experience through practices and to gain sustainability awareness by integrating these experiences into his/her life (Yazıcı Demir & Hayta, 2023).

Economic Sustainability

It is to continuously increase financial gains, secure existing financial resources and revenues, and obtain new sustainable resources (Uçar, 2024). Economic sustainability covers areas such as economic growth, productivity, production and investment (Karaboğa, 2022). The possibility of resource depletion jeopardizes production. With economic sustainability, risks that may arise in production should be taken under control and environmental protection should be encouraged while producing.

The most basic definition of economic sustainability is the preservation and prevention of capital degradation (Goodland, 2002). However, this traditional approach has changed over time as natural capital has become insufficient and non-renewable to meet needs. The potential for resource depletion is important for economic sustainability. Sustainability is therefore central to the renewable natural resources economy (Vivien, 2008). Economic sustainability is economic development that does not hurt the environment or social sustainability. In other words, an increase in economic capital should not lead to a decrease in natural capital or social capital (KTH Royal Institute of Technology, 2018).

Akgül (2010) defines economic sustainability as “the ability to calculate the benefits beyond the costs”, “the ecological constraint on economic activities”, “the state of balance between economic costs and environmental benefits”. What is referred to as balance here is the entire process of paying attention to the use of natural resources while carrying out economic activities, protecting the renewability of resources, using non-renewable resources sparingly and replacing them with renewable ones.

There are many definitions of the economic dimension of sustainable development, these definitions are determined by four qualities (Baumgartner & Quass, 2009).

- It should focus on the relationship between man and nature,
- It should be oriented towards a long-term and intrinsically uncertain future,
- It should establish justice between man and nature, now as well as in the next generation,
- Economic concerns should not be considered a waste of time in the allocation of man-made and complementary natural goods and services.

The issues addressed in the economic dimension of sustainability are generally: direct reduction of the burden of production on the environment, the use and saving of goods and services, the consumption of goods and services that have a positive impact on human health, and the enhancement of development within global environmental constraints (Siraj-Blatchford et al., 2010).

Social Sustainability

It ensures the continuity of social values and relations for the future. Improvement in the quality of life, protection of rights and freedoms, social equality, and meeting individual basic needs are among the scopes of social sustainability (Tıraş, 2012). It emphasizes the need to work towards common goals. In general, this dimension aims to increase the quality of life of society by increasing the welfare level of society (Uçar, 2024).

Studies on sustainability are mainly addressed within the framework of technological and economic approaches. However, the fact that the issue is related to society and the individual makes it important to approach it from a social perspective (Goel & Sivam, 2015). Social sustainability emphasizes meeting the basic needs of members of society. Sustainable societies should be able to sustain and develop their resources and the flexibility to prevent or solve future problems (City of Vancouver, 2005). Three stages are mentioned in the social dimension of sustainability:

- Improving sustainability: Providing basic needs such as justice, equality and social capital.
- Commitment to sustainability: Changing behaviors for the realization of environmental goals.
- Maintaining sustainability: Preserving socio-cultural characteristics in the face of change (Vallance et al., 2011).

For a society to have social sustainability, individual (human) and social (community) resources are mentioned. While individual resource refers to the actions of individuals that contribute to their welfare and the welfare of society, social resource refers to collective actions (Yücetürk, 2024). According to the

City of Vancouver (2005), for an effective and sustainable society, both individual and social resources should be developed; while ensuring this development, equality, socialization and interaction, safety and adaptability should be taken into consideration. Improving education and health standards, maintaining cultural diversity, respect for human rights and living in standards where basic human rights are practiced are among the goals of social sustainability (Sencar, 2007).

Social sustainability encompasses the concepts of equity, empowerment, accessibility, participation, cultural identity and institutional stability (Daly, 1992). In this context, social sustainability theory posits that poverty alleviation should lead to neither unjust environmental destruction nor economic instability (Mensah, 2019). McKenzie (2004) mentions five basic principles for a society with a social dimension of sustainability. These principles are

- Equality: Equal opportunities should be provided for all members of the community, especially for the least able and most vulnerable.
- Diversity: The community should promote diversity.
- Engagement: Systems and structures for interconnectedness within and outside the community, formal, informal and institutional levels, should be encouraged and provided.
- Democracy and Governance: Ensure democratic processes and transparent and accountable governance structures for the community.
- Quality of Life: Ensure that basic needs are met for all members at the individual, group, and community level and ensure a good quality of life.

Principles of Sustainable Development

Achieving sustainable development is based on a set of principles. However, the dominant message about the principles of sustainable development (Ji, 2018; Mensah & EnuKwesi, 2018) is directed toward the environment, economy and society. One of the fundamental principles of sustainable development is ecosystem protection. The ecosystem and biodiversity need to be protected. The overuse of resources has negative impacts on the environment. Therefore, for development to be sustainable, the use of natural resources should be within the carrying capacity of the earth (Kanie & Biermann, 2017). People are responsible for using and protecting the environment. People are the ones who have to ensure that peace is maintained. These elements can also help to develop a positive attitude towards nature. Education can also influence society to protect the environment and appreciate human values and acceptable production methods (Mensah, 2019). Pearce et al. (1989) examined the principles of sustainable development under six headings:

- Social justice
- Self-governance, community participation, democracy
- A sustainable balance in the use of local and imported resources
- Utilization of the potential local economy
- Environmental protection
- Protection of cultural heritage

Table 1. Sustainable Development Principles (Du Plessis,1998)

	Sustainable Development Principles
Environmental Sustainability	Protection of the vitality and diversity of the earth Protection of life support systems Sustainable use of renewable resources Minimization of the use of non-renewable resources Minimization of pollution and damage to the environment and the health of all living things Protection of the cultural and historical environment
Economic Sustainability	Promote fairness across nations and generations Avoid unequal exchange Do not impoverish one group to enrich another Ensure true cost pricing Promote ethical procurement and investment policies Support equitable distribution of costs and benefits Support local economies
Social Sustainability	Allow for improvement in the quality of human life Promote social justice among peoples Take into account cultural and social integrity Promote self-confidence and free will Encourage cooperation and initiative in decision-making at all levels, from individual to international Provide opportunities for popular empowerment and capacity building

Education for Sustainable Development

Nature and the environment interact with humans (Ozmehmet, 2008). Along with industrialization, many changes that will affect our lives and tomorrow, such as urbanization, population growth, the gap between poor and rich the depletion of resources, have caused people to take action and take measures. The main purpose of these measures has been sustainable development (Bulut & Çakmak, 2018).

The concepts of sustainability and development have various meanings on their own. However, when these concepts are used together, they gain meaning and serve a specific purpose because the concepts of sustainability and development are closely related to each other. The realization of development is

possible with sustainability. Living a balanced life with nature by taking into account the environment and its problems is only possible through education. The reflection of the philosophy of sustainable development on the programs in educational institutions will create a common awareness in all individuals in terms of producing and implementing solutions by sharing the concerns about the common future of the people (Yapıcı, 2003). People who become conscious with education will realize the importance of the environment, will engage in consistent economic activities in order not to disrupt the natural balance and will continue to be an integral part of the social environment (Başgelen Akkaş, 2019).

Raising individuals who have gained knowledge about environmental problems, changed their behaviors and attitudes towards environmental problems, gained awareness about sustainable development, and become sustainable in line with sustainable development goals can be achieved through education (Koçulu, 2018). In addition to being the right of all people to receive a good education, it is also a prerequisite for the realization of sustainable development that promises a better future. Education for sustainable development improves the quality of life of people by enabling informed decision-making, changing individuals' perspectives on the environment they live in, developing democracy, strengthening ties with future generations based on equality, and making our world more beautiful, healthy and livable (BMAEK, 2004). Sustainable development is an approach that is analyzed in terms of environment, people and economy. Education for sustainable development aims to provide people with the knowledge, skills and values necessary to strive for sustainable living and to support sustainable development behavior (Başgelen Akkaş, 2019).

Sustainable development goals can be achieved by having individuals who embrace the goals of sustainable development and make it a lifestyle. For this purpose, it is necessary to raise individuals with sustainable development awareness (Torun, 2024). Raising young minds with environmental awareness and sensitivity and a sense of responsibility is an important step in raising awareness and adopting a sustainable lifestyle for sustainable development to occur. However, teachers who are aware of sustainable development can raise students like themselves (Koçulu, 2018).

Both sustainable development and sustainable development education are vital for all humanity (Kaya & Tomal, 2011). Education for sustainable development will bring a new understanding among students in terms of environmental, economic and social areas and contribute to the development of a sense of responsibility. In addition, it will raise awareness that the choices they make as individuals in society affect all segments of society (Alkış & Öztürk, 2007).

References

Akgül, U. (2010). Sürdürülebilir kalkınma: Uygulamalı antropolojinin eylem alanı.*Antropoji Dergisi, 24*, 133-164.

Akpulat, F. (2019). Sürdürülebilirlik kavramına farklı yaklaşımlar: üniversite öğrencileri üzerine bir araştırma. Yayımlanmamış Yüksek Lisans Tezi. İstanbul Üniversitesi.

Alada, A., Gürpınar, E. & Budak, S. (2012). Rio konferansı üzerine düşünceler. İstanbul Üniversitesi Siyasal Bilgiler Fakültesi Dergisi, no.3-4-5, 93-108.

Alkış, S., & Öztürk, M. (2007). Türkiye'de ilköğretim öğretmen adaylarının ve öğretmen adaylarının görüşlerinde sürdürülebilir gelişme. Geographiedidaktische Forschungen, 42(9), 134-143.

Ataman, C.B. (2020). Ekonomi ve sosyal teoride yeni bir paradigma olarak büyüme. Sosyal Bilimler Dergisi, 5(2), 97-108.

Atmaca, A. C. (2018). *Fen Bilgisi Öğretmen Adaylarının Sürdürülebilir Kalkınma Farkındalıklarının Belirlenmesi.* Yayımlanmamış Yüksek Lisans Tezi. Necmettin Erbakan Üniversitesi, Konya.

Başgelen Akkaş, L. (2019). *Sürdürülebilir kalkınma konusunda yapılan eğitim araştırmalarına yönelik doküman analizi* Master's thesis, Fen Bilimleri Enstitüsü, Kastamonu Üniversitesi.

Baumgartner, S., & Quaas, Martin, F. (2009). What is sustainability economics? *University of Lüneburg Working Paper Series in Economics*, (138).

Bazin, M. S. (2012). *Sürdürülebilir kalkınma*. (G. Gündoğan, Çev.). Caretta Çocuk.

Bener, Ö. & Babaoğul, M. (2008). Sürdürülebilir tüketim davranışı ve çevre bilinci oluşturmada bir araç olarak tüketici eğitimi. Sosyolojik Araştırmalar Dergisi.

BMAEK, (2004). Birleşmiş Milletler Avrupa Ekonomik Komisyonu, Kamu İdaresi Altyapı Geliştirme için Özel Ortaklıklar. Cenevre: Birleşmiş Milletler, www.unece.org/ie/ppp.

Bozlağan, R. (2004). Sürdürülebilir gelişme kavramı üzerine yapılan tartışmalara bir bakış. *Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 18*(3-4), 1-19.

Bulut, B., & Çakmak, Z. (2018). Sürdürülebilir kalkınma eğitimi ve öğretim programlarına yansımaları. McKenzie, S. (2004). Social Sustainability: Towards Some Definitions. Hawke

City of Vancouver (2005, 15 Ağustos 2023*). City of vancouver policy report social development*. https://council.vancouver.ca/20050524/documents/p1.pdf

Daly, H. E. (1992). U.N. conferences on environment and development: retrospect on Stockholm and prospects for Rio. Ecological Economics : the Journal of the International Society for Ecological Economics, 5, 9–14.

Dernbach, J. C. (1998). Sustainable development as a framework for national governance. Case Western Reserve Law Review, 49(1), 1–103.

Dernbach, J. C. (2003). Achieving sustainable development: The Centrality and multiple facets of integrated decision making. Indiana Journal of Global Legal Studies, 10, 247–285.

Du Plessis, C. (1998) The meaning and definition of sustainable developmentin the built environment. Unpublished Mater's Thesis, University of Pretoria.

Duran, M. & Bozok, Ş. (2021). Okul öncesi öğretmen adaylarının sürdürülebilir gelişmeye ilişkin görüşleri. *Journal of Individual Differences in Education*, 3(2), 44-59.

Duru, B. (2016) *"Birleşmiş milletler, unep ve ekolojik bunalım"*, insan, çevre, toplum. Der. Ruşen Keleş, İmge Yayıncılık. Ankara, s. 461-482.

Emrealp, S. (2005). Türkiye yerel gündem 21 programı. IULA-EMME (UCLG-MEWA) Yayını

Evers, B. A. (2018) Why adopt the Sustainable Development Goals? The case of multinationals in the Colombian coffee and extractive sector: Master Thesis Erasmus University Rotterdam

Goel, S. & Sivam, A. (2015). Social dimensions in the sustainability debate: The impact of social behavior in choosing sustainable practices in daily life.*International Journal of Urban Sustainable Development, 7*(1), 61-71.

Goodland, R. (2002). *Sustainability: Human, social, economic and environmental*.(Ted Munn, Ed.), Encyclopedia of global environmental change, içinde (1-3), John Wiley&Sons Ltd.

Gossling-Goidsmiths, J. (2018). Sustainable development goals and uncertainty visualization. Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Cartography.

Gray, R. (2010). Is accounting for sustainability actually accounting for sustainability … and how would we know? An exploration of narratives of organisations and the planet. Accounting, Organizations and Society, 35(1), 47–62.

Güner, U. (2020). *Çevresel sürdürülebilirlik*. (Versiyon 1.0.1 sf.5). Erişim adresi, GoogleBOOKS. E.T: 24.05.2024

Günsoy, B. (2013). Sürdürülebilir kalkınma. Günsoy, G. ve Aktaş, M.T. (Ed.). Doğal Kaynaklar ve Çevre Ekonomisi içinde (Ünite 6). *Eskişehir: Anadolu Üniversitesi Yayınları.*

Guo, F. (2017). The spirit and characteristic of the general provisions of civil law. Law and Economics, 3, 5–16, 54.

Gürbüzer, G. B., & Hayta, A. B. (2020). Sürdürülebilir Kalkınma ile Sürdürülebilir Sigortacılık İlişkisi. Finans Ekonomi ve Sosyal Araştırmalar Dergisi, 5(4), 609-619.

Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable development goals: A need for relevant indicators. Ecological Indicators, 60(1), 565–573.

Hofman, M. (2015). What is an education for sustainable development supposed to achieve-a question of what, how and why. *Journal of Education for Sustainable Development*, *9*(2), 213–228.

Hylton, K. N. (2019). When should we prefer tort law to environmental regulation? Washburn Law Journal, 41, 515–534. Sustainability 2019, 11, 294.

Ji, O. (2015). Education for sustainable development in early childhood in Korea.

Johnson, B., & Lundvall, B. Å. (2013). *Are there alternatives to growth pessimism?: Reflections on how innovation strategies may contribute to sustainable development*. In 2nd Lundvall-Symposium

Kanie, N., & Biermann, F. (2017). Governing through goals; sustainable development goals as governance innovation. Cambridge: MIT Press.

Karaboğa, F. (2022). Sürdürülebilirliğin üç temel boyutu: on birinci kalkınma planı içerik analizi. *Sürdürülebilir Çevre Dergisi*, 2(2), 76-84.

Karademir, A.H., Uludağ, G., Cingi, M.A. (2017). Okul öncesi öğretmen adaylarının sürdürülebilir çevreye ilişkin davranış düzeylerinin incelenmesi. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 41, 120-136.

Kaya, F. & Ek, N.H. (2021). Kalkınmanın çevre sorunları üzerine etkisi: sürdürülebilir kalkınma kavramına bütüncül bir bakış. *Şehir Sağlığı Dergisi*, 2(2), 79-84.

Kaya, M. F., & Tomal, N. (2011). Sosyal bilgiler dersi öğretim programının sürdürülebilir kalkınma açısından incelenmesi. Eğitim Bilimleri Araştırma Dergisi, 1(2), 49-65.

Kayhan, A.K. (2013). Birleşmiş milletler çevre programı üzerine bir inceleme. Public and Private International Law Review, 33(1), 61-90.

Keleş, R. (2023). Dünya'da ve Türkiye'de çevre politikaları ve sürdürülebilir kalkınma. *Çevre, Şehir ve İklim Dergisi*, 1(3), 24-30.

Koçulu, A. (2018). Fen Bilgisi Öğretmen Adaylarının Sürdürülebilir Kalkınma Farkındalıkları İle Çevre Sorunlarına Yönelik Tutum Ve Davranışları Arasındaki İlişkinin İncelenmesi. Yüksek Lisans Tezi, Akdeniz Üniversitesi Eğitim Bilimleri Enstitüsü. Antalya.

Kolk, A. (2016). The social responsibility of international business: From ethics and the environment to CSR and sustainable development. Journal of World Business, 51(1), 23–34.

KTH Royal Instıtute of Teknology, (2018, 8 Eylül 2023). *Economıc Sustaınabılıty*. https://www.kth.se/en/om/miljo-hallbar-utveckling/utbildning-miljo-hallbar utveckling/verktygslada/sustainable-development/ekonomisk-hallbarhet 1.431976

McGrath, S., & Powell, L. (2016). Skills for sustainable development: Transforming vocational education and training beyond 2015. International Journal of Educational Development, 50, 12–19.

McKenzie, S. (2004). Social Sustainability: Towards Some Definitions. Hawke Research Institute, Working Paper Series, 27, 1-31.

Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent social sciences*, *5*(1), 1653531.

Mensah, J., & Enu-Kwesi, F. (2018). Implication of environmental sanitation management in the catchment area of Benya Lagoon, Ghana. Journal of Integrative Environmental Sciences

Mohieldin, M. (2017). The sustainable development goals and private sector opportunities. EAFIT University of Medellín. http://pubdocs.worldbank.orgThe- Sustainable Development-Goals-and-Private-Sector- Opportunities.pdf

Moldan, B., Janousková, S. & Hak, T. (2012). How to understand and measure environmental sustainability: indicators and targets. *Ecological Indicators*, 17(1), 4-13.

Morelli, J. (2011). Environmental sustainability: a definition for environmental professionals. *Journal of Environmental Sustainability*, 1(2), 1-9.

Nakiboğlu, A. & Bozkaya, Ş. (2019). Sürdürülebilir kalkınma kapsamında çevre zirveleri. *Route Educational and Social Science Journal*, 6(11), 934-950.

Ozmehmet, E. (2008). Dünyada ve Türkiye Sürdürülebilir Kalkınma Yaklaşımları. *Yaşar Üniversitesi E-Dergisi, 3*(12), 1853-1876.

Önder, A. & Özkan, B. (2013). *Sürdürülebilir Çocuk Gelişimi: Okul Öncesi Etkinliklerle Çevre Eğitimi.* Anı Yayıncılık.

Özkan, K. B. (2017). *Sürdürülebilir Kalkınma Bağlamında Çevre Sorunlarının Önemi: Türkiye ve AB Karşılaştırması*. Yayımlanmamış Yüksek Lisans Tezi. Bilecik Şeyh Edebali Üniversitesi, Bilecik.

Özkişi, B. (2024). Sürdürülebilir Eğitim ve Çocuk Kitapları. Yüksek Lisans Tezi, Lisansüstü Eğitim Enstitüsü, Bahçeşehir Üniversitesi

Pearce, D. W., Markandya, A., & Barbıer, E. (1989), *Blueprint for a green economy*, Earthscan.

Pressoir, E. (2008). Preconditions For Young Children "Learning And Practice For Sustainable Development. In UNESCO (2008). "The Contribution Of Early

Saner, R., Yiu, L., & Nguyen, M. (2019). Monitoring the SDGs: digital and social technologies to ensure citizen participation, inclusiveness and transparency. Development Policy Review (Wiley). doi:10.1111/ dpr.12433

Saraç, B., & Alptekin, N. (2017). Türkiye'de İllerin Sürdürülebilir Kalkınma Göstergelerine Göre Değerlendirilmesi. *Uluslararası Yönetim İktisat ve İşletme Dergisi, 13*(1), 19-49.

Schaefer, A., & Crane, A. (2005). Addressing sustainability and consumption. Journal of Macromarketing, 25(1), 76–92.

Şeker, F., & Aydinli, B. (2023). A trial patch to sustainable development: perspectives from extracurricular activities of elementary schools in Turkey. Science & Education, 32(2), 421-446.

Şen, H., Kaya, A. & Alpaslan, B. (2018). Sürdürülebilirlik üzerine tarihsel ve güncel bir perspektif. *Ekonomik Yaklaşım Derneği*, 29(107), 1-47.

Sencar, P., (2007), Türkiye'de Çevre Koruma ve Ekonomik Büyüme İlişkisi, Yayımlanmamış Yüksek Lisans Tezi, Trakya Üniversitesi.

Siraj-Blatchford, J., Smith, K. C., & Pramling-Samuelsson, I. (2010). Education for sustainable development in the early years. http://www.omep.org.gu.se/publications/education-for-sustainabledevelopment.

Siraj Blatchford, J., Smith, K.C. & Samuelsson, I.P. (2014). Erken çocuklukta sürdürülebilir kalkınma için eğitim. (M. Toran, Çev.). Hedef CS Yayınları.

Stoddart, H., Schneeberger, K., Dodds, F., Shaw, A., Bottero, M., Cornforth, J., & White, R. (2011). A pocket guide to sustainable development governance. Stakeholder Forum 2011.

Taylor, S. J. (2016). A review of sustainable development principles: Centre for environmental studies. South Africa: University of Pretoria.

Tıraş, H. H. (2012). Sürdürülebilir kalkınma ve çevre: teorik bir inceleme. *Kahramanmaraş Sütçü İmam Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Dergisi*, 2(2), 57-73.

Torun, K. T. (2024). Fen Bilgisi Öğretmen Adaylarının Sürdürülebilir Kalkınma Farkındalıklarının Çeşitli Değişkenlere Göre İncelenmesi Yüksek Lisans Tezi, Necmettin Erbakan Üniversitesi, Konya.

Tosun, E.K. (2009). Sürdürülebilirlik olgusu ve kentsel yapıya etkileri. Paradoks, Ekonomi, Sosyoloji ve Politika Dergisi, 5(2), 49-76.

Türer (2010). *Fen Bilgisi ve Sosyal Bilgiler Öğretmen Adaylarının Sürdürülebilir Kalkınma Farkındalıklarının Belirlenmesi*. [Yayınlanmamış Yüksek Lisans Tezi]. On Dokuz Mayıs Üniversitesi, Samsun.

Turgut, N. (1997). Sürdürülebilir kalkınmanın sağlanmasında katılımın rolü. Ankara Üniversitesi SBF Dergisi, 52(1), 701-715.

Uçar, Z. (2024) İlkokulların Eğitimde Çevresel Sürdürülebilirlik Kapsamında İncelenmesi, Yüksek lisans tezi, Lisansüstü Eğitim Enstitüsü Temel Eğitim Anabilim Dalı, Bolu Abant İzzet Baysal Üniversitesi

UNDP BM 2030 Sürdürülebilir Kalkınma Hedefleri. (2015). https://www.undp.org/

Üzel, H., Atasever, S., İdem, U. & Çelik, T. (2024). Eğitimde sürdürülebilirlik konusuna okul yöneticilerinin bakışı. Ulusal Eğitim Dergisi, 4(1), 127-146.

Valance, S., Perkins, H. & Dixon, J. (2011). What is social sustainability? A clarification of concepts. *Geoforum*, 42, 342-348.

Wanamaker, C. (2018) The Environmental, Economic, and Social Components of Sustainability: The Three Spheres of Sustainability: Adapted from the U.S. Army Corps of Engineers https://soapboxie.com/ social-issues/The-Environmental-Economic-and-Social-Components-of-Sustainability

Yaman, K. & Gül, M. (2018). Kuruluşundan günümüze Avrupa Birliği'nin çevre politikası. *Ekonomi, İşletme ve Yönetim Dergisi*, 2(2), 198-217.

Yapıcı, M., (2003). Sürdürülebilir kalkınma ve eğitim. *Sosyal Bilimler Dergisi*, 5(1), 223-229.

Yazıcı Demir, Y. & Hayta, P. (2023). Türkiye'de eğitim alanında "sürdürülebilirlik" üzerine yapılan tezlerin incelenmesi: tanımlayıcı bir çalışma. *2nd International Conference on Scientific and Academic Research*, 2(1), 476-481.

Yılmaz, H. & Yücel, T. (2022). Sürdürülebilir kalkınmanın sağlanmasında uluslararası çalışmalar ve eleştirileri. *Uluslararası Yönetim Akademisi Dergisi*, 5(3), 691-702.

Yücel, C. & Kurnaz, L. (2021). Yeni gerçeğimiz sürdürülebilirlik. Yeni İnsan Yayınevi.

Yücetürk, T. (2024). Okul Öncesi Eğitim Kurumlarının Sürdürülebilirlik Özellikleri Bakımından Çok Yönlü Değerlendirilmesi. Yüksek Lisans Tezi Trakya Üniversitesi Sosyal Bilimler Enstitüsü.

Yüksel, A. & Barut D. (2023). Uluslararası çevre hukukunda sürdürülebilir kalkınma. *Çevre, Şehir ve İklim Dergisi*, 2(3), 32-58.

Zhai, T. T., & Chang, Y. C. (2019). Standing of environmental public-interest litigants in China: Evolution, obstacles and solutions. Journal of Environmental Law, 30, 369–397.

Zoller, U. (2015). Research-based transformative science/STEM/STES/STESEP education for “sustainability thinking: From teaching to know to learning to think. *Sustainability, 7*, 4474–4491.

Chapter 2

Introduction to Data Analysis: Data Organization and Basic Statistical Criteria

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Statistics is a tool that can easily solve complex processes when you follow the right steps. Correct analysis of the data collected in social science research also affects the accuracy of the results obtained. In this section, statistical methods used in organizing, summarizing and interpreting data, which are the critical first steps of data analysis, are examined. In this context, firstly, it is shown how raw data are organized and made meaningful, and then the use of measures of central tendency and dispersion are presented in an applied manner. Supported by examples, this chapter provides the reader with a practical guide to interpreting data in a meaningful way.

1. Data Organization

1.1. Frequency Tables

The use of tables and graphs is very important in organizing and describing the data obtained as a result of any observation. Organizing raw data is the first step in making the data meaningful. For example, in Table 1, the statistical exam results of 50 students are given as raw data. Examine the table carefully and answer the following questions quickly.

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Table 1. Statistical examination results for 50 students (raw data)

Score	Score	Score	Score	Score
45	88	85	45	45
88	60	80	37	35
85	38	63	47	58
63	58	58	58	45
63	80	80	76	84
35	58	76	45	34
56	50	80	84	96
76	56	56	76	92
50	56	45	37	50
33	33	63	80	34

- What is the highest score in the exam?
- What is the lowest score on the exam?
- What is the most common score on the exam?
- What is the difference between the highest score and the lowest score?
- When the scores are ranked, what is the score in the middle?

In unorganized data, it will be very difficult to answer the above questions quickly and accurately, especially when the number of data is large. In order to make healthier evaluations of the raw data, the data must first be organized. Organized data (primitive series) is obtained by sorting the raw data from small to large or from large to small. In Table 2, the primitive series of the exam results of 50 students is presented below.

Table 2. Organized statistical exam results of 50 students (primitive series)

Score	Score	Score	Score	Score
33	45	56	63	80
33	45	56	63	80
34	45	56	63	84
34	45	58	76	84
35	45	58	76	85
35	47	58	76	85
37	50	58	76	88
37	50	58	80	88
37	50	60	80	92
45	56	63	80	96

When Table 2 is analyzed and the questions are answered again, it is seen that the highest score is 96, the lowest score is 33 and the difference between the highest and lowest score is 67. The score of 45 was the most frequently occurring score (4 times) and the score in the middle was 63.

Although converting data sets into primitive series facilitates interpretation, it may not be practical in some cases, especially when there is more than one repetitive data and especially when the number of data is large. One of the ways to interpret the data in a more meaningful way is to prepare frequency tables. Frequency is the number of times a characteristic is repeated. At the same time, frequencies are divided into two as "absolute frequency" and relative (proportional) frequency" (Çil, 2000). Absolute frequency (f): It is the number of repetitions of each value in the data. Relative (proportional/relative) frequency (fr): The ratio of each absolute frequency to the total number of observations (fr=f/n). The following columns are included in the frequency tables:

Cumulative frequency (F): Cumulative sum of frequency values. A sample frequency table is given in Table 3.

Table 3. Frequency table example

X	f_i	F
10	5	5
15	3	5+3=8
20	6	8+6=14
25	2	14+2=**16**
$n = \sum_{i=1}^{4} f_i = \mathbf{16}$		

Cumulative frequency values are calculated by summing the previous frequencies in each row. The cumulative frequency value in the last row and the sum of the frequencies (n) must be equal to each other.

Cumulative percentage (F%): The ratio of cumulative frequencies to each absolute frequency given as a percentage ($F\% = \frac{F}{n}100$)

Table 4 presents the frequency, absolute frequency, relative frequency, cumulative frequency and cumulative percentage values of 50 students' physics course scores.

Table 4. Frequency table for physics examination scores

X	f_i	%	F	F%
50	2	4	2	4
52	2	4	4	8
55	4	8	8	16
58	4	8	12	24
63	4	8	16	32
64	2	4	18	36
65	4	8	22	44
67	5	10	27	54
68	3	6	30	60
71	3	6	33	66
75	7	14	40	80
77	2	4	42	84
84	8	16	50	100
	$n = \sum_{i=1}^{13} f_i = 50$	Total=100		

When the values in the table are analyzed, it is seen that a total of 50 students received the lowest score of 50 and the highest score of 84 in the physics exam, the gap between the scores was 34, and 84 points were received most frequently in the class (8 people). When calculating the values, the sum of the absolute frequencies and the last line of the cumulative frequency must be the same (50). Similarly, the sum of the relative frequency (%) and the last row of the cumulative percentage should be 100. Four different types of frequencies are given in the table. For example, the frequencies for 67 points are interpreted as follows:

- Absolute frequency: 5 students scored 67 points (f=5).
- Relative frequency (%): 10% of the class scored 67 points.
- Cumulative frequency (F): 27 students scored between 67 and 50.
- Cumulative percentage (F%): 54% of the class scored between 67 and 50.

Data Grouping

Data grouping (classification) can be used in cases where the number of raw data is too large, there are too many values with a frequency of one (too many unique values), or the data are in a wide range. Grouping is the process of common classification of data values within certain limits (Çil, 2000). The point to be considered here is that the group intervals for each group should be equal and each data should be in only one group (Ravid, 2010). While in some cases the number of

groups is determined by the researcher, the most common method used to determine the number of groups is Sturges' Rule and is given in Equation 1.

k = 1+3.332 log (n); Equation (1)

- k: number of groups
- n: number of data

After determining the number of groups, the group spacing in Equation 2 is calculated.

$$\text{Group range} = \frac{\text{max value} - \text{min value}}{\text{number of groups (k)}}; \text{ Equation (2)}$$

For example, the preparation of the grouped frequency distribution for the physics scores of 50 students in Table 5 is given below.

First, the number of groups (k) and then the group range are determined.

$$k=1+3.332\times\log(50)= 6{,}61 \cong 7$$

$\text{Group range} = \frac{84-50}{7} = 4{,}86$ and rounding this value to the nearest whole number gives a group interval of 5.

Table 5. Frequency distribution of grouped data

Groups	The group Mean Value (X_i)	True Range of the Group	f_j	%	F	F%
50-54	52	49,5-54,5	4	8	4	8
55-59	57	54,5-59,5	8	16	12	24
60-64	62	59,5-64,5	6	12	18	36
65-69	67	64,5-69,5	12	24	30	60
70-74	72	69,5-74,5	3	6	33	66
75-79	77	74,5-79,5	9	18	42	84
80-84	82	79,5-84,5	8	16	50	100
			$\sum_{j=1}^{7} f_j = 50$	100		

Unlike the ungrouped data, in the grouped frequency tables, it is seen that the details of each data are missing. For example, it is seen that the physics scores of 12 students are between 65-69. However, it is not known how many of these students scored 65, 66, 67, 68 and 69. Therefore, group medians (Xi) representing each group

are calculated. Accordingly, it is assumed that the weight of the physics scores of 12 students is 65+69=67. The actual range of the group, by definition of the continuous variable, allows the lower and upper limits of the groups to be determined precisely when grouping the data of these variables. By subtracting 0.5 from the lower boundaries of each group and adding 0.5 to the upper boundaries, it helps to eliminate the gaps between the groups and to merge the groups exactly.

1.2. Interpretation of Data with Graphs

Various graphs are used to summarize and interpret the data. The preferred graphics differ according to the type of data and variables (Mann, 1992; Smith, 1962). In this section, bar, circle, histogram and frequency polygon are discussed.

1.2.1. Bar Graph

It is used to summarize data on qualitative or discrete variables such as gender and blood group. For example, the bar graph for the blood groups of 200 individuals is as follows.

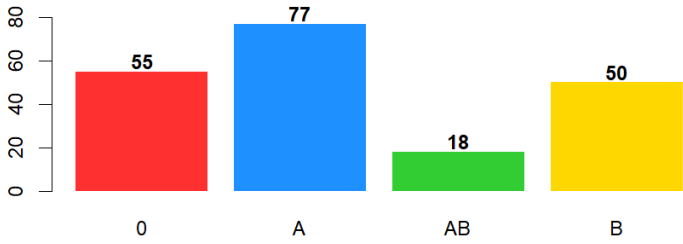

Figure 1. Bar graph of blood groups of 200 individuals

1.2.2. Circle Graph

Similar to the bar graph, it is also used to summarize data on qualitative or discrete variables. In the circle graph, relative frequency values need to be obtained. For example, the blood groups of 150 individuals are as follows:

Table 6. Frequency distribution of blood groups of ındividuals

Blood Groups	f	%
0	60	40
A	50	33,3
B	30	20
AB	10	6,7

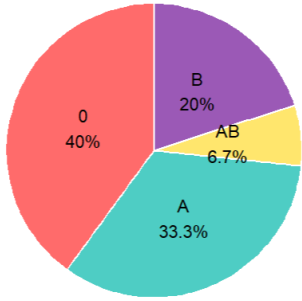

Figure 2. Circle graphic of blood groups of individuals

1.2.3. Histogram Graph

Histogram graph is used to summarize continuous data (Büyüköztürk, Çokluk, & Köklü, 2015). The data in Table 5 are presented in the histogram graph in Figure 3.

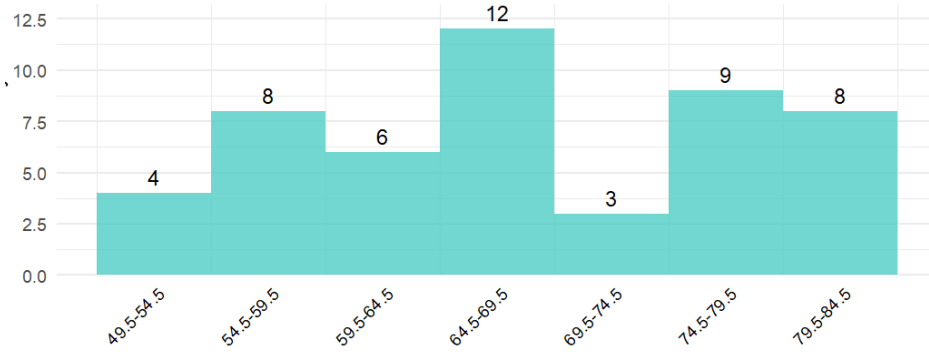

Figure 3. Histogram graph for the scores of 50 students

1.2.4. Frequency Polygon

It is obtained when the midpoints of the group intervals in the histogram graph are combined (Büyüköztürk, Çokluk, & Köklü, 2015). The frequency polygon obtained from the histogram graph in Figure 3 is presented in Figure 4.

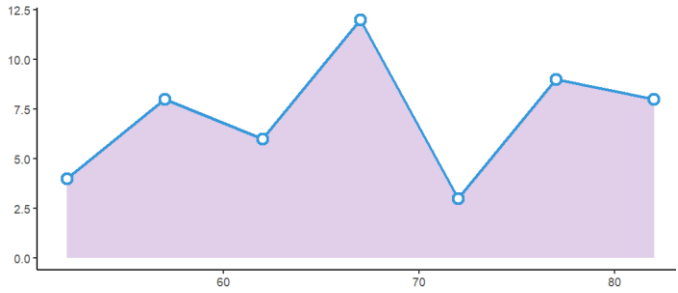

Figure 4. Frequency polygon

2. Measures Of Central Tendency

The central value is the value that best represents all values in a data set and is also known as measures of central tendency (mode, median/median and mean) (Salkind, 2010). Therefore, measures of central tendency indicate a central value around which all values of a variable in a data set are gathered (Oral Erbaş, 2019).

2.1. Mode

It is the value with the highest frequency or the most repeated value in a data. It is calculated in data measured at least at the classification level. It is also the only measure of central tendency that can be calculated at the classification level and in qualitative data (Akhun, 1988; Baykul, 1999). Figure 5 shows the bar graph of unimodal (mode=67) and bimodal (mode= 62 and 77) data.

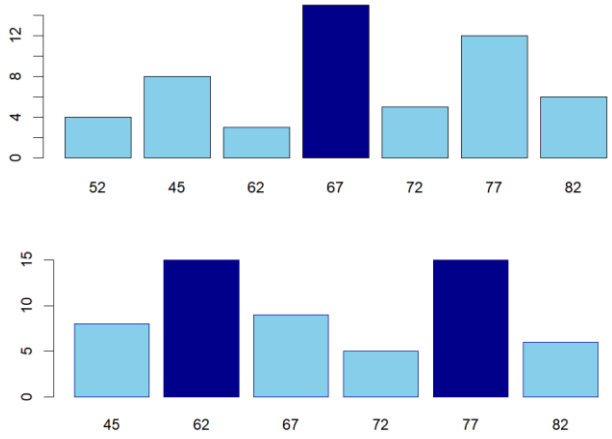

Figure 5. Bar graph for single mode and dual mode data

2.2. Arithmetic Mean

It is one of the measures of central tendency representing all values in the data.

2.2.1. Arithmetic mean for the population and sample for ungrouped data

There are some differences in the representation of the arithmetic mean obtained from the population and the sample. The arithmetic mean is denoted by μ if it belongs to the population and $\bar{X}$ if it belongs to the sample. The arithmetic mean of the population for simple ungrouped data is given in Equation 3.

$$\mu = \frac{\sum_{i=1}^{N} X_i}{N} = \frac{X_1+X_2+\cdots+X_N}{N}; \text{ Equation (3)}$$

- μ: Arithmetic mean of the population
- N: Total number of frequencies of the population

The arithmetic mean of the sample in ungrouped simple data is given in Equation 4.

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{X_1+X_2+\cdots+X_n}{n}; \text{ Equation (4)}$$

- $\bar{x}$: Arithmetic mean of the sample
- n: Total number of frequencies of the sample

The arithmetic mean of the sample for data with ungrouped frequency distribution is given in Equation 5.

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i f_i}{n} = \frac{X_1 f_1+X_2 f_2+\cdots+X_n f_n}{n}; \text{ Equation (5)}$$

For example, the final exam scores of 10 students in the statistics course are X: 53, 65, 78, 71, 71, 63, 83, 27, 42, 82 and 46. The arithmetic mean of the students' scores;

$$\bar{x} = \frac{\sum_{i=1}^{n} X_i}{n} = \frac{\sum_{i=1}^{10} X_i}{10} = \frac{53+65+78+71+63+83+27+42+85+46}{10} = \frac{610}{10} = 61.$$

2.2.2. Arithmetic mean of the population and sample for grouped data

The arithmetic mean of the population for the grouped data is given in Equation 6.

$$M = \frac{\sum_{j=1}^{k} X_j f_j}{N} = \frac{X_1 f_1+X_2 f_2+\cdots+X_k f_k}{N}; \text{ Equation (6)}$$

- μ: arithmetic mean of the population
- N: number of data belonging to the population
- k: number of groups
- X_j: middle value of the group
- f_j: frequency value of the group

The arithmetic mean of the sample for grouped data is given in Equation 7.

$$\bar{x} = \frac{\sum_{j=1}^{k} X_j f_j}{n} = \frac{X_1 f_1 + X_2 f_2 + \cdots + X_k f_k}{n}; \text{ Equation (7)}$$

- $\bar{x}$: arithmetic mean of the sample
- n: number of data for the sample
- k: number of groups
- X_j: middle value of the group
- f_j: frequency value of the group

For example, the statistics course exam scores of 50 students are given in Table 7.

Table 7. Statistics course examination scores

Group No	X	X_j	f_j	$X_j * f_j$
1	50-54	52	4	52*4=208
2	55-59	57	8	57*8=456
3	60-64	62	6	62*6=56
4	65-69	67	12	67*12=804
5	70-74	72	3	72*3=216
6	75-79	77	9	77*9=693
7	80-84	82	8	82*8=656
			$n = \sum_{j=1}^{7} f_j = 50$	$\sum_{j=1}^{7} X_j f_j = 3089$

$$\bar{x} = \frac{\sum_{j=1}^{7} X_j f_j}{n} = \frac{208+456+56+804+216+693+656}{50} = \frac{3089}{50} = 61{,}78.$$

2.3. Median

The median is the value in the middle when all values in a data are sorted (from smallest to largest or from largest to smallest). The median value is in the middle of the data and half of the data is below the median and the other half is above the

median value (See Figure 5). The median is also more useful than the mode (Mann, 1992; Smith, 1962).

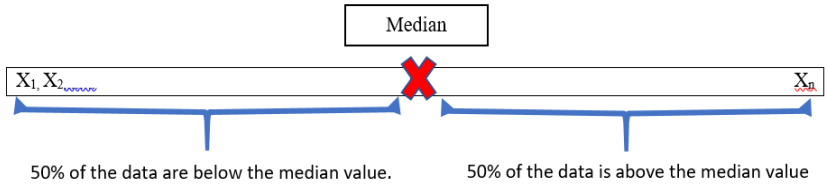

Figure 6. Location of the median value in the data

2.3.1. Calculation of median value in ungrouped data

There is no standard formula for calculating the median. Obtaining the median differs depending on whether the number of data is odd or even. If the number of elements in the data set is odd, the median value is obtained as in the example below.

For example, the height (cm) of 9 students: 154, 145, 153, 165, 165, 161, 156, 169, 169, 158, 163. First, the data should be sorted from smallest to largest (thus obtaining a primitive series). Then (n+1)/2=(9+1)/2=5th student's height is obtained as the median value.

X	145	153	154	156	**158**	161	163	165	169
Orderno	1	2	3	4	**5**	6	7	8	9

If the number of elements in the data is even, the median value is obtained as in the example below.

For example, the height (cm) of 10 students: 160, 153, 165, 145, 154, 154, 168, 161, 156, 169, 158. First, the data should be sorted from smallest to largest (thus obtaining a primitive series). Then the ordinal numbers $\left(\frac{n}{2}\right)$ and $\left(\frac{n+2}{2}\right)$ of the two values in the middle are found and their averages are calculated. From this, the mean of (n/2)=5th place value (158) and (n+2)/2=12/2=6th place value (160) is calculated and the median value is 159 cm ((158+160)/2=159).

X	145	153	154	156	**158**	**160**	161	165	168	169
Orderno	1	2	3	4	**5**	6	7	8	9	10

2.3.2. Calculation of median value in grouped data

Cumulative frequency values are used to calculate the median value in grouped data. Since the data are summarized in groups in grouped data sets, it is difficult to directly find out which value is in the middle, that is, which value is the median (Çil, 2000). After first finding which group the median is in (the group corresponding to the n/2nd rank), Equation 8 is used to calculate the median value.

$$\text{Median} = L_{low} + \left(\frac{n/2 - f_c}{f_{med}}\right) a \text{ ;Equation (8)}$$

- L_{low}: lower limit of the median group
- f_c: cumulative frequency value of the group before the median group
- f_{med}: frequency of the median group
- a: frequency of the median group

For example, Table 8 shows the statistics scores of 50 students.

Table 8. Frequency distribution of statistics scores of 50 students

Group no	Groups	f_j	F
1	50-54	4	4
2	55-59	8	12
3	60-64	6	18
4	**65-69**	**12**	**30**
5	70-74	3	33
6	75-79	9	42
7	80-84	8	50

For the statistics scores of 50 students, the score of the student ranked n/2=50/2=25th is the median value. The score in 25th place is within the cumulative frequency=30 and therefore the fourth group (65-69) is the median group. Then the median value is;

$$\text{Median} = L_{low} + \left(\frac{n/2 - f_c}{f_{med}}\right) a = 65 + \left(\frac{50/2 - 18}{12}\right) 5 = 67{,}9$$

3. Measures Of Central Dispersion

It may be insufficient to examine the data only according to measures of central tendency. For example, let the scores of 5 students from 3 different courses be as follows.

Table 9. Scores from three different courses

Econometrics X_E	Physics X_K	Statistics X_i
0	45	67
87	50	67
77	65	67
71	75	67
100	100	67
$\sum X_E = 335$	$\sum X_P = 335$	$\sum X_S = 335$

Although the average scores of the courses are equal, the scores are different from each other. The score distributions of the courses are given in the graphs in Figures 7, 8 and 9 respectively.

Figure 7. Score distribution of the econometrics course

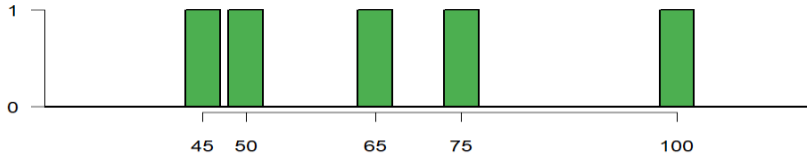

Figure 8. Score distribution of the physics course

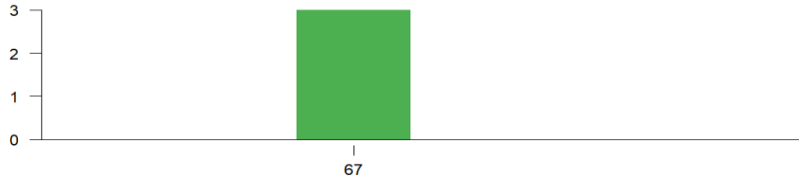

Figure 9. Score distribution of statistics course

When the graphs are analyzed, it is seen that students received scores between 0 and 100 in econometrics course and the spread of scores is higher than in other courses. In the physics course, it is seen that the scores spread between 45 and 100, and all the scores obtained from the statistics course do not differ from each other, that is, they are the same. Although the averages of all courses are equal, the spread in scores or the differentiation in scores can be understood more clearly in the graphs. Dispersion or distribution is the differentiation of the values in the data set from each other and from the average (Çil, 2000). The average of the three courses above was 67. It is seen that the maximum spread between the scores is in Figure 7, followed by Figure 8. Therefore, as the scores move away from the mean, it is seen that there is more spread.

There are different measures of dispersion to examine the spread or distribution of scores in more detail. In this section, the measures of range, quartile deviation, mean deviation and standard deviation are discussed.

3.1. Ranj

Range is the difference between the highest score and the lowest score in a data. The range, which is used to compare groups with equal means and the same total frequency (Σf=n) (Büyüköztürk, Çokluk, & Köklü, 2015), shows how far the scores are from each other (Salkind, 2010). The range does not provide information about how much each score in the data differs from each other (Salkind, 2010), but only general information about the spread of scores around the mean (Çil, 2000).

3.1.1. Calculation in ungrouped data

It is calculated by finding the difference between the highest value and the lowest value in ungrouped data.

$Ranj = X_{max} - X_{min}$

For example, the weights of 10 individuals: 65, 48, 56, 66, 59, 72, 63, 71, 83, 91. In this case, the range= 43.

3.1.2. Calculation in grouped data

In grouped data, the difference between the middle value of the last group and the middle value of the first class gives the range value. According to some authors, the range is calculated as the difference between the upper limit of the last group and the lower limit of the first group (Çil, 2000). For example, the data on the daily study times of 200 students are given in Table 10 as 8 groups.

Table 10. Frequency distribution of students' study periods

Group no	Time (minutes)	The Group Mean Value (X_j)	f_j
1	25-33	**29**	11
2	34-42	38	22
3	43-51	47	26
4	52-60	56	29
5	61-69	65	35
6	70-78	72	42
7	79-87	83	18
8	88-96	**92**	17
			$n = \sum_{j=1}^{8} f_j = 200$

According to the data in the table, before calculating the range, the median values of each group are obtained and then the range is calculated as =92-29=63.

Ratio, which is easy to obtain and is calculated only by finding the difference between the highest and lowest value in the data, may give misleading information in some cases. For example, Test A and Test B are administered to a group of 25 people.

The scores on Test A: 3, 55, 57, 59, 62, 55, 55, 58, 45, 45, 48, 48, 48, 48, 48, 63, 63, 63, 63, 66, 66, 66, 66, 66, 97.

Scores from Test B: 3, 3, 59, 3, 18, 12, 25, 25, 36, 38, 48, 48, 52, 52, 90, 95, 97, 40, 63, 76, 73, 50, 82, 88, 97.

The graph showing the results of Test A and Test B are given in Figures 10 and 11 respectively.

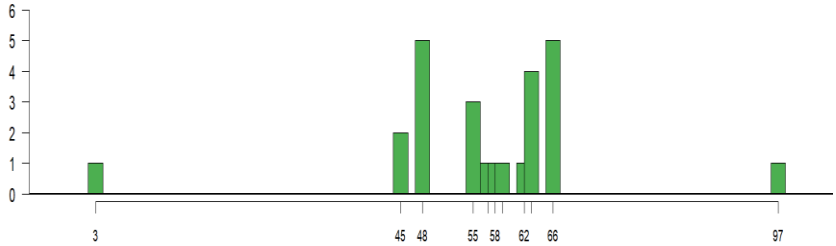

Figure 10. Score distribution of Test A

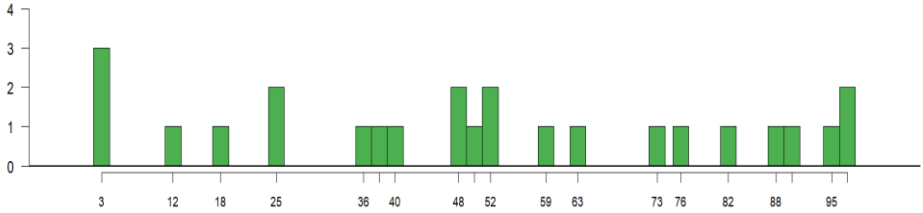

Figure 11. Score distribution of Test B

Although the ranges of both test scores are equal to each other (range=97-3=94), it is seen in the graphs that the variations in the scores are different. This is because of the extreme values in Test A. When examined carefully, it is seen that 23 students generally scored between 45 and 66. Therefore, it may be misleading to make a decision about the spread by looking only at the range value without examining the data.

3.2. Quartile Deviation

Especially when there are outliers in the data set, the interpretation of the range will be inconvenient. Therefore, the quartile deviation is calculated instead of the range, which is sensitive to extreme values. In addition, when comparing data belonging to more than one group, it can be said that the spread in the group with a larger quarter deviation is higher (Çil, 2000).

Quartile deviation is a measure of central dispersion obtained by dividing the difference of the values corresponding to the 75th percentile and the 25th percentile

by two after sorting the data from smallest to largest. As seen in Figure 12, there are three quartile values.

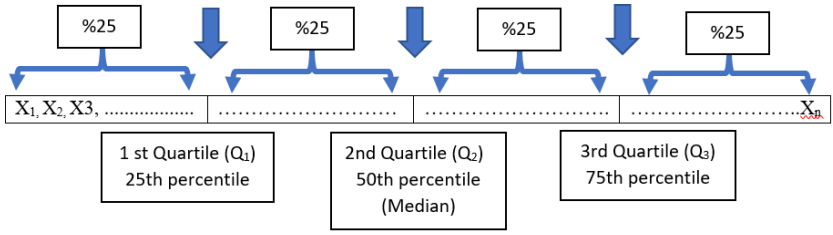

Figure 12. First quartile, second quartile, and third quartile

Figure 12 shows that the first quartile (Q1) is the 25th percentile, the second quartile (Q2) is the 50th percentile and the third quartile (Q3) is the 75th percentile. The second quartile, Q2, is also the median value and is located in the middle of the data set. The rationale for the quartile deviation is that it does not take into account outliers that may be in the top 25% and bottom 25%, and so in the presence of outliers, the quartile deviation is used instead of the range.

For ungrouped data, the quarter deviation is calculated according to Equation 9 (Mann 1992; Smith, 1962).

$$Q = \frac{Q_3 - Q_1}{2} \text{ ; Equation (9)}$$

For example, the quarter deviation of 25 students' scores on Test B is calculated as follows.

X: 3, 3, 59, 3, 18, 12, 25, 25, 36, 38, 48, 48, 52, 52, 90, 95, 97, 40, 63, 76, 73, 50, 82, 88, 97

First, the scores must be ranked in descending order.

X: 3, 3, 3, 12, 18, 25, 25, 36, 38, 40, 48, 48, 50, 52, 52, 59, 63, 73, 76, 82, 88, 90, 95, 97, 97

Then the rank of the score at the 25th percentile is (25/100)*(n+1)=6.5. That is, it is the average of the values in the 6th and 7th rank (Q_1=25).

The rank of the score in the 25th percentile is (75/100)*(n+1)=19.5. That is, it is the average of the values in the 19th and 20th places (Q_3=79).

Therefore, the quarter deviation is $Q = \frac{Q_3 - Q_1}{2} = \frac{79-25}{2} = 27$.

3.3. Mean Deviation

Deviation from the mean is the average of the absolute value of the differences of each value in the data from the mean (Çil, 2000; Salkid, 2010). For example, let the average of the final exam of the statistics course in a class of 50 students be 65.

Let's calculate how far or how different each student's score is from the average. For example, if Ali scored 45 points, then Ali's score is 20 points lower (further away) from the class average. Similarly, Sukran, who scored 80 points, scored 15 points higher (farther) than the average. In these procedures, the distances (X-$\overline{X}$) of the scores from the mean were calculated. When the distances of all students' scores from the mean are summed, 0 is obtained. For example, the scores of 5 students are 25, 45, 65, 75 and 90.

Table 11. Statistics final scores of 5 students

Students	X	X-$\overline{X}$	IX-$\overline{X}$I
A	25	25-60= -35	35
B	45	45-60= -15	15
C	65	65-60= 5	5
D	75	75-60 =15	15
E	90	90-60= 30	30
	$\overline{X} = \frac{300}{5} = 60$	$\sum_{i=1}^{5}(X_i - \overline{X}) = 0$	$\sum_{i=1}^{5} IX_i - \overline{X}I = 100$

The deviation of the statistical scores from the mean is 100/5=20.

3.4. Standard Deviation

Standard deviation, the most important measure of central dispersion, is calculated by taking the squares of the differences of the scores from the mean. The standard deviation is the average of the variability of the values in the data. If the standard deviation is 0, the scores are the same and there is no variability between the scores. As the standard deviation value increases, the spread between scores increases (Salkind, 2010). Variance is obtained by squaring the standard deviation. The standard deviation value is calculated according to Equation 10 (Akhun, 1988; Blalock, 1972).

$$S = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \overline{X})^2}{n-1}}; \text{ Equation (10)}$$

For example, statistics final exams of 5 students are given in Table 12.

Table 12. Statistics final scores of 5 students

Students	X	$X-\bar{X}$	$(X-\bar{X})^2$
A	25	25-60= -35	$(-35)^2=1225$
B	45	45-60= -15	$(-15)^2=225$
C	65	65-60= 5	$5^2=25$
D	75	75-60 =15	$15^2=225$
E	90	90-60= 30	$30^2=900$
	$\bar{x} = \frac{300}{5} = 60$		$\sum_{i=1}^{5}(X_i - \bar{X})^2 = 2600$

Standard deviation is found to be $S = \sqrt{\frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{n-1}} = \sqrt{\frac{2600}{4}} = 25{,}5.$

Variance is found to be $S^2 = \frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{n-1} = 650.$

References

Akhun, İ. (1988). *Temel istatistiksel kavramlar* (3. baskı) [Basic statistical concepts]. Hacettepe Üniversitesi.

Baykul, Y. (1999). *İstatistik metotlar ve uygulamalar* (3. Baskı). Anı Yayıncılık.

Blalock, H. M., Jr. (1979). *Social statistics* (2nd ed.). McGraw-Hill.

Büyüköztürk, Ş., Çokluk, Ö. & Köklü (2015). *Sosyal bilimler için istatistik* (15. Baskı). Pegem.

Çil, B. (2000). *İstatistik*. Detay Yayıncılık.

Erbaş, S. O. (2019). *Olasılık ve istatistik: Problemler ve çözümler ile* [Probability and statistics: With problems and solutions]. Gazi Kitabevi.

Mann, P. S. (1992). *Introductory statistics* (7th ed.). Wiley.

Oral Erbaş, S. (2019). *Olasılık ve istatistik: Problemler ve çözümleri ile.* Gazi Kitabevi.

Ravid, R. (2010). *Practical statistics for educators* (4th ed.). Rowman & Littlefield.

Salkind, N. J. (2010). *Statistics for people who (think they) hate statistics*. SAGE Publications.

Smith, G. M. (1962). *A simplified guide to statistics for psychology and education* (3rd ed.). Holt, Rinehart and Winston.

Chapter 3

Innovation Process of School Based Management

Fethi KAYALAR[1]

Introduction

Education has been one of the central issues of innovation and regulations in many countries. At the same time, education has been accepted as one of the most important tools in reaching the intended goals (Kurt, 2006). In order for the change and innovation movement in the education process, which has an extremely complex structure, to be more efficient and effective, the determined goals and education policies should be defined clearly and regularly and reviewed at regular intervals. Although this situation is not a big problem in developed countries, it cannot be said that sufficient research has been done in the inspection and control stages in developing countries (Karip, 1998). In order to ensure organizational continuity, members of the organization should be able to keep up with the rapidly changing environmental conditions and even stay ahead of the times. The relevant information should be collected and made ready for use by the organizations (Ömür, 2014). This allows organizations to decide how and to what extent they will initiate innovation. Organizations should continue to innovate in order to keep up with the changing environment, never become complacent and should direct the environment with these innovation strategies. In other words, organizations need to affect and be affected by their innovation strategies (Acaray, 2007).

Many factors such as globalization, acceleration of communication, importance of information and development of information technologies, and increase in consumer awareness have caused an increase in competition at national and international levels. Businesses should be able to compete both domestically and internationally. However, this requires a different management style. It is predicted that the chances of survival of companies that cannot adapt to the speed and concept of changes affecting all aspects of today's business life will decrease (Türksoy, 2005). In order for companies to be successful and survive in a competitive environment, they need to have some elements of

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competition. Competition factors such as strategic effectiveness, common competition, product and service quality, cost savings, innovation, continuity and stability are very important for the success of companies in a competitive environment (Zerenler et al., 2007).

Innovation processes define the activities at each development stage of innovation. Innovation management is the management and organization of these innovation processes (Opeiraylo, 2022; Güzen, 2020). Innovation management is a management practice that aims to advance the organizational goals of innovation in the field. Today, almost all individuals in a society are required to receive education in schools. Therefore, the education provided by school organizations affects the entire future of a society. The most general effect of innovation in education is the change of society; its most specific effect is the preparation of the individual for society with positive changes (Göl and Bülbül, 2012). Innovation in educational management includes various strategies and concepts aimed at creating a dynamic and effective learning environment (Novitawaty, 2024).

School-based Management

School-based Management (SBM) is one of the models of educational innovation in many countries, as the estuary of educational decentralization within the framework of the educational reform process, in this case educational innovation is an activity of trying new ways is a necessity (Fullan, & Watson, 2000; Siahaan, et al. 2006). SBM is a formal process involving the principal, teachers, parents of students, students and the community close to the school in the process of making various decisions. SBM is a strategy that raises the concept of empowerment and empowers all individuals in the school (Honig and Rainey, 2012; Rosyada, 2004).

Rusdiana (2014) explained that SBM is essentially a harmonization of resources carried out independently by schools by involving all stakeholders directly related to the school in the decision-making process to meet the needs of improving school quality or achieving national education goals. Drury and Lewin (2014) and Kamars (2004) stated that SBM means a management model that provides greater autonomy to schools and encourages participatory decision-making that directly involves all school members (teachers, students, principals, staff, parents and the community), to improve school quality based on national education policies (Ananda, 2017).

SBM is defined as a management model that provides greater autonomy or independence to schools in participatory decision-making that directly involves all school members according to quality standards related to the needs of infrastructure, school facilities, improving the quality of the curriculum and teacher job growth. SBM is a school management model that provides autonomy

to schools and encourages participatory decision-making that directly involves all school members and the community served while remaining in line with national education policies.

Based on the explanation above, it can be interpreted that SBM is a form of educational management autonomy in educational units, in which case the principal and teachers are assisted by the school committee in managing educational activities. The essence of SBM is the granting of school autonomy in order to improve school quality. School autonomy can also be interpreted as the granting of more independent authority to schools which contains the meaning of self-initiative, self-work, self-financing, self-management, and self-sufficiency. It can also be defined as the management of resources carried out independently by schools, by involving all interest groups related to the school in decision-making, to achieve the goal of improving school quality. Important elements contained in the definition of SBM include:

- Management is interpreted from two perspectives, namely the process and components of school management.

As a process, school management is in the form of a system whose components include planning, organizing, implementing, and supervising. In terms of its components, school management includes: (a) curriculum and learning, (b) students, (c) educators and education personnel, (d) financing, (e) facilities and infrastructure, (f) school and community relations, and (g) school culture and environment.

- School resources include human resources, funds, facilities and infrastructure.
- Student-centered learning strategies, including PAKEM.
- Implementation of a conducive school culture and environment.
- Community participation.
- Achievement of school quality improvement goals.

Objectives of School Based Management

In general, SBM aims to increase school independence by providing greater authority in managing school resources, and encouraging the participation of all interest groups related to the school in decision-making to improve school quality. Specifically, SBM aims to:

- Foster and develop curriculum and learning management components.
- Foster and develop student management components.
- Foster and develop educator and education personnel management components.
- Foster and develop facilities and infrastructure management components.
- Foster and develop financing management components.

- Foster and develop school and community relationship management components.
- Foster and develop school culture and environment management components.

In line with the explanation above, Sagala (2005) explains the objectives of SBM as follows:

- Ensure the quality of student learning based on the principles of service and learning achievement.
- Improve the quality of knowledge transfer and build a cultured national character.
- Improve school quality by strengthening empowerment through independence, creativity, initiative and innovation in managing and empowering school resources.
- Increase the concern of school residents and the community in organizing education through decision making by accommodating shared aspirations.
- Increase school responsibility to parents, the community and the government regarding school quality.
- Increase healthy competition between schools regarding the quality of education to be achieved.

Furthermore, according to Kamars (2004) the objectives of SBM are:

- Improve the quality of education through school independence (autonomy) and initiative (initiative) in managing and empowering available resources.
- Increase the concern of school residents and the community in organizing education through joint decision making.
- Increase the responsibility of schools to parents, the community and the government regarding the quality of their schools.
- Increase healthy competence between schools regarding the quality of education to be achieved.

Based on the explanation above, related to the objectives of implementing SBM, this shows the rationality of implementing SBM. In this case, the reasons for implementing it are explained by Kamars (2004) as follows.

- Schools are more aware of their strengths, weaknesses, opportunities and threats to themselves.
- Schools are more aware of the needs of their institutions, especially the educational input that will be developed and the level of development and needs of students.

- Decision-making that will be carried out by schools is more suitable to meet school needs.
- The use of educational resources is more efficient and effective when controlled by the local community.
- The involvement of all school residents and the community in school decision-making creates transparency and healthy democracy.
- Schools can be responsible for the quality of education to the government, parents of students and the community.
- Schools can quickly respond to the aspirations of the community and the environment that are changing rapidly.

Characteristics of School Based Management

The characteristics of SBM are inseparable from the characteristics of an effective school that can be viewed as a system, so in this case the characteristics of SBM are the elements that need to be owned which are categorized into input, process and output. According to Kamars (2004:255) the characteristics of SBM are:

1. Expected output.

Output can be classified into two, namely: academic achievement (NEM, youth scientific paper competition, several subject competitions, critical, creative/divergent, reasoning, inductive, deductive, and scientific thinking), in addition to non-academic achievements (high curiosity, self-esteem, honesty, tolerance, and so on).

2. Process.

*A highly effective learning process.

*Strong school leadership. *A safe and orderly school environment. *Effective management of educational staff. *The school with a culture of quality. *The school with a compact, intelligent and dynamic teamwork. *The school with authority (independence). *High participation from school residents and the community. *The school with transparent (open) management. *The school with the will to change (psychological and physical). *The school carrying out continuous evaluation and improvement. *The school being responsive and anticipates needs. *The school with good communication. *The school with accountability.

3. Educational input.

* Clear policies and quality targets. *Resources available and ready. *Competent and highly dedicated staff. * high achievement expectations. *Focus

on high achievement expectations. *Focus on customers, especially students. *Management input.

Furthermore, SBM is a new alternative in educational management that emphasizes the independence and creativity of schools. This concept focuses more on improving the educational process to achieve quality educational outcomes. Therefore, the characteristics of SBM are as follows:

1. Safe and orderly school environment.

The atmosphere and environment of the school, both physically and psychologically, are the main prerequisites for the implementation of an optimal learning process, a conducive school climate provides protection to students and other school residents to carry out educational activities according to the set target plan. Therefore, one of the main characteristics of an effective school is seen from a pleasant, safe and orderly school environment, so that students feel at home learning and socializing with school residents in daily activities.

2. Formulation of clear vision, mission, and quality targets.

Effective schools have a board vision and mission that will be clearly and straightforwardly achieved. This vision is the board's future view of its existence in providing services to the community. Meanwhile, the mission is the tasks that must be carried out to realize the vision of the institution. To achieve this vision and mission, the school also sets quality targets that will be achieved both in the short and long term. In this way, the direction of the policy and implementation of education in this school always adheres to the vision and mission of the institution through efforts to achieve the quality targets that have been set.

3. Strong school leadership.

In an effective school, the principal has a very central role in managing and mobilizing all available educational resources. The school principal's leadership is one of the factors that encourage the school to be able to realize the vision and mission of its institution through the achievement of educational targets in a planned and gradual manner. Therefore, school principals are required to have adequate management and leadership skills in order to be able to take the initiative to improve school performance.

4. High performance expectations.

Effective schools have high motivation and expectations to improve the performance of students and their institutions. The principal has a strong commitment and motivation to improve school performance optimally. Teachers have high hopes that their students can achieve the maximum level of performance, even with all the limitations of the educational resources available

in the school. While students have the motivation to always improve themselves to perform according to their talents and abilities. High expectations from these three elements is one of the factors that cause the school to always be dynamic to always be better than the previous situation.

5. Continuous development of school staff.

The development of school staff, both educational and administrative, is one of the school's effective efforts to improve the quality of learning at school. This staff development in the form of in-service or on-service training is carried out based on the needs of teachers and other staff. It is not based on requests from outside the school, therefore the principal continuously observes, supervises and explores the needs and abilities of each teaching staff and other personnel, so that they get training that suits their individual needs.

6. Evaluation of learning for the improvement of learning.

Regular learning evaluation is not only aimed at knowing the level of absorption and ability of students, but the most important thing is how to utilize the results of the learning evaluation to improve and perfect the learning process at school. Therefore, the function of evaluation becomes very important in order to improve the ability and performance of students and the performance of the school as a whole.

7. Communication and support of parents and the community.

The participation and support of parents and the community in the implementation of education contributes greatly to the effectiveness of a school. This support is not only in the form of educational fund contributions, but more importantly is the contribution of thinking to improve school performance and student performance. Because of that, effective schools always carry out intensive communication with parents, community leaders and other social institutions in the planning of quality targets, decision-making, and monitoring of educational implementation in general.

. Principles of SBM

Law Number 20 of 2003 Concerning the National Education System in Article 48 Paragraph (1) states that, "The management of education funds is based on the principles of justice, efficiency, transparency, and public accountability". In line with the mandate, Government Regulation Number 19 of 2005 Regarding the National Standard of Education Article 49 Paragraph (1) states: "The management of education units at the primary and secondary education levels applies school-based management that is demonstrated by independence, partnership, participation, openness, and accountability". Based on the two

contents of the policy, SBM principles include: (1) independence, (2) justice, (3) openness, (4) partnership, (5) participation, (6) efficiency, and (7) accountability.

1. Independence

Independence means the authority of the school to manage resources and organize the interests of school members according to their own initiative based on the aspirations of all school members in accordance with legal regulations. The school's independence should be supported by the school's ability to make the best decisions, democratically, mobilize resources, communicate effectively, solve problems, be anticipatory and adaptive to educational innovation, so that it can synergize, collaborate, and meet the needs of the school itself.

2. Justice

Justice means that the school does not take sides with any of the human resources involved in managing school resources, and in the distribution of resources for the benefit of improving school quality. The human resources involved, both school residents and other stakeholders, are given the same opportunity to participate in providing support for improving school quality according to their capacity. The distribution of resources for managing all school management substances is carried out wisely to accelerate and sustain efforts to improve school quality. By being treated fairly, all stakeholders will provide optimal support to the school.

3. Transparency

Management in the context of SBM is carried out openly or transparently, so that all school residents and stakeholders can know the mechanism for managing school resources. Furthermore, the school gains trust and support from stakeholders. Transparency can be done through the dissemination of information in schools and providing information to the community about the management of school resources, to gain public trust in the school. The growth of public trust is the first step in increasing community participation in schools.

4. Partnership

Partnership is a collaborative relationship between schools and the community, both individuals, groups/organizations, and the business world and industry. In the principle of partnership between schools and the community in an equal position, which implements mutually beneficial cooperation to improve the quality of education in schools. The benefits received by schools include increasing the abilities and skills of students, increasing the quality and quantity of school facilities and infrastructure, obtaining ideas for school development, obtaining financial contributions to improve school quality, and assisting the

duties of the principal and teachers. Benefits for the community are usually felt indirectly, for example the availability of educated workers, fostering members of the community who have good morals, and creating social order. Schools can establish partnerships, including with religious leaders, community leaders, traditional leaders, the business world, the industrial world, government institutions, professional organizations, youth organizations, and women's organizations.

5. Participatory

Participatory is intended as the participation of all stakeholders related to the school in managing the school and making decisions. Their participation can be done through formal procedures, namely the school committee, or involvement in school activities incidentally, such as commemorating national holidays, supporting the success of inter-school competitions, or developing learning. Participation can be in the form of donations of manpower, funds, and infrastructure, as well as technical assistance in the context of school development.

6. Efficiency

Efficiency can be interpreted as the use of resources (funds, infrastructure and manpower) in a certain amount to obtain optimal results. Efficiency also means saving on the use of resources but still being able to achieve the target of improving school quality.

7. Accountability

Accountability emphasizes the responsibility for the implementation of education in schools, especially the achievement of school quality improvement targets. Schools in managing resources are based on laws and regulations and can be accountable to the government, all school residents and other stakeholders. Accountability includes the implementation of school management processes and components. Accountability can be carried out in writing and unwritten accompanied by valid administrative evidence and physical evidence (such as buildings, benches, and laboratory equipment).

In line with the provision of greater autonomy for schools to make decisions, the implementation of the seven SBM principles in schools is in accordance with the situation and conditions of the school. Schools may add SBM implementation principles that are in accordance with the characteristics of the school, in order to accelerate efforts to improve school quality both academically and non-academically.

Process of School Based Management

1. Planning

Planning is the process of determining goals, activities, resources, time, place and procedures for organizing school-based management components. In relation to school planning, it is related to two things as explained:

a. Planning related to schools as educational institutions.
b. School planning related to education, namely the process of formulating programs carried out by schools in the future. Planning occupies a strategic position, so schools must have good programs. In addition, the level of quality and excellence of schools can be seen from how good the planning is. In the current era of regional autonomy, the educational planning that should be chosen is school-based educational planning.

Planning includes several main points as follows:

a. Assumptions based on facts, meaning that planning should be prepared based on assumptions supported by existing facts or evidence. This is important because the results of planning are the basis for implementing activities or activities.
b. Alternatives or choices as the basis for determining the activities to be carried out, meaning that the preparation of plans needs to consider various alternatives according to the activities to be carried out.
c. The goals to be achieved, planning is a tool/means to achieve goals through implementing activities.
d. Predictive in nature as a step to anticipate possibilities that can affect the implementation of planning.
e. Policy as a result of decisions that must be implemented.

For this reason, the requirements for planning in school management include: (1) clear goals, (2) simple, (3) realistic, (4) practical, (5) detailed, (6) flexible, (7) comprehensive, and (8) effective and efficient.

2. Organizing

Organizing is the process of connecting people involved in a particular organization and integrating their tasks and functions in the organization. In the process of organizing, tasks, authorities, and responsibilities are divided in detail based on their respective sections and fields so that synergistic, cooperative, harmonious and in tune working relationships are integrated in achieving the agreed goals

From the explanation above, it can be understood that organizing is the process of selecting, forming working relationships, compiling job descriptions and authorities of people involved in certain school management component

activities so that a clear unity of tasks and organizational structure is formed in an effort to achieve the goal of improving school quality.

Selecting people involved in certain activities takes into account the characteristics and backgrounds of those concerned, including: physical and psychological characteristics (interests, abilities, emotions, intelligence, and personality); and background (education, experience, and previous positions). Forming working relationships into one unit means that the placement of people in certain activities is formed in the form of an organizational structure and/or structure, complete with a description of their duties and authorities.

The principles of organization are: (1) clarity of duties and authority, (2) unity of command, (3) flexible, (4) all people or work units understand the goals to be achieved, (5) Techniques in using resources, and (6) Understanding strategies and methods/techniques used in carrying out their duties.

The school organizational structure contains a system of organization and administration that is described clearly and transparently. All leaders, educators, and education personnel have clear descriptions of duties, authority, and responsibilities regarding the overall organization and administration of the school.

The guidelines governing the school organizational structure are: (1) including elements of administrative staff with clear authority and responsibility to carry out administration optimally, (2) evaluated periodically to see the effectiveness of the school management work mechanism, and (3) decided by the principal by considering the opinions of the school committee.

The principal carries out his duties and responsibilities as the leader of school management. Teachers carry out their duties and responsibilities as learning agents who motivate, facilitate, educate, guide, and train students so that they become quality human beings and are able to actualize their human potential optimally.

Counselors carry out their duties and responsibilities in providing guidance and counseling services to students. Library staff carry out their duties and responsibilities in managing learning resources in the library. Laboratory staff carry out their duties and responsibilities in assisting teachers in managing practical activities in the laboratory. Learning resource technicians carry out their duties and responsibilities in preparing, maintaining, and repairing learning facilities and infrastructure. Administrative staff carry out their duties and responsibilities in organizing administrative services. Cleaning staff carry out their duties and responsibilities in providing environmental cleaning services.

3. Implementation

Implementation means the implementation of the planning and organization that has been prepared. In the implementation, motivation, supervision, and monitoring need to be provided. Providing motivation is an effort to encourage educators and education personnel in schools to always improve the quality of activities that are their duties and responsibilities.

Supervision is the provision of assistance for improving and developing implementation activities of school management components to be more effective and efficient in achieving the goal of improving school quality. Supervision includes managerial and academic supervision, which is carried out regularly and continuously by the principal, superiors and other stakeholders. Monitoring is carried out by the principal, superiors, and other stakeholders regularly and continuously to assess the efficiency, effectiveness, and accountability of the implementation of school management components. The principles of implementation include: (1) determining operational standards for activities, (2) determining the measure of activity success, (3) developing activities or taking corrective actions if necessary.

Implementation of school activities that are not in accordance with the established plan must be approved through a meeting of the education council and school committee. The principal is responsible for the implementation of academic management at the education council meeting and non-academic management at the school committee meeting in the form of a report at the end of the school year which is submitted before the preparation of the next annual work plan.

In implementing school programs, schools create and have guidelines that regulate various aspects of management in writing that are easy to read by related parties. Formulation of school guidelines: (1) considers the vision, mission and goals of the school, and (2) is reviewed and reformulated periodically in accordance with community developments.

School guidelines function as operational implementation guidelines. School management guidelines include:

a. Curriculum implementation.
b. Educational/academic calendar.
c. School organizational structure.
d. Division of tasks among teachers.
e. Division of tasks among education personnel.
f. Academic regulations.
g. School regulations.
h. School code of ethics.
i. School operational costs.

4. Supervision

Supervision is defined as a process of activities to compare between established standards and the results of activity implementation. Supervision is useful for measuring success and deviations, providing reports and implementing a feedback system for all activities of school management components. Supervision includes evaluation activities, reporting, and follow-up of supervision results. Supervision activities are also based on motivation, direction, supervision, and monitoring activities.

Schools prepare objective, responsible and sustainable supervision programs. Preparation of supervision programs in schools is based on National Education Standards. Supervision programs are socialized to all educators and education personnel. Supervision of school management includes monitoring, supervision, evaluation, reporting, and follow-up of supervision results. Monitoring of school management is carried out by the school committee or other forms of representative institutions of interested parties regularly and continuously to assess the efficiency, effectiveness, and accountability of management. Supervision of academic management is carried out regularly and continuously by the principal and school supervisor.

Teachers report the results of evaluations and assessments at least at the end of each semester to the principal and parents/guardians of students. Education personnel report the technical implementation of their respective tasks at least at the end of each semester to the principal.

The principal continuously supervises the implementation of the duties of education personnel. The principal reports the results of the evaluation to the school committee and other interested parties at least at the end of each semester.

School supervisors report the results of supervision at the school to the regent/mayor through the District/City Education Office responsible for education and the school concerned, after being confirmed with the relevant school. Supervisors report the results of supervision to the District/City Education Office, after being confirmed with the relevant school. Every party that receives the report of the results of supervision follows up on the report of the results of supervision in order to improve the quality of the school, including imposing sanctions for deviations found. The school documents and uses the results of monitoring, supervision, evaluation, and reporting as well as follow-up notes to improve school performance, in learning management and overall management.

The school conducts self-evaluation of school performance. The school determines priority indicators to measure, assess performance, and make improvements in the context of implementing National Education Standards. School self-evaluation is carried out periodically based on valid data and information. The school carries out: (1) periodic evaluation of the learning process, at least twice a year, at the end of the academic semester, and (2) periodic

evaluation of the annual work program at least once a year, at the end of the school budget year.

In the school supervision process, schools prepare the materials needed to participate in accreditation in accordance with applicable laws and regulations. Schools must always strive to improve their accreditation status, by using external accreditation institutions that have legitimacy. Schools must continue to improve the quality of their institutions holistically by following up on suggestions from accreditation results.

References

1. Acaray, A. (2007). *Küçük ve orta boy işletmelerde yenilik yönetimi: yenilik yönetiminde etkili olan örgütsel yapı ve faktörlere ilişkin bir araştırma.*Yayımlanmamış yüksek lisans tezi, Kocaeli Üniversitesi, Kocaeli
2. Ananda, H. R. (2017). *Inovasi Pendidikan: Melejitkan Potensi Teknologi dan Inovasi Pendidikan.* Editor Muhammad Rifa'i, Medan, September 2017
3. Drury, D., & Levin, D. (1994). *School-based management: The changing locus of control in American public education.* U.S. Department of Education: Office of Educational Research and Improvement.
4. Fullan, M., & Watson, N. (2000). School-based management: Reconceptualizing to improve learning outcomes. *School Effectiveness and School Improvement, 11*.
5. Göl, E. & Bülbül, T. (2012). İlköğretim okulu yöneticilerinin yenilik yönetimi yeterliklerine ilişkin öğretmen algıları. *Mersin Üniversitesi Eğitim Fakültesi Dergisi,* 8(2), 97-109.
6. Güzen, S.A. (2020). *Liselerde yenilik yönetimi ile örgütsel öğrenme arasındaki ilişki (Şanlıurfa İli Örneği).*Yayımlanmamış yüksek lisans tezi, Harran Üniversitesi, Şanlıurfa.
7. Honig, M. I., & Rainey, L. R. (2012). Autonomy and school improvement: What do we know and where do we go from here?. *Educational Policy, 26*,
8. Kamars, M. D. (2004). *(Educational Administration. Theory and Practice) Administrasi Pendidikan. Teori Dan Praktek.* Padang: Suryani Indah.
9. Karip, E. (1998). Dönüşümcü liderlik. *Kuram ve uygulamada eğitim yönetimi,* 4(16), 443-466
10. Kurt, T. (2006). Eğitim yönetiminde yerelleşme eğilimi. *Kastamonu Eğitim Dergisi,* 14(1), 61-72.
11. Notiwaty, D. (2024). Innovation in Educational Management: Creative Approaches for Improving the Quality of Learning, *International Journal of Teaching and Learning (INJOTEL),* Vol. 2 No. 8, August 2024, pages: 2325~2337
12. Opeiraylo, S. I. (2022). Approaches to Management Provision Educational Process. *Educational Dimeinsion,* 15
13. Ömür, Y.E. (2014). *Lise yöneticilerinin yenilik yönetimi becerileri ile okullardaki örgütsel öğrenme mekanizmalarina yönelik öğretmen görüşleri.*Yayımlanmamış yüksek lisans tezi, Abant İzzet Baysal Üniversitesi, Bolu

14. Rosyada, D. (2004). Democratic Education Paradigm, A Model of Community Involvement in the Implementation of Education. Jakarta: Kencana Prenada Media Group.
15. Rusdiana, A. (2014). *Educational Innovation Concept (Konsep Inovasi Pendidikan).* Bandung: Pustaka Setia.
16. Sagala, S. (2005). *School and Community Based Management, Strategy to Win Quality Competition* (Manajemen Berbasis Sekolah Dan Masyarakat, Strategi Memenangkan Persaingan) Mutu. Jakarta: Nimas Multima.
17. Siahaan, S. (2003). *Pembelajaran Elektronik (E-Learning) di SLTA: Perkembangan, Tantangan, dan Permasalahannya*. Dalam Durri Andriani, dkk. Cakrawala Pendidikan. E-Learning Dalam Pendidikan. Jakarta: Universitas Terbuka.
18. Türksoy, A. (2005). Otel işletmelerinde dış kaynaklardan yararlanma (outsourcıng). *Ege Akademik Bakış Dergisi*,5(1), 11-18.
19. Zerenler, M., Türker, N. ve Şahin, E. (2007). Küresel teknoloji, araştırma-geliştirme (ar-ge) ve yenilik ilişkisi. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*,1(17), 653-667.

Chapter 4

Model-Based Physical Education and Sports Teaching for Physical Education Teachers and Coaches with Examples

Halil TANIR[1]

Abstract

The teaching models used in physical education and sports support students' physical and mental development, providing effective learning experiences. These models offer teachers and coaches a structured teaching process tailored to the diverse learning needs of students. Model-based physical education and sports teaching makes the learning process more efficient by using specific teaching approaches to help students acquire a particular skill or knowledge set. For example, the "direct instruction model" is a model where basic skills are taught through lessons controlled by the teacher, while the "peer teaching model" refers to an interactive teaching style where students guide each other.

Presenting these teaching models with examples helps teachers and coaches compare different approaches and understand in which situations each model may be more effective. The advantages and limitations of each model are explained through practical examples, allowing teachers to develop a flexible teaching style based on classroom dynamics. For instance, the "sports training model," used to develop skills in a sport, serves different learning goals than the "individual and social responsibility model," applied to foster social responsibility.

The aim of this study is to explain the different teaching models used in physical education and sports through examples. In line with this goal, the study is expected to help teachers and coaches effectively choose different teaching methods, providing the most appropriate learning experiences for students or athletes. Thus, it is anticipated that the quality of the teaching and learning process, and consequently student success, will increase.

Key words: Coach, physical education and sports, teacher, teaching models

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Introductıon

Model-based physical education and sports teaching is an instructional approach used by teachers/coaches to enhance the effectiveness of the teaching process. This approach provides a structured, systematic teaching process aimed at helping students and athletes develop their skills and knowledge. Unlike traditional teaching methods, model-based teaching meets the individual learning needs of students and athletes by ensuring their active participation (Metzler, 2017).

Model-based physical education and sports teaching allows students and athletes to improve their motor skills. This teaching model provides step-by-step guidance in the teaching of technical skills, showing how the learned concepts can be applied in real-life situations. By adapting the teaching process to individual needs, teachers and coaches facilitate an effective learning experience. Model-based physical education and sports teaching enables teachers and coaches to use effective instructional methods. Based on a specific model, teachers and coaches plan activities that are carried out according to the developmental levels of students and athletes (Casey & MacPhail, 2018).

In model-based physical education and sports teaching, continuous feedback is provided to students and athletes, allowing their progress to be monitored. This process helps students and athletes to evaluate themselves and track their development. Through this, mistakes can be corrected under the guidance of the teacher and coach, and skill development can be ensured. This approach not only helps students and athletes improve their physical skills but also plays a role in developing healthy lifestyle habits, social skills, and boosting self-confidence. All of these factors increase the interest of students and athletes (Kirk, 2005).

Model selection in physical education and sports instruction

The correct implementation of the chosen model in physical education and sports teaching is crucial for the development of students' and athletes' physical and social skills. Some factors to consider when deciding on the selection of a model in physical education and sports teaching are outlined below (Metzler & Colquitt, 2021).

- Needs of students and athletes
- Learning objectives
- Teaching environment and resources
- Experience of the teacher and coach
- Time constraints

Teaching models used in physical education and sports teaching

1. Direct instruction model

It is a structured, goal-oriented teaching approach in which the control lies with the teacher/coach. This model is an approach where the learning objectives are clearly defined. Students and athletes follow the instructions given to them. During this process, the teacher/coach provides feedback and monitors the development of the students and athletes. This model is one of the most effective methods for students and athletes to learn new skills. However, in the teaching process where the direct instruction model is used, students and athletes are generally passive, which can limit their creativity, problem-solving, and independent thinking skills. This situation may hinder the provision of a teaching process customized to individual needs (Guzman & Paya, 2020).

Tablo 1. Direct instruction model: Example application (Dance activity)

Stages of the model	**Teaching-learning process (Physical education lesson at 5th grade level)**
○ Reviewing previous learning ○ Presenting new content or skill ○ Initial student or athlete practice ○ Feedback and correction ○ Independent practice ○ Periodic review	**Instructions** ○ Perform each exercise carefully. These exercises will help you develop the basic movement skills for dance and become aware of your dancing abilities. Additionally, your ability to listen to music and choose movements according to the rhythm will also improve. While you are working on the exercises, I (the teacher) will be walking around making necessary corrections. **Exercise** **Shuttle runs** ○ Students are asked to zigzag between the obstacles placed on the field. Using locomotor skills and combinations, they can make long turns in various ways using rhythmic movements and dance steps. **Waves in the sea** ○ Students line up on one side of the area. They cross to the opposite line using dance, step (footwork), locomotor, and combination movements. **Assessment and Evaluation** ○ Checklists, rubrics (for teachers).

Source: (Hünük, 2023).

2. Peer teaching model

The peer teaching model is one of the approaches frequently used in physical education and sports teaching. It encourages students and athletes to learn by guiding each other. In this model, more experienced and knowledgeable students and athletes take on the role of instructors by mentoring their peers. The peer teaching model contributes to making the learning process more interactive and participatory by ensuring that students and athletes actively participate in their learning processes. This model not only improves students' and athletes' leadership, communication, and collaboration skills but also enhances their physical abilities. As an effective learning tool, the peer teaching model boosts students' and athletes' self-confidence and their ability to take responsibility (Ward et al., 2005; Jenkinson et al., 2014).

Like every teaching model, the peer teaching model also has some limitations. When students or athletes take on the role of instructors, they may not have sufficient knowledge, skills, and experience. This can lead to the transmission of incorrect information and cause students or athletes to learn the wrong skills. Additionally, some students or athletes may be reluctant to take on the responsibility of teaching, which can reduce the effectiveness of the teaching process (Jenkinson et al., 2014).

Tablo 2. Peer teaching model: An example application
(Table tennis forehand skill)

Stages of the model	**Teaching-learning process (Physical education class at 6th grade level)**
o Explanation of learning objectives or outcomes, o Presentation of expectations from teaching students (what should be done, what should not be done) o Presentation of the task and checking its clarity o Checking the structure and clarity of the task, o Determining how errors will be explained to learning students o Deciding how reinforcement will be appropriately provided,	**Introduction** o The students are greeted. The teacher informs the students that today's topic will be "forehand stroke in table tennis." The teacher asks questions about what a forehand stroke is and where it is used. The teacher briefly explains the forehand stroke and demonstrates its execution. The teacher tells the students that in the next part of the lesson, their peers, who will be teaching students, will guide them. **Table tennis forehand stroke practice** o The teaching students gather their materials and go to the practice area with their groups. o The teaching students have their groups perform warm-up exercises. o The teaching students explain the skill to their group members and demonstrate how it is done. o Then, they explain and demonstrate the activity.

○ Sharing how safety precautions will be implemented during practice ○ Determining how to assess whether the topic (rules, skills, tactics, etc.) has been learned or the task has been completed ○ Determining when students should ask questions to the teacher	○ They explain how the worksheets will be used. ○ The teaching students start the activity. ○ The students take turns performing the forehand stroke at the table tennis table and then move to the back of the line. ○ The teaching students observe their peers and provide feedback/corrections/reinforcement. ○ The teacher observes the class, walks around the groups, and provides feedback/corrections/reinforcement to the teaching students to assist them. ○ The teaching students lead their groups through a cool-down activity. ○ The lesson is summarized and concluded. **Assessment and evaluation** ○ Completion of the table tennis forehand stroke worksheet and peer assessment forms, as well as filling out peer assessment forms during the rally activity with a net in between.

Source: (Hünük, 2023).

3. Collaborative learning model

Collaborative learning is an instructional approach that aims to help students or athletes acquire knowledge and develop skills by working together in small groups. In physical education and sports teaching, this model encourages students or athletes to collaborate in achieving a common goal, fostering teamwork, leadership qualities, physical skills, communication skills, and social skills development. Another key feature of this model is that the learning process requires active interaction and collaboration between students or athletes (Bores-García et al., 2020).

Students can assist their teammates by guiding them and helping them improve their skills. At the same time, each student is expected to take an active role in the group, making the learning process more participatory and effective. Collaborative learning reinforces social relationships while also emphasizing elements like teamwork and strategy creation, which are intrinsic to sports (Bores-García et al., 2020). However, the collaborative learning model in physical education and sports instruction has some drawbacks. Firstly, the lack of participation from some students or athletes can create imbalances in group dynamics. Additionally, since the collaboration process requires a longer and more detailed time frame, it can become difficult to implement this model when time and resources are limited. Effective guidance is also essential for this model. Therefore, the teacher/coach's experience, management skills, and ability to use resources are critical for the successful implementation of the model (Casey & Goodyear, 2015)

Tablo 3. Collaborative learning model: Example application (Finger pass skill in volleyball)

Preparation teaching	Learning process
○ The identification of group members and an explanation of how and based on what criteria they were selected. ○ The explanation of the time allocated for the groups to complete the assigned task. ○ An explanation of which collaborative learning strategies (e.g., splitting and joining, learning together, etc.) will be used for the tasks. ○ An explanation of the rules that the students or athletes need to follow. ○ An explanation of how the available resources and facilities will be used among the groups. ○ The explanation of the learning objectives and how these objectives will be evaluated. ○ The explanation of the learning objectives required for social learning and how these will be assessed. ○ The teacher/coach explaining their role as a facilitator. ○ An explanation of the products (e.g., posters, product data sheets, team records, etc.) that the groups need to prepare during the tasks. ○ An explanation of the competition rules for the teams.	**Introduction** ○ The topic to be covered in the lesson/training session is introduced. ○ The splitting and joining method is explained to the students/athletes. ○ In previously assigned groups, one person will take the responsibility of finger pass, another will take the responsibility of forearm pass, and another will take the responsibility of underhand serve skill. ○ Based on these selected skills, three skill-based working groups (finger pass, forearm pass, underhand serve) will be formed. ○ These groups will discuss and work on the critical points of their respective skills among themselves. ○ Then, they will return to their original (own) groups and, one by one, teach their peers the critical points of each skill and guide them in practice. **Activity** ○ In the previously assigned groups, one person takes responsibility for finger pass, another for forearm pass, and another for underhand serve skill. ○ Based on these selected skills, three skill-based working groups (finger pass, forearm pass, underhand serve) are formed. ○ These groups discuss the critical points of their respective skills among themselves and practice by passing roles. ○ Then, they return to their original (own) groups and, one by one, teach their peers the critical points of their chosen skills, ensuring healthy communication, and guide them through practice in their respective areas. **Assessment and evaluation** ○ The group evaluation form is filled out.

Source: (Hünük, 2023).

4. Personalized instruction model

The Personalized Teaching Model is an approach tailored to the individual needs and abilities of students/athletes. This model ensures that each student/athlete receives education suited to their own learning pace, style, and development level. In physical education and sports instruction, the personalized teaching model offers a variety of activities at different levels and with diversity to help students/athletes develop their physical skills. This way, each student/athlete can strengthen their strengths while also having the opportunity to improve their weaknesses (Young, 2019).

During the implementation of the personalized teaching model, students must follow specific learning tasks. These tasks are created by considering each skill that needs to be taught within the unit and the learning areas related to these skills. The teaching units prepared for each skill are referred to as "modules." For example, a teacher/coach who wants to teach badminton might prepare a model that includes modules for forehand shots, backhand shots, and serves. The model consists of a combined plan for the unit to be taught. In this model, there are no daily lesson or training plans. Students or athletes complete learning tasks in sequence and progress at their own pace. In this application process, where students or athletes try to learn skills independently, a student or athlete who completes one module can move on to another module from the list of learning tasks. The teacher/coach observes the students/athletes and anticipates which teaching materials will be used in the next lesson/training and ensures that the necessary tools and equipment are available when the student needs them. In the workbook that the teacher/coach prepares, the rules students/athletes must follow during the application process, learning tasks, and how assessment will be conducted should be explained. Additionally, the workbook should include topics, exercises, and self-assessment forms that direct the student's attention to the important content and guide students or athletes on how to proceed with their learning. The students or athletes' task is to follow the learning tasks in the workbook, which are listed in a predefined order. The teacher/coach intervenes when the content is not sufficiently explained in the book or when the student or athlete does not understand a part, contributing to the teaching process (Hünük, 2023). However, it can be time-consuming for teachers/coaches to develop different activities and strategies for the needs of each student or athlete. For this model to be implemented, teachers/coaches must be experienced and able to closely monitor each student or athlete. This can make classroom management more challenging. Tracking the individual development of each student or athlete and providing appropriate materials may add extra workload for teachers/coaches (Young, 2019).

Tablo 4. Personalized instruction model: An example module (Racket grip techniques in badminton)

Module content	Performance tips	Comprehension task (Peer evaluation)
○ Written introduction for the skill ○ A slide showing the appropriate skill technique (When you're ready for a new skill, take the appropriate slide and watch it on the tablet available in the gym. Don't forget to pay attention to the highlighted critical behavior tips.) ○ Comprehension tasks to understand the critical behavior tips ○ Preparatory exercises to develop the initial skill patterns ○ A error analysis and correction section for self-analyzing common mistakes ○ Learning tips to enhance specialization ○ Criterion tasks to improve skill mastery/specialization ○ Challenge tasks to improve tactical awareness and skill application with modified game situations ○ Personal record form for selected tasks, also used to document successful practice efforts	**Grip technique** ○ The thumb and index finger are placed crosswise on either side of the racket handle. ○ The handle of the racket extends outward, reaching the wrist alignment. ○ When the racket is extended forward, it should resemble a hammer grip. ○ A 90-degree angle should form between the racket and the forearm. ○ The racket should rest comfortably in the hand without being gripped too tightly.	○ Find a partner and make sure you both have a racket in hand. Show each other the correct performance tips. ○ Ensure that both of you demonstrate the correct technique by showing each other both the right and wrong performance tips until it is done correctly. ○ Use the evaluation scale below to assess your partner's performance and correct their mistakes.

Source: (Hünük, 2023).

5. Research-based teaching model

The research-based teaching model in physical education and sports is an approach that enables students or athletes to actively engage in research, acquire knowledge, and participate in their own learning processes. This model allows students or athletes to develop problem-solving skills, enhance their critical thinking abilities, and relate knowledge to real-world situations. Since research-

based teaching enables students or athletes to explore topics in depth through research, it increases their motivation to learn. Implementing this model in physical education and sports teaching can help students or athletes understand how to apply theoretical knowledge in practice. In addition to strengthening students' or athletes' independent learning skills, this model also contributes to achieving common goals through group work (O'Connor et al., 2014; Ostergaard, 2016).

Table 5. Research-based teaching: An example application (Basic first aid knowledge)

Steps of the research cycle	**Introduction, activities, and conclusion (9th grade physical education course)**
○ The teacher/coach should know how to guide students or athletes in learning the concepts they need to master skills through a well-planned sequential questioning approach. ○ The teacher/coach should ask one or more focused questions that define the learning task and the problems that students or athletes want to solve. ○ The teacher/coach should observe students or athletes as they attempt to solve the problem, providing feedback and asking facilitating questions. ○ The teacher/coach should use hints, feedback, and facilitating questions to refine the students' or athletes' thinking and direct them towards one or more appropriate solutions. ○ After solving the problem and completing the task, students/athletes should present their solutions to their peers, either individually or as a group.	**Introduction** ○ Attendance is taken and greetings are made. ○ Students are seated in a U-shape. The teacher asks the students: What are basic first aid practices? ○ How can I prevent sports injuries? The teacher uses these questions to introduce the topic. **Activity 1** ○ *Question 1:* What is first aid? Answer: Interventions made at the scene without medical equipment. ○ *Question 2:* How long should first aid be applied? Answer: Until the ambulance arrives. ○ *Question 3:* What are the basic first aid practices? Answer: Protection, Notification, and Rescue (PNR). ○ *Question 4:* If the patient or injured person is unconscious, which situations should be quickly assessed? Answer: Assessment of the airway, assessment of breathing (Look-listen-feel). Assessment of circulation. ○ *Question 5:* What should we pay attention to when calling 112? Answer: Remain calm. Provide clear answers to the questions asked. Give accurate location and address details. Stay in communication. ○ *Question 6:* What is the primary purpose of first aid? Answer: To eliminate life-threatening situations. ○ *Question 7:* What causes sports injuries? Answer: Personal factors: Age, gender, height, weight, body fat percentage, and psychological factors. Environmental factors: Insufficient warm-up, duration, frequency, scope, intensity, and volume of

	the training, quality of the sports environment, and unqualified coaches. ○ *Question 8:* How does nutrition affect the prevention of sports injuries? Answer: Through the foods individuals consume, their bodies become stronger. They can exercise healthily. With a balanced and regular diet, individuals have stronger bones and muscles, which helps prevent injuries and strains. **Activity 2** ○ Students are provided with information about sports injuries caused by incorrect techniques, insufficient warm-up, overloading, improper clothing for sports, inappropriate surfaces, etc. They are asked to explain what should be done to prevent these injuries and strains. Students are divided into 3 equal groups. The topic "Sports injuries that may occur while engaging in sports or physical activities and ways to prevent them" is assigned to all groups, and they are asked to create a drama related to this topic. ○ Each group first demonstrates practical examples of the sports injuries they might encounter in sports and physical activities. After all the groups complete their first round, there is a discussion on the games and the scenarios. Then, each group dramatizes ways to prevent these types of injuries. After all group presentations, the necessary preventive measures are discussed. **Activity 3** ○ Teacher: "Now, to help you better understand the answers to these questions, we will do one more activity." Posters are prepared with visuals showing basic first aid practices and examples of sports injuries. The students are divided into groups of six, and each group is given one poster. Each group is asked to write down the situation depicted on their poster and how to prevent it. Afterward, the groups present their posters to the class, and discussions are held regarding the posters. **Conclusion** ○ The teacher summarizes the lesson: "In today's class, we worked on finding the answers to the questions, 'What are the basic first aid practices? What sequence should be followed during application? How should we behave during first aid? What should we pay attention to in order to prevent injuries and strains while exercising?'

	○ The teacher asks the students how they can protect themselves from injuries and strains during physical activities in physical education and sports classes, as well as in extracurricular activities. Students are asked to research this topic and present their findings in the next lesson. The lesson concludes with the collection of teaching materials.

Source: (Hünük, 2023).

6. Sports training model

The sports training model is an approach structured to teach students or athletes the technical and tactical aspects of sports in physical education and sports instruction. This model aims to help students or athletes develop their motor skills and learn sports more effectively. In the sports training model, the teacher/coach not only teaches specific movements but also facilitates the understanding of sports through practical applications. The main goal of this model is to ensure that students or athletes learn the rules, strategies, and basic techniques of the sport (Perlman, 2012).

In the sports training model, students or athletes acquire new skills through various physical activities and games, while also gaining knowledge about the physical, psychological, and socio-cultural dimensions of sports. One of the most important features of this model is encouraging active participation from students or athletes during the learning process. Under the guidance of the teacher/coach, students or athletes take on practical tasks related to sports and learn through making mistakes. Additionally, fostering cooperation and team spirit among students or athletes is also a crucial element of the model. The sports training model goes beyond teaching the technical aspects of the sport; it also guides students or athletes to think strategically and solve problems. In this way, the sports training model not only helps students or athletes develop physical skills but also mental skills (Perlman & Goc Karp, 2010).

In the sports training model, a student or athlete primarily serves as a team player for the competitions throughout the season but, by the nature of this model, must also take on different roles. In other words, each student or athlete must participate in the practice as a player while also fulfilling a different responsibility. These roles may vary depending on the sport in which the model is applied. In general, the roles that students or athletes may take on include coach, captain, referee, equipment manager, press officer, first aid specialist, statistician, etc. (Hünük, 2023).

Table 6. Sports training model: Responsibilities and duties of students/athletes (Specific to football)

Tasks	Responsibilities
Player	Puts effort into learning techniques and tactics. Plays the game with determination and fairness. Supports teammates. Shows respect to opponents and referees.
Referee	Manages the matches. Makes game-related decisions. Ensures the smooth progression of the matches.
Scorekeeper	Records performance-related data during the matches. Keeps track of the scores during the matches. Delivers the result records to the relevant individuals (teacher, press members, administrator, or statistician).
Coach	Leads the entire team. Directs technical and tactical training sessions. Assists in making decisions related to player selection for matches. Communicates player selection information to the teacher and team manager.
Captain	Represents the team in situations that require communication with referees on the field. Provides leadership during the game. Helps and encourages teammates.
Team manager	Takes on administrative duties related to team responsibilities. Prepares necessary forms. Assists in assigning team members to roles such as player, referee, scorekeeper, etc.
Equipment manager	Collects and distributes team equipment. Collects and distributes team uniforms. Notifies the teacher in case of lost or damaged equipment.
First aid specialist	Knows common sports-related injuries. Accesses first aid supplies when necessary. In case of any injury or accident during training or matches, Informs the teacher/coach.
Press / journalist	Collects and publishes match results.
	Contributes weekly to the school and sports newspaper.

Source: (Hünük, 2023).

7. Tactical games model

The Tactical Games Model refers to a game-based approach used in physical education and sports instruction. This model is designed to help students or athletes understand the fundamental tactical aspects of games. Tactical games typically involve team sports and individual activities requiring strategy. In this

model, teachers/coaches assist students or athletes in developing their strategic thinking skills. Students or athletes can improve their decision-making abilities during games by creating strategies, analyzing the opposing team's gameplay, and making the right moves (Hodges et al., 2018).

The tactical games model not only allows students or athletes to develop physical skills but also promotes the development of analytical thinking, problem-solving, and teamwork. As these games are often played in a competitive environment, they can also boost the motivation of students or athletes. The primary aim of this model is to ensure that students actively think while playing the game. This model can also be adapted for individual sports. For example, in sports like tennis or wrestling, players analyze their opponents' strategies and shape their own gameplay accordingly. The Tactical Games Model not only teaches the rules of the game but also helps students or athletes develop a deeper understanding of the game itself (Griffin & Sheehy, 2013).

Table 7. Tactical games model: Example application (Fast break in handball)

Pre-Lesson or Pre-Training Planning	**Introduction, Activities, and Assessment**
○ Deciding on game categories ○ Determining the focus of the game ○ Identifying the tactical structure of the selected sport ○ Preparing an adapted game format to direct students/athletes toward the focus of the lesson ○ Using questions to bring out tactical awareness in students/athletes ○ Identifying and working on game-based activities related to the skill or movement that forms the focus of the lesson/training ○ Returning to the initial game after completing the skill practices to highlight the difference in students/athletes' game performance between the beginning and the end of the session.	**Introduction** ○ The lesson/training begins with a game. **Lesson/Training Focus** ○ Deception and shooting drills (Piston) **Conditions** ○ Goalkeepers are placed in two halves of the field, and a game is played. One of the two teams, split into groups of seven, will be given the ball. The team with the ball, upon hearing the whistle, performs deception and passing to make a fast attack. **Questioning** ○ *Question:* What was our tactical problem? ○ Answer: Fast attack. ○ *Question:* What is the goal of a fast attack? ○ Answer: To make a shot on goal after a couple of passes. ○ *Question:* What did you focus on during a fast attack? ○ Answer: Attacking before the defense takes position.

	○ *Question:* What is needed to score a goal? ○ Answer: Moving together and using systematic attack techniques. ○ *Question:* What is an advanced fast attack? ○ Answer: An attacking style performed with two or more players before the defense organizes. ○ Return to 7x7 Game ○ The game returns to 7x7 format. ○ Fast Attack Questions ○ The lesson/training ends with questions related to fast attacks. **Assessment** ○ The game performance evaluation tool is filled out.

Source: (Hünük, 2023).

8. Individual social responsibility model

In physical education and sports teaching, the individual and social responsibility model is an approach that aims not only to develop students' physical skills but also to instill a sense of responsibility. This model focuses on individuals developing a sense of responsibility toward both themselves and their surroundings during physical activity participation. As students learn to fulfill their personal responsibilities, they also learn to fulfill their social responsibilities within the group. This process encourages students to act with discipline, show respect for others, and contribute to teamwork (Wright et al., 2004; Escarti et al., 2010).

Individual responsibility refers to students managing their own performance and participation. Students view success or failure as a personal responsibility. This responsibility enables students to contribute to their own development. Social responsibility, on the other hand, involves students' responsibilities toward their roles within the group and their teammates. In this model, students learn to fulfill their responsibilities not only individually but also as part of a group. This approach helps students develop a sense of community and fulfill their social responsibilities. This model is particularly important in activities such as team sports and group events (Balderson & Sharpe, 2005).

Table 8. Individual social responsibility model: An example application (Passing in korfball)

Stages of the model	Learning-teaching process (Physical education lesson for 10th grade)
○ Consultation hour (At the beginning or end of the lesson) ○ The lesson begins with an awareness talk. ○ Transition to the physical activity section. ○ A group meeting is held towards the end of the lesson. ○ The lesson concludes with reflection time.	**Consultation hour** ○ The teacher gives students the opportunity to speak by saying, "How is school going? How are your relationships with your friends? Is there anything you would like to say about our physical education class? I would be happy to hear these from you. Let's share our thoughts on these topics together." This encourages students to express themselves and helps develop their communication skills. **Awareness speech** ○ The teacher says, "What does 'self-control' mean? You committed a foul in a game, but the referee didn't notice it. What would you do in this situation?" and a discussion about self-control is held. The levels of self-control are explained to the students. It is stated that the focus of the lesson will be on self-control, and the students are expected to control themselves. Therefore, in today's activity, it is explained that "The player who commits a foul will step aside and wait off the field for 30 seconds without waiting for referee intervention" (Self-management strategy). **Physical activity** ○ In the designated area, the outside players pass the ball among themselves while trying to avoid losing it to the defenders in the middle, aiming to hit the cone or knock the ball off. ○ While the defenders try to steal the ball, the passing players cannot engage in physical contact with them. They are not allowed to use their feet to interfere with the ball. A player who commits a foul steps aside and waits off the field for 30 seconds without waiting for the referee's intervention. ○ The winner is determined by counting how many balls the defenders have won and

	how many targets the attackers have knocked down within 5 minutes. At the end of the 5 minutes, the defenders in the middle switch places with the two outside players **Group meeting** ○ The teacher gathers the students. The group shares ideas on why self-control is important and what can be done to improve it. The teacher asks, "What didn't you like about today's lesson, and what did you enjoy?" The group discusses any negative experiences from today's lesson and works together to find solutions. **Activity reflection** ○ The teacher assigns levels. Each student evaluates themselves based on whether they have met the criteria for their level. The discussion focuses on self-control, whether the criteria for the level were met, and what needs to be improved to achieve these goals.

Source: (Hünük, 2023).

REFERENCES

Balderson, D., & Sharpe, T. (2005). The effects of personal accountability and personal responsibility instruction on select off-task and positive social behaviors. *Journal of Teaching in Physical Education, 24*(1), 66–87. https://doi.org/10.1123/jtpe.24.1.66

Bores-García, D., Hortigüela-Alcalá, D., Fernandez-Rio, F. J., González-Calvo, G., & Barba-Martín, R. (2020). Research on cooperative learning in physical education: Systematic review of the last five years. *Research Quarterly for Exercise and Sport, 92*(1), 146–155. https://doi.org/10.1080/02701367.2020.1719276

Casey, A., & Goodyear, V.A. (2015). Can cooperative learning achieve the four learning outcomes of physical education? A review of literature. *Quest, 67*(1), 56–72. https://doi.org/10.1080/00336297.2014.984733

Casey, A., & MacPhail, A. (2018). Adopting a models-based approach to teaching physical education. *Physical Education and Sport Pedagogy, 23*(3), 294–310.

Escarti, A., Gutiérrez, M., Pascual, C., & Marín, D. (2010). Application of Hellison's teaching personal and social responsibility model in physical education to ımprove self-efficacy for adolescents at risk of dropping-out of school. *The Spanish Journal of Psychology, 13*(2), 667–676. https://doi.org/10.1017/s113874160000233x

Griffin, L.L., & Sheehy, D.A. (2013). Using the tactical games model to develop problem-solvers in physical education. In critical inquiry and problem solving in physical education. Routledge, Oxfordshire.

Guzman, J. F., & Paya, E. (2020). Direct instruction vs. cooperative learning in physical education: Effects on student learning, behaviors, and subjective experience. *Sustainability, 12*(12), 4893. https://doi.org/10.3390/su12124893

Hodges, M., Wicke, J., & Flores-Marti, I. (2018). Tactical games model and its effects on student physical activity and gameplay performance in secondary physical education. *The Physical Educator, 75*(1), 99–115. https://doi.org/10.18666/tpe-2018-v75-i1-7551

Hünük, D. (2023). Beden eğitimi ve spor öğretim stratejileri, modelleri ve yöntemleri, Gençlik Spor Yayınları, Ankara.

Jenkinson, Kate. A., Naughton, G., & Benson, A.C. (2014). Peer-assisted learning in school physical education, sport and physical activity programmes: A systematic review. *Physical Education and Sport Pedagogy, 19*(3), 253–277. https://doi.org/10.1080/17408989.2012.754004

Kirk, D. (2005). Model-based teaching and assessment in physical education: The tactical games model. physical education: *Essential Issues*, 128–142. https://doi.org/10.4135/9781446215876.n8

Metzler, M. (2017). Instructional models in physical education. Routledge, Oxfordshire.

Metzler, M., & Colquitt, G. (2021). Instructional models for physical education. Routledge, Oxfordshire. https://doi.org/10.4324/9781003081098

O'Connor, J., Jeanes, R., & Alfrey, L. (2016). Authentic inquiry-based learning in health and physical education: a case study of 'r/evolutionary' practice. *Physical Education and Sport Pedagogy, 21*(2), 201–216. https://doi.org/10.1080/17408989.2014.990368

Ostergaard, L.D. (2016). Inquiry-based learning approach in physical education: Stimulating and engaging students in physical and cognitive learning. Journal of *Physical Education, Recreation & Dance, 87*(2), 7–14. https://doi.org/10.1080/07303084.2015.1119076

Perlman, D. (2012). The influence of the sport education model on amotivated students' in-class physical activity. *European Physical Education Review, 18*(3), 335–345. https://doi.org/10.1177/1356336x12450795

Perlman, D., & Goc Karp, G. (2010). A self-determined perspective of the sport education model. *Physical Education and Sport Pedagogy*, *15*(4), 401-418.

Ward, P., Lee, M.A., & Lee, M.A. (2005). Peer-assisted learning in physical education: A review of theory and research. *Journal of Teaching in Physical Education, 24*(3), 205–225. https://doi.org/10.1123/jtpe.24.3.205

Wright, P.M., White, K., & Gaebler-Spira, D. (2004). Exploring the relevance of the personal and social responsibility model in adapted physical activity: A collective case study. *Journal of Teaching in Physical Education, 23*(1), 71–87. https://doi.org/10.1123/jtpe.23.1.71

Young, A. (2019). Personalized system of instruction in physical education. *International Journal of Arts and Humanities*, *5*(1), 13-15.