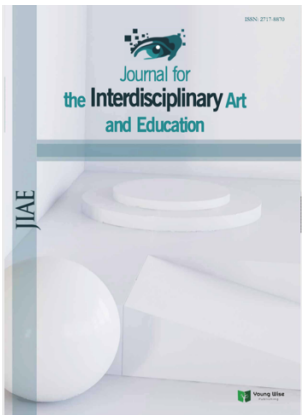
ISSN: 2717-8870

Journal for the Interdisciplinary Art and Education

Vol. 6 No.2 June 2025 (Summer)

JIAE

Young Wise Publishing



Journal for the Interdisciplinary Art and Education
e-ISSN: 2717-8870

Interdisciplinary ART & EDUCATION

Vol. 6 No. 2 June 2025 (Summer)

Indexing & Abstracting
Asos, EBSCO, GoogleScholar, Index Copernicus, Research Bible, Türk Education Index, Current Index to Journals in Education: CIJE-WorldCat

Genç Bilge (Young Wise) Publishing
Adress: Bahçelievler District 3015 St. No:9/1, Isparta, Turkiye
Web site: http://gencbilgeyayincilik.com/ E-mail: info@gencbilgeyayincilik.com

Form the Editorial

Dear Readers, Authors, and Colleagues,

As we introduce the second issue of 2025, we are pleased to present the latest volume of the *Journal for the Interdisciplinary Art and Education (JIAE)*. Our journal continues to serve as a platform for interdisciplinary discussions on art and art education, bringing together innovative methodologies, critical reviews, and experimental approaches to understanding art's evolving role in education and society.

The **June 2025 (Summer) issue** features a diverse selection of articles covering contemporary and interdisciplinary topics, including:

A comparative analysis of augmented reality supported virtual guides in cultural heritage tourism
Zeynep Feyza Yücebaş and Ertan Toy

RondoSquared • Kabalevsky, Op. 59
Ismet Karadeniz

Investigation of Artificial Intelligence literacy levels of music teachers
Ömer Üçer, Hüseyin Yılmaz and Yakup Açar

Development of a mobile learning application for pattern teaching in fashion design
Ayfer İnci and Birsen Çileroğlu

Movement and voice plastics: suggestion for the combined use of movement and voice as a method to improve mental, emotional, physical capacities
Beste Naiboğlu

An analysis of Ayaz Gambarli's piano work titled Six Children's Pieces
Minahanım Babayeva

These articles contribute valuable perspectives to interdisciplinary art studies, blending theoretical insights with practical applications.

We extend an open invitation to researchers, artists, and academics to submit their work to JIAE for upcoming issues. Your contributions help advance interdisciplinary discussions in the fields of art and art education. Additionally, we are actively seeking scholars to join our *Editorial Board*, bringing their expertise to our peer-review process and strengthening the academic integrity of our journal.

We express our deepest gratitude to our authors, reviewers, and readers for their ongoing support. We hope that this issue stimulates new conversations and research directions in interdisciplinary art and education.

Warm regards

JIAE Editorial

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Genç Bilge yayıncılık

Journal for the Interdisciplinary Art and Education, 6(2), 71-88, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

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Research Article

A comparative analysis of augmented reality supported virtual guides in cultural heritage tourism[1]

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Article Info

Received: 1 February 2025
Accepted: 20 April 2025
Available online: 30 June 2025

Keywords
AR guided tours
Augmented Reality
Cultural heritage
Interactive experiences
Location-based services

Abstract

This paper focuses on the growing importance of augmented reality technology, especially in the case of applications of virtual tours in relation to cultural heritage and tourism. Augmented reality superimposes digital information on the real world, enhancing users' experiences with interactive and educative ways of exploring cultural destinations. The paper discusses three different case studies: the Taiwan Lantern Festival, the Institute of Contemporary Art San Diego, and the Singapore Tourism Board. These cases demonstrate how augmented reality, often through the use of virtual mascots, can be integrated into various cultural and geographical contexts to achieve a variety of goals. This article provides an overview of the development of AR, its access through any common device, and its potential for disrupting cultural tourism. This study tries to analyze how AR-based virtual guide applications perform through case studies of these cases and categorizes various methods and tools used in applications.

To cite this article

Yücebaş, Z.F., and Toy, E. (2025). A comparative analysis of augmented reality supported virtual guides in cultural heritage tourism. *Journal for the Interdisciplinary Art and Education, 6*(2), 71-88. DOI: https://doi.org/10.5281/zenodo.15510369

Introduction

Advancements in technology continue to create profound effects across all areas of life. New technologies are continuously researched and developed to enhance the quality of life, being integrated into daily routines in more functional and practical ways. This process not only involves improving existing technologies but also fosters the development of entirely new innovations.

Since the rapid evolution of computer technologies in the 1980s, accessing and processing information has become increasingly significant. In this context, augmented reality (AR) technology has emerged as a remarkable innovation. Augmented reality refers to technologies that integrate virtual components with physical elements in real-time applications (Cheng & Tsai, 2014). With the growing computational power of computers, the introduction of the internet, the proliferation of mobile devices, and the diversification of wearable technologies, AR has evolved in various dimensions over the years (Altınpulluk, 2015).

[1] This article is part of the thesis titled "An Examination of Augmented Reality Supported Virtual Guides in Museum Experience and a New Model Proposal," which is being conducted under the supervision of Assoc. Prof. Dr. Ertan Toy within the Interactive Media and Design Master's Program, affiliated with the Institute of Social Sciences at Yıldız Technical University.

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AR integrates virtual objects into the real world, providing users with an experience where both virtual and real elements coexist. According to Berryman (2012), AR represents a new technological domain where digital environments and the real world converge. AR rapidly gains popularity as a technology that enriches user experiences by overlaying digital information onto the real world.

In recent years, AR technology has been effectively utilized in virtual tour applications, especially in the fields of cultural heritage preservation and tourism. This approach offers an innovative method for destination marketing and the promotion of cultural heritage, allowing visitors to interact with destinations in a more engaging and informative manner.

One of the key reasons for AR's widespread use is that it no longer requires expensive hardware such as head-mounted displays (HMDs) or complex equipment. Today, AR technology is accessible through computers or mobile devices, making its adoption significantly more convenient (Akçayır & Akçayır, 2017).

By enabling an innovative approach to promoting cultural heritage through virtual tour applications, AR allows destinations to provide visitors with interactive and educational experiences. This combination of virtual and real-world interactions enhances the potential of virtual tour applications and creates new opportunities in tourism and cultural heritage.

The rapid development and proliferation of AR technology have led to the emergence of innovative applications in the arts, extending the reach of technology to a broader audience (Willett et al., 2023). With AR applications integrated into ubiquitous devices like smartphones and tablets, this technology has become a part of everyday life, making it easier to share artistic content with wider audiences (Ferrão et al., 2023). For example, the Google Arts & Culture app allows users to virtually tour museums and galleries worldwide, exploring artworks through AR. These applications enable users to examine details of the works closely and gain insights about the artists.

This study examines examples of AR-supported virtual guide applications, focusing on projects such as the Taiwan Lantern Festival, the Institute of Contemporary Art San Diego, and the Singapore Tourism Board. These examples were chosen to reflect geographical, cultural, and technological diversity, with their common feature being the use of mascots as virtual guides. However, each project employs AR technology with distinct objectives and approaches.

The selected projects originate from different regions- Asia, Europe, and North America-allowing for an examination of how AR-guided applications are used in diverse cultural and geographical contexts. The study begins with a review of the definition and historical development of AR technology and evaluates the impacts of AR-supported virtual guide applications through an analysis of these three distinct cases. The technologies discussed here are categorized based on various techniques and tools employed in virtual tour applications.

Virtual Guide Applications

Virtual guide applications serve as an essential tool for enhancing the visitor experience in museums and cultural sites. These guides aim to attract, educate, entertain, and direct visitors by providing verbal or non-verbal instructions and information (Best, 2012). Virtual museum guides, in particular, hold significant potential to improve interaction and social communication among visitors (Kopp et al., 2005). By increasing engagement and interest, they can enrich the museum experience (Rzayev et al., 2019) and contribute to the economic importance of tourism, serving as a vital revenue source for museums (Rosentraub & Joo, 2009).

Traditional museums often use systems that include transmitters, receivers, and communication channels to deliver verbal and non-verbal information to visitors (Munodawafa, 2008). However, virtual museum guides, supported by advancements in science and technology, have created new opportunities for enhancing user experiences in museums and exhibition halls. These guides offer diverse and valuable services that support users throughout their visits. Visitors can receive personalized, adaptive content tailored to their needs and preferences, leading to a more effective and individualized experience (Ardissono et al., 2011).

In this context, mobile guides also play a significant role. According to Joel Lanir and colleagues (2013), mobile guides surpass traditional museum tools by offering personalized content delivery based on visitors' specific needs. These guides integrate multimedia elements such as images, videos, and audio commentaries to support diverse learning styles

and are accessible at any time, unlike human guides. Additionally, they cater to various populations, including those with disabilities, by providing content in multiple languages and accommodating different interaction preferences. Numerous studies have explored the role of virtual guides and how they can educate visitors (Best, 2012; 1999; Horn, 1980; Zhang & Chow, 2004). For example, Best (2012) highlighted the shift toward AR guides to enhance visitors' educational experiences in museums. AR interactions within a museum context strengthen the guidance functions, fostering more profound engagement between visitors and exhibits (Ng Giap Weng et al., 2011; Trunfio et al., 2020). Furthermore, the gamification of AR guidance systems in museums has been shown to increase visitor participation and promote active learning (Raptis et al., 2017).

Contemporary digital guides have evolved significantly from the simplistic "play, pause, play" audio guides of the past (Best, 2012). These systems now provide personalized content based on user preferences. Many modern audio and multimedia guides utilize location-aware technologies to deliver content tailored to visitors' positions within galleries (e.g., Tate Modern Multimedia Tour, London) or tourist areas (e.g., BT MySpace). Additionally, research has focused on robotic tour guides that respond to visitor feedback to adapt the tour dynamically (Bennewitz et al., 2005; Kuzuoka et al., 2008). These technological systems enable users to experience tailored tours based on their individual needs.
Bennewitz and colleagues (2005) developed a humanoid robot system designed for museum guidance. This system uses visual perception, sound localization, and speech recognition technologies to interact with multiple visitors simultaneously. The robot can shift its attention between individuals based on audio-visual input and uses gestures to draw visitors' attention to exhibits. Experiments demonstrated that the robot effectively interacted with multiple visitors, capturing their interest and facilitating engagement. This approach highlights the potential of virtual guides in offering personalized experiences tailored to users' interests and engagement levels.

Similarly, Chen et al. (2014) proposed an AR-based museum guidance system that provides intuitive, user-friendly interactions through computer vision techniques. The system allows users to interact with museum content by performing specific gestures, such as pointing to symbols on a brochure. It displays 3D models of museum artifacts and multimedia content in real-time without requiring additional hardware like keyboards or touchscreens. This approach reduces costs and minimizes the risk of contamination in public environments, making it an efficient solution for museum settings.

In another study, Damala et al. (2008) explored the impact of virtual guides on visitor behavior in museum environments. Their findings indicated that visitors using virtual guides spent more time in the museum and focused more on the exhibits. However, the study also revealed that such guides could decrease group interactions and increase physical distance among visitors.

Finally, Teixeira et al. (2021) examined the use of AR-based virtual guides at the Ecomuseu in Foz do Iguaçu. The prototype allowed visitors to interact with virtual AR elements positioned at various locations within the museum, enhancing their understanding and perception of the exhibits. The application was adapted for virtual use during the COVID-19 pandemic and received positive feedback from users.

Zikky et al., (2024) study developed an augmented reality (AR)-based tourism guidance application for heritage sites in Surabaya and examined how this application transformed the user experience. The study proposed a mobile application supported by GPS navigation and AR gamification features as a solution to the challenges brought by the COVID-19 pandemic to the tourism sector. The results showed that gamification and augmented reality elements increased users' interest and interaction with the app, and users were more motivated by gamified elements such as collecting virtual objects and completing tasks.

Overview of Virtual Guide Applications in the Cultural Field

Advances in science and technology have increased human-machine interaction in the service sector, leading to the adoption of robots and artificial intelligence applications. In this context, digital tourism applications have strengthened the human-machine relationship in museums and exhibition halls (Yıldız, 2019). Virtual guide applications have increased human-machine interaction in the service sector with developments in science and technology, and offered new experience opportunities, especially in museums and exhibition halls. Augmented reality (AR) and virtual reality

(VR) technologies provide visitors with advantages such as visualization, navigation and interactive experience. Mobile applications and AI-assisted guidance have strengthened the human-machine relationship by offering personalized experiences to users (Benyon, et al. 2013).

The digitalization process of museums started with the digitization of written sources, followed by the creation of museum websites and online archives. Technologies such as digital projection and audio guides provided visitors with more interactive experiences (Güzel, 2024). Later, the concept of virtual museums emerged. Virtual museums are designed as "Meta-Museums" or "web-based museum networks" as digital copies of physical museums. By integrating traditional and digital museums into this framework, physical and temporal barriers between the museum and the visitor were removed and interactive and functional experiences were offered online (Vargün, 2024). Virtual museums, which were initially perceived as web pages opened by museums, have been narrowed down over time as the name given to three-dimensional virtual spaces where visitors can visit the museum interior and artifacts 360 degrees interactively (Vargün, 2024).

While in the past, visitors used to learn about artworks in museums by using audio guides with headphones, today this technology has evolved into comprehensive multimedia systems. The rapid development of digital technologies in the 2000s has contributed to the expansion of museums' digital assets by providing more interactive, gamified experiences for museum visitors, through tools such as virtual tours and digital games. Mobile devices increase the flexibility and accessibility of museum visits by providing virtual tours and guidance services that users can access from anywhere. In this way, museum tours have become an interactive and dynamic experience that is shaped according to the needs of users rather than just providing information (Batuhan, 2024).

Today, virtual tour applications are frequently seen in the world (Bağçı & İçöz, 2019). The use of virtual tours, especially in destination and museum visits, is becoming more and more common. For example, the British Museum in London and the Metropolitan Museum in New York have succeeded in bringing their cultural heritage to a global audience thanks to the virtual tours they offer in digital environments and have attracted great international attention (Durmaz et al., 2018). These tours offer visitors the opportunity to explore cultural and artistic collections without being physically present in the museum, thus increasing accessibility and strengthening the global appeal of museums.

Augmented Reality Technologies

Augmented reality is a new branch of technology that combines the digital environment with the real world (Berryman, 2012). In other words, augmented reality is a joint representation of the real world and the computer-generated environment (Walsh, 2011). The foundations of augmented reality technology date back to the 1950s and the device called "Sensorama" developed at that time is the first example of this technology (H. Altınpulluk & M. Kesim, 2015). Then, Ivan Sutherland invented the head-mounted display in 1966. In 1968, Sutherland was the first person to create an augmented reality system using an optically transparent head-mounted display (Figure 2). With all these developments, the term augmented reality was first used by Ronald Azuma and entered the world literature (Eroğlu, 2018).

Figure 1. The Sensorama machine

Azuma defined augmented reality technology as the reproduction and enhancement of the natural environment with hard-to-perceive information (Azuma, 1997). The efficient and practical use of this technology requires the simultaneous presence of a mobile device, camera and triggering visual (Çankaya, 2019).

Augmented reality refers to the technology that projects digital materials onto real objects. This definition can be summarized as defining a wide range of technologies from completely virtual environments to real environments (Milgram & Kiyono, 1994).

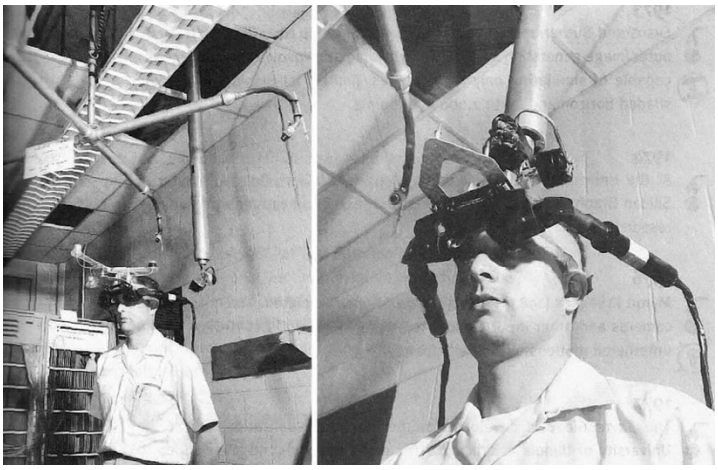

Figure 2. Ivan Sutherland's HMD

Höllerer and Feiner (2004) define augmented reality as a system that combines real and computer-generated information interactively and in real time in a real environment, reconciling virtual and physical objects. Ludwig and Reimann (2005) conceptualize augmented reality as a human-computer interaction that adds virtual objects to the sense of reality provided by a video camera in real time.

Augmented reality technology provides intuitive information for a better perception of the real world. This technology makes it possible to improve the user's perception by embedding virtual objects or information cues into the real world (Behringer, 2001). Augmented reality involves the enhancement and support of reality by providing information that is not normally detectable by human senses and cognitive processes (Azuma, 1999).

Augmented reality technology was initially applied in defense industry, industry and medicine (Caudell, & Mizell, 1992 and Cover, et al., 1993). The usefulness and effectiveness of the applications in these fields and the widespread use of various devices such as mobile phones/tablets with the cheapening of technology have led to the use of augmented reality technology in different fields. Today, the extraordinary speed of technological developments has increased the

accessibility of augmented reality technologies and enabled its use in many fields (Morales, Arenas, Delgado, & Huamani, 2022).

In recent years, many curators and artists have applied new technologies to various events, tourist attractions, museums and exhibitions with the rapid development of technology, especially with the use of augmented reality technologies (Moorhouse, Dieck, & Jung, 2019).

Especially in education and cultural heritage conservation, the experiential learning opportunities offered by AR are remarkable (Damala et al., 2008 and Klopfer & Squire, 2008) and researchers have emphasized that AR adds an innovative dimension to teaching environments. In addition, in the fields of entertainment, art, marketing and advertising, AR allows users to have interactive and immersive experiences (Moltenbrey, 2011).

Types of Augmented Reality by Use Technologies

Throughout the development of augmented reality (AR) technology, various classifications have been made. One of these classifications is based on the devices that provide the AR experience. AR can be realized with wearable and non-wearable devices. Wearable devices include headsets and helmets, while non-wearable devices include mobile devices (smartphones, tablets), fixed devices (televisions, computers). Another classification is based on how the AR experience is triggered. AR systems can be marker-based or markerless.

Marker-based AR is triggered by visual markers such as QR codes, printed images or real-world objects. Marker-based AR is also called image recognition because it requires a special visual object and a camera to scan it. This can be anything from a printed QR code to special markers (Estrada et al., 2022). In some cases, the AR device also calculates the position and orientation of a marker to position the content. Thus, a marker initiates digital animations for users to view and the images can be transformed into 3D models. Marker-based AR may require downloading an application specific to the device being used.

Image tracking is one of the prominent technologies in marker-based AR. In this method, virtual content is overlaid on an image or photo identified by the camera. When the image target is detected, the system recognizes this image and integrates virtual objects over it. Image tracking is an augmented reality (AR) technology that provides applications with the ability to recognize 2D images and overlay digital content over them. This triggers the display of a variety of digital content such as videos, slideshows, 360° panoramas, audio, text and 3D animations (Gaikwad, 2020).

Figure 3. Image tracking

Markerless AR detects the user's environment through mobile device cameras and sensors without the need for physical markers. Common types of markerless AR include location-based systems and surface tracking. These types can be further diversified; projection-based, overlay-based and outline-based systems are examples of markerless AR systems. Various classifications of augmented reality are based on the input/output systems and technology types used (Kuhail et al., 2022). Table 1 presents examples of different AR systems included in existing classifications.

Table 1. Augmented Reality Classifications

Type	Technology
Marked-based	Image Tracking
Markerless	Location-based Surface Tracking

Location-based augmented reality (AR) works by using sensors such as GPS, compass, gyroscope and accelerometer that provide data based on the user's location (El Filali and Krit, 2018). This data determines how AR content is

presented in a given region. Mobile devices and AR applications powered by these sensors typically offer maps, business information, directions and interactive content. Google Maps uses location-based AR systems to provide users with directions and information about points of interest (Kuhail et al., 2022). The user can access this content by scanning physical surfaces with their mobile device. For example, the world-famous AR-based game application "Pokemon Go" enables interactive experiences based on geolocation and places AR objects in the physical world using SLAM (Simultaneous Localization and Mapping) technology (Ketchell et al., 2019). Simultaneous Localization and Mapping (SLAM) is a technology that detects and maps the features of the environment and tracks the location of users. SLAM, which has become widespread with smartphones in recent years, improves object tracking in augmented reality (AR) applications and more accurately places virtual objects in the real world (Chi, 2020).

Figure 4. Google Maps app

Figure 5. Pokemon Go

Surface tracking technology is used to obtain measurements of real-world deformable systems. Tracking object surfaces is used continuously in the fashion and film industries for CGI and special effects (Bradley et al. 2008). This type of AR detects real-world surfaces and places virtual objects on them. Surface tracking recognizes horizontal and vertical surfaces and uses them to overlay virtual content (Saez Martinez, 2019).

Figure 6. IKEA Catalog application

For example, applications that scan a floor and place a virtual piece of furniture on it are of this type. The IKEA Catalog application, which allows users to place virtual items from furniture catalogs in their rooms, is an example of surface tracking.

Aim/problem of the Study

The aim of the research is to discuss the role of Augmented Reality (AR)-supported virtual tour applications in the tourism industry, particularly in enhancing user experience, visitor engagement, and destination marketing. AR technologies are increasingly being integrated into museums, historical sites, and city tours, yet there remains a lack of comprehensive understanding regarding their effectiveness, usability, and impact on tourism experiences.

This study seeks to address the following research questions:

- How do AR-supported virtual tour applications influence user experience in the tourism industry?
- What technologies are utilized in AR-based virtual guide applications, and how is their effectiveness evaluated?
- What role does AR play in the marketing and visitor engagement strategies of tourism destinations?

Method

This research evaluates the effects of augmented reality technology in educational and cultural promotion areas by comparing the variety of content offered by virtual guide applications and the use of interactive elements. The use and effects of augmented reality supported virtual guide applications are examined using qualitative research methodology. In the first phase of the research, a comprehensive literature review was conducted to understand the applications of AR technology in the fields of virtual guidance and cultural heritage. After reviewing current research and applications, basic concepts were identified. The differences and similarities between the Taiwan Lantern Festival, Institute Of Contemporary Art San Diego and Singapore Tourism Board projects were evaluated.

These three projects offer a broad perspective in terms of geographical, cultural and technological diversity. Taiwan Lantern Festival is an example from Asia, showing how traditional folklore and storytelling are enriched by AR technology. ICA San Diego demonstrates how AR is used for spatial navigation and artistic guidance in the context of a North American art gallery, while the Singapore Tourism Board demonstrates the potential of AR for promoting cultural and historical fabric in the context of modern city guidance.

These projects also demonstrate different technological approaches. The Taiwan Lantern Festival used location-based services (LBS) and SLAM technologies, while ICA San Diego emphasized static image recognition and animation. The Singapore Tourism Board used innovative tools such as Google ARCore and Geospatial Creator to digitally map the city and provide AR guidance systems. Each project enriches the user experience in different dimensions such as gamification, educational content delivery and spatial guidance, demonstrating the impact of AR technology in these areas.

The research aims to understand the contribution of the technological components used in these projects to the user experience and to evaluate the potential of AR to enhance spatial awareness, support the learning experience and strengthen the cultural context. The examples examined provide a comprehensive framework of how AR can be applied in different contexts and illustrate the opportunities and challenges that this technology offers.

Procedure

The study was conducted through the following steps:

- Literature Review – Analyzing existing academic research on AR in tourism.
- Project Selection – Identifying three AR-supported virtual tourism applications for case study analysis.
- Data Collection – Gathering information from literature, technical reports, and user feedback.
- Content Analysis – Examining the selected projects based on predefined research categories.
- Interpretation of Findings – Evaluating the results in relation to the research questions.

Results

Using Augmented Reality in Virtual Guide Applications

Virtual guide applications supported by augmented reality offer users richer and more interactive experiences by adding digital content to the physical environment. Especially in museums and tourism, AR provides visitors with real-time information about artifacts or places.

Augmented reality technology provides a more enriching experience by allowing visitors to interact with museum artifacts. Visitors can access detailed information about the objects on display, watch related animations or participate in gamified activities offered within the museum (Akkuş and Akkuş 2018).

Taiwan Lantern Festival 2020

The Taiwan Lantern Festival is Taiwan's globally recognized and important lantern day event. The Lantern Festival is the first full moon sighting after the Spring Festival. Taiwan has organized lantern exhibitions at the Lantern Festival every year since 1990 (Taiwan Tourism Bureau, 2021). The festival reflects the cultural identity of the cities where it is held, stimulates tourism, and promotes Taiwan's traditional lantern culture around the world. Held in 2020, the festival included a lantern display as well as light performances, cultural parades, and various interactive elements (Taiwan Tourism Bureau, 2021).

These elements include immersive projections and virtual reality experiences that allow visitors to participate. These experiential activities incorporate gaming elements and mechanics in a non-gaming context. As 2020 is the year of the mouse according to the Chinese calendar, visitors attending the festival were offered a DIY kit to make a mouse lantern. The festival was held in Taichung from February 8 to 23, 2020, attracting a total of 11.82 million visitors (Taiwan Tourism Bureau, 2021).

The Lantern Festival was a tourism festival related to a series of events that took place during the same time period. Each festival represents a collective event of religion, culture and entertainment. This cultural preservation has created important measures for intangible traditions (Shih and Chen, 2022).

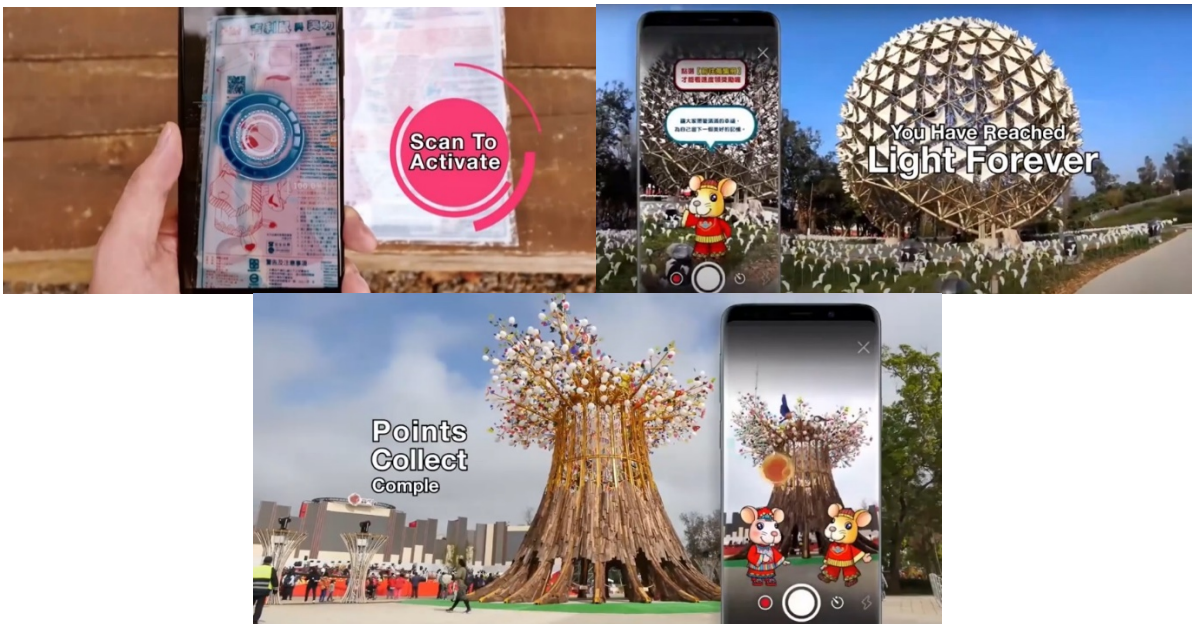

Figure 7. Screenshots from the Marq+ Application

Technological Infrastructure and AR Usage

Taiwan Lantern Festival 2020 combines augmented reality (AR) and real-time location-based service (LBS) to create a unique blend of technological innovation and traditional folklore through the classic folktale "Mouse Gets Married". In this interactive experience, the mouse groom guides visitors through the festival grounds, helps them find the mouse bride, and finally lets them watch the AR fireworks display. Participants also immortalize their memories with a Taiwan Lantern Festival themed AR photo frame.

Visitors to the festival site use AR navigation to find the coordinates of the 10 most beautiful scenic spots. At the same time, they log in to the system using their mobile devices to complete the treasure hunt task and get a chance to participate in the gift raffle.

An application called marq+ is used for the AR system used in the festival. The marq+ application, which supports the AR system in the festival area, not only guides visitors between certain points, but also provides information about the festival with a gamified mobile guide system. Using real-time location data, the app optimized visitors' routes and enabled them to have a more meaningful experience during the festival. The mission design in the puzzle game is based on a traditional story, placing storyboards at vantage points to enhance understanding of historical information. Storytelling is often adopted in AR applications. People can mentally process and organize information more efficiently when it is communicated through a story (Evagelou, Athanasios, Alexandros Kleftodimos, and Georgios Lappas. 2024). The LBS (Location Based Service) system increased the visitors' awareness of the space and enabled a deeper exploration of the festival site through interactive tasks.

This experience enriched the participants' experience by combining the educational and playful aspects of AR, while at the same time enabling visitors to become active participants, not just spectators.

Institute of Contemporary Art San Diego

Another Reality Studio developed an augmented reality (AR) based virtual tour guide for the exhibition Gabriel Rico: Unity in Variety exhibition at the Institute of Contemporary Art San Diego. Running from September 24, 2021 to January 23, 2022, the exhibition features striking works that question the pandemic and the human relationship with nature. The various materials used by the artist reflect the balance created by the combination of nature and human beings through a visual language (Institute of Contemporary Art San Diego, 2021).

The artist is known for his sculptures, installations and poetic assemblages inspired by contemporary culture, nature, science, physics, philosophy and history. Using a variety of materials such as neos, branches, rocks, porcelain flowers, old cell phones and CDs, she creates socially conscious works that question the relationship between man and nature (Institute of Contemporary Art San Diego, 2021).

Figure 8. A frame from the Unity in Variety exhibition

Another Reality Studio developed an Augmented Reality (AR) guided tour for this art gallery exhibition. The downloadable mobile application, ICA San Diego, includes a digital mascot that guides customers through an art exhibition.

Technological Infrastructure and Use of AR

For the AR interaction in the art gallery it is necessary to use the ICA San Diego app. The app first recognizes a physical image on the gallery floor to calibrate the scene and give a fixed path for the coyote to start. Once recognized, the coyote mascot appears and moves in a fixed path while integrating animations.

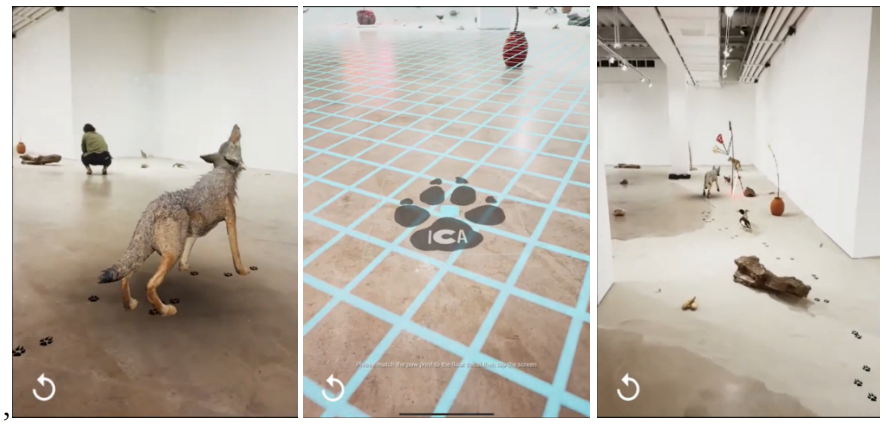

Figure 9. Screenshots from the ICA San Diego application

Instead of allowing visitors to interact with the exhibition, this AR guide aims to help them navigate the exhibition space more effectively. The technology provides visitors with a wayfinding facility, allowing them to use the physical space more efficiently. Controlling the visitors' process of exploring the exhibition is the main function of this AR guide. Although it does not provide direct information about the artworks, this orientation in the exhibition space helps visitors to follow a specific route without getting lost in the space.

The fact that there is no direct interaction with the artworks or additional information about them suggests that the AR guide keeps the experience more at the level of spatial guidance. Therefore, it can be argued that AR technology functions here as a visual guide for visitors rather than deepening the art experience.

Singapore Tourism Board

The Singapore Tourism Board has created an innovative project that aims to transform the tourist experience in the city using augmented reality (AR) technology. Using Google ARCore and Unity platforms, this project offers visitors the opportunity to explore Singapore's major tourist attractions and hidden gems with a virtual guide. Users can download the VisitSingapore Travel Guide application to their phones and experience Singapore through a virtual guide (Google AR & VR, 2023).

With this project, users can gain both cultural and historical information, while also interactively experiencing touristic elements such as local cuisine. During the guided tour, Merli, Singapore's official tourism mascot, guides the user by introducing visitors to the city's iconic buildings (Silva, 2023).

Merli, Singapore's mascot, guides visitors as a virtual guide in this project. Starting from the iconic Merlion Park, Merli introduces visitors to important buildings such as the Victoria Theater and Concert Hall (Silva, 2023). In this route, Merli not only shows visitors around the sites, but also provides them with cultural and historical information supported by AR technology.

Figure 10. Screenshots from Visit Singapore Travel Guide app

Technological Infrastructure and AR Usage

The technologies underpinning the project are Google ARCore and Unity's Geospatial Creator tool. These tools enable the digital mapping of key tourist attractions in the city and their presentation to visitors through augmented reality. The ARCore platform integrates real-world and digital content, allowing the virtual guide Merli to accompany the user on specific routes, depending on the location of the visitor. This digital guidance helps to present the historical and cultural values of the city in a more interactive and instructive way during the physical tour (Silva, 2023).

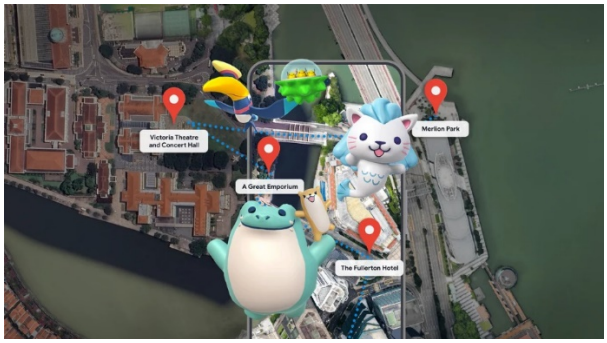

Figure 11. Visit Singapore Travel Guide app

Discussion

This study analyzes the use of augmented reality (AR) technology in virtual guide applications through the Taiwan Lantern Festival, Institute Of Contemporary Art San Diego and Singapore Tourism Board projects. Each project offers interactive experiences to its users by integrating AR technology with different purposes and methods. This study examines the projects in four main categories: gamification and interactivity, technologies used, interface design and visual use. The findings related to these categories are summarized as follows:

Gamification and Interactivity

Taiwan Lantern Festival: Gamification elements like tasks, rewards, and interactive stories significantly increased user engagement.

Institute of Contemporary Art San Diego: No gamification elements were included, but spatial guidance enhanced visitors' navigation through the exhibit.

Singapore Tourism Board: Delivered gamified and interactive guidance using the Merli mascot, which drew tourists' attention.

Technologies Used

Taiwan Lantern Festival used location-based services (LBS) and SLAM technology.

ICA San Diego provided AR guidance with static image recognition and animation features.

Singapore Tourism Board integrated Google ARCore and Geospatial Creator platforms.

Interface Design

The Taiwan Lantern Festival and Singapore Tourism Board apps provided easy navigation and information with user-friendly interfaces.

ICA San Diego's mobile application adopted a design to guide users only spatially.

Visual Use

Taiwan Lantern Festival emphasized visuals with AR fireworks and interactive visuals.

ICA San Diego adopted a more minimalist visual approach and focused on navigation.

Singapore Tourism Board enriched the visual narrative with the Merli mascot.

Table 2. Comparative Analysis of Augmented Reality Supported Virtual Tour Applications

Criteria	Taiwan Lantern Festival	Institute of Contemporary Art San Diego	Singapore Tourism Board
Technologies Used	AR, LBS, SLAM	AR, Surface Tracking	AR, LBS,SLAM
Gamification	Yes. Engagement is increased with tasks and rewards; the user completes interactive tasks.	No. It does not include gamification elements; only guidance is provided.	Yes. It provides a gamified experience in the city with interactive quests and exploration.
Interactivity	Users interact with the virtual guide, providing a dynamic experience filled with wayfinding and virtual elements.	Provides access to artistic information with AR guide; interactive elements are limited.	AR guidance where users can interact with location-based content.
Interface Design and Visual Use	A design that draws the user in with lighting, projection and colorful 3D content.	The AR guide focuses on artworks with a simple interface; minimal animation.	User-friendly interface, visual focus with landmarks and local information for city guidance.

Taiwan Lantern Festival, Institute of Contemporary Art San Diego, and Singapore Tourism Board projects have enriched virtual guidance experiences by using augmented reality (AR) technology in different ways. The projects analyzed in this study demonstrate different applications of augmented reality technologies. The technologies used in these projects include innovative solutions such as location-based services (LBS), SLAM and ARCore. However, the scope of augmented reality technologies is not limited to this study. There are examples in the literature where AR is used in a wider range of applications such as face recognition, augmented audio, holographic projection, etc. The study

focuses on technologies appropriate to the context of the projects analyzed, and other applications are excluded from the study.

At the Taiwan Lantern Festival, location-based services (LBS) and SLAM (Simultaneous Localization and Mapping) technology were used to locate users in the festival area. This provided real-time guidance and allowed users to be guided around the festival site. Interactivity was enhanced through gamification elements (e.g. quests and rewards). By completing tasks, visitors both interacted with the cultural heritage and explored the festival site. This shows that AR makes users' experiences more engaging through gamification. Natalia Teixeira et al. (2021) examined how augmented reality (AR) technology can be gamified with interactive elements and its effects in increasing user engagement. They find that gamification elements such as tasks and rewards increase user engagement. The case of the Taiwan Lantern Festival demonstrates the potential of AR technology in gamification and interactivity. The location-based services and interactive tasks used at the festival enabled visitors to connect with cultural heritage and increased participants' interest in gamified experiences. This application is in line with the theoretical themes outlined in previous studies and provides an example that reinforces the impact of AR in enriching the user experience. A simple and intuitive navigation interface was provided for users to explore the festival site. The AR map serves as a guide for completing tasks and winning prizes. The visuals are designed to visually entice users, in line with the theme of the festival. AR elements are visually enriched by integration with the physical space.

In the Institute of Contemporary Art San Diego project, a guided tour application was created using AR technology in the context of an art gallery. There are no gamification elements in this project. AR was used to guide visitors through the exhibition space and provide information about the artworks. Interactivity was limited. A simpler implementation was used for AR. The guide is focused on guiding users through the physical exhibition space. The technology used here is a visual tool to guide the visitor experience, but less focused on interactivity and information presentation. AR guidance was used to optimize the orientation in the exhibition space. Here the interface is more minimal and focused on providing spatial guidance rather than information about the artworks.

The Singapore Tourism Board used AR technology to allow exploration of the city's key cultural and historical landmarks. Gamification elements and interactive guidance allowed tourists to learn about landmarks in the city, while providing an interactive learning experience about local culture and history. The AR is enriched with interactive tasks and tourist items while exploring the city's highlights. The Merli mascot provides the historical and cultural context of the city while guiding users. This allows users to actively participate. Using Google ARCore and Unity platforms, key areas of the city were digitally mapped and an AR experience was provided. This provided a multi-layered AR experience for the discovery of tourist spots and allowed users to explore the city in a more interactive way. The AR navigation and interactive tour is integrated with an interface that provides information on the city's key landmarks. The Merli mascot effectively presents information for each point while guiding users. AR visuals are designed to make the city more attractive and are combined with landmarks. While the Merli mascot conveys historical information to visitors through AR, the visual elements make the city vibrant and attractive.

Zikky et al. (2024) found that the combination of technologies such as AR and GPS navigation enhances the user experience and strengthens the orientation function in heritage sites. This combination of technologies offers an effective solution that combines physical space exploration with a digital experience, similar to the Singapore Tourism Board's location-based AR guidance application.

Visual elements in AR projects act as a bridge connecting the digital and physical worlds. Azuma et al. (2001) emphasized the importance of ensuring visual consistency in AR when adding digital content to the real world. The Singapore Tourism Board's visualization of local culture using the Merli mascot is an example of this principle. The AR fireworks display and visual effects in the story “Mouse Gets Married” at the Taiwan Lantern Festival succeeded in capturing the attention of visitors and presenting a visual story.

Conclusion

This paper analyzes three case studies of the use of augmented reality (AR) technology in virtual directory applications. The projects analyzed how AR was integrated, the purposes for which it was applied, and the interactive experiences it offered to users. The study reveals how the Singapore Tourism Board, the Institute of Contemporary Art San Diego and the Taiwan Lantern Festival all utilize AR in different ways, such as deepening user experiences, increasing spatial awareness and digitally presenting cultural stories.

The immersive experiences offered by AR take users beyond physical spaces and offer a new way of exploration through interactive guidance. In this sense, the use of AR adds a new dimension to traditional guidance approaches. AR enables users not only to passively consume information, but also to make the experience more meaningful through active participation. Digital guiding with AR technology not only provides visitors with information, but also makes cultural heritage more accessible and interactive. However, in addition to the advantages offered by this technology, user feedback and technical improvements should also be considered.

Gamification and interactivity have emerged as a powerful way to increase user engagement, particularly in the Taiwan Lantern Festival and Singapore Tourism Board projects. Task-based gamification elements enabled users to have fun and interact with cultural heritage at the same time. Technological infrastructure played a critical role in the success of the projects, with the effective integration of technologies such as LBS, SLAM and ARCore enhancing the user experience. Interface design focused on providing a user-friendly experience in each project, providing practical solutions for navigation and information presentation. The use of visuals emphasized the educational and artistic potential of AR by presenting cultural and historical content in both aesthetic and informative ways.

Looking at the intensity and prevalence of digitalization today, it is estimated that the use of "artificial intelligence, augmented reality, personalized services and robots" will increase in tourism businesses and activities in the future (Bağcı & İçöz, 2019). In the future, various improvements can be made to ensure that augmented reality (AR)-based guidance systems become more accessible and widespread. Integrating artificial intelligence (AI) technology into these applications can facilitate a more personalized and dynamic guidance experience. AI-powered systems have the potential to increase user satisfaction by providing content recommendations tailored to visitors' interests. Furthermore, the combination of AR and AI can analyze visitor behavior to create a more interactive and efficient experience. To expand the reach of this technology, it is crucial to develop cost-effective and user-friendly AR systems for smaller museums and tourist destinations.

AR technology remains an important tool for redefining the user experience and strengthening cultural context. However, the integration of this technology with other advanced technologies such as AI, big data analytics and MR offers the opportunity to develop more personalized, effective and sustainable applications. Future work should consider in more detail how such integrations can be applied in societal and cultural contexts.

In the future, AR technology is expected to offer more advanced, personalized and contextual guidance through its integration with artificial intelligence (AI). By analyzing users' interests, learning habits and individual needs, AI-powered AR systems can deliver content tailored to each user. For example: Speech recognition and natural language processing technologies allow users to interact with the guide by voice, ask real-time questions and receive instant information. In addition, recommendation systems allow visitors to be directed to exhibits or areas of interest based on previous interactions. Visual recognition and advanced AR technologies enable users to recognize an artifact in real time and learn about its historical, cultural or artistic context. These integrations strengthen both the educational and entertainment aspects of AR, enabling users to make a more meaningful connection between the physical and digital worlds. Integrating such technologies can further deepen both educational and entertainment-oriented experiences, especially in museums and tourism spaces. AI-enhanced AR can provide a more interactive and natural user experience, enhancing visitors' spatial perception and contextual understanding.

Recommendations

Both researchers and practitioners should focus on enhancing the effectiveness and accessibility of AR in tourism. Researchers should conduct user-centered studies to assess AR's long-term impact on engagement and satisfaction, while

also comparing it with other immersive technologies like VR and MR. Practitioners, including tourism organizations and cultural institutions, should prioritize intuitive design, interactivity, and seamless integration to maximize AR's potential. Collaboration between academia and industry can drive cost-effective, scalable, and engaging AR solutions, ultimately improving tourist experiences.

Limitations of Study

This study has several limitations. First, the research primarily relies on case study analysis, which provides an in-depth examination of selected AR-based tourism projects but may not be generalizable to all tourism applications. Future studies could employ quantitative methodologies, such as surveys or experimental designs, to collect user feedback and performance metrics on a larger scale.

Second, the study focuses on three specific AR projects (Taiwan Lantern Festival, ICA San Diego AR Guided Tour, and Singapore Tourism Board AR Application), which may limit the scope of findings. A broader dataset, including a more diverse range of AR applications across different cultural and geographical contexts, would offer a more comprehensive understanding of AR's role in tourism.

Lastly, technological advancements and evolving user expectations could impact the relevance of current findings. As AR technology continues to develop, future research should address new hardware capabilities, artificial intelligence integration, and evolving user behaviors to ensure continued relevance in the tourism sector.

Acknowledgment

The authors would like to express their gratitude to all researchers and industry professionals whose studies and technological innovations contributed to this research. No funding was received for this research, and there are no conflicts of interest to declare. All authors contributed equally to the conceptualization, data collection, analysis, and writing of this paper.

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Figure 7. https://www.youtube.com/watch?v=LTqnoR45OdI

Figure 8. https://icasandiego.org/art/gabriel-rico/

Figure 9. https://www.youtube.com/watch?v=Io720xPShn8

Figure 10. https://www.youtube.com/watch?v=zFxpXiAkT2k&list=PLjhgRr1fomj2s3rx221ay1__kiChLzorp&index=2

Figure 11. https://blog.google/around-the-globe/google-asia/singapore-arcore-stb/

Journal for the Interdisciplinary Art and Education, 6(2), 89-115, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

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Research Article

Rondo[Squared] • Kabalevsky, Op. 59

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Article Info

Received: 14 January 2025
Accepted: 18 April 2025
Available online: 30 June 2025

Keywords
Analysis
Form
Kabalevsky
Op. 59
Rondo

Abstract

Dmitry Borisovich Kabalevsky's (1904-1987) *Rondo* in A Minor, Op. 59 (1958), composed for the inaugural Tchaikovsky International Piano Competition, stands as a remarkable convergence of traditional rondo principles and innovative compositional techniques emblematic of the 20th century. This study examines the structural and motivic complexities of the piece, providing a detailed analysis of Kabalevsky's inventive approach to classical forms and his skillful fusion of tradition and innovation. Traditionally characterized by alternating a principal theme (A) with contrasting episodes (B, C, etc.) in patterns such as ABACADA, the rondo form is the foundation of Kabalevsky's composition. However, Kabalevsky transcends conventional approaches by embedding additional 'sub-rondos' within sections B, C, and D, resulting in a multi-tiered formal design. This unique framework, termed 'Rondo[Squared]' [R^2] for the first time in this study, offers a new analytical perspective in which rondo structures interact across multiple levels. By emphasizing the cyclical and recursive qualities of the form, this approach underscores Kabalevsky's ingenuity in pushing the limits of traditional composition. Motivic analysis of the piece reveals nine distinct motifs, each meticulously woven into the tonal and structural fabric of the work. These motifs demonstrate Kabalevsky's mastery of balancing repetition and contrast and highlight his skill in generating fluid transitions between tonal areas and structural sections. Integrating traditional rondo characteristics with elements reminiscent of the sonata-rondo form reflects Kabalevsky's ability to reinterpret classical forms for a contemporary audience. This synthesis results in a work that is both accessible and intellectually sophisticated, appealing to performers, educators, and listeners alike. The 'Rondo[Squared]' concept, proposed in this study, offers a novel perspective for understanding complex formal relationships, providing new avenues for exploring the evolution of classical forms in modern music.

To cite this article

Karadeniz, I. (2025). Rondo[Squared] • Kabalevsky, Op. 59. *Journal for the Interdisciplinary Art and Education, 6*(2), 89-115. DOI: https://doi.org/10.5281/zenodo.15510392

Introduction

> *Only when the constituent parts of a whole have the unique end of contributing to the consummation of a conscious experience, do design and shape lose superimposed character and become form. They cannot do this so long as they serve a specialized purpose; while they can serve the inclusive purpose of having "an" experience only when they do not stand out by themselves but are fused with all other properties of the work of art* (Dewey, 1980: 117).

> *In most intellectual work, in all save those flashes that are distinctly esthetic, we have to go backwards; we have consciously to retrace previous steps and to recall distinctly particular facts and ideas* (Dewey, 1980: 182).

Dewey's perspective highlights a crucial aspect of music theory: Form is not merely a structural blueprint but a dynamic process of fragmentation and reintegration. Musical analysis, therefore, extends beyond identifying formal

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patterns; it requires a deeper engagement with how disparate elements coalesce into a unified artistic experience. This perspective is particularly relevant in works that challenge conventional boundaries, where structure emerges through transformation rather than static design. By adopting this interpretative approach, music theory moves beyond mere classification, embracing the way form is perceived, reconstructed, and ultimately understood.

Dmitry Kabalevsky's (1904-1987) *Rondo* in A Minor, Op. 59 (1958) was composed for the inaugural Tchaikovsky International Piano Competition[2], a major cultural event showcasing Soviet musical excellence (Sikorski, 2018: 83). This context influenced the piece's virtuosic demands, formal clarity, and balance between tradition and innovation. As a Soviet composer, Kabalevsky adhered to Socialist Realism, favoring accessible yet sophisticated structures. The piece also aligns with Soviet preferences for structured, technically demanding music that highlights national artistry. A closer analysis of the work reveals how Kabalevsky reimagines the rondo form in a highly innovative manner, a concept that will be explored in the following sections. This study highlights how Kabalevsky enhances the rondo form by balancing complexity with clarity.

General Structure: Journey to the Form

Among the genres, forms, and concepts of Western Music, the 'rondo' (in Italian, English, and German usage; in French, *rondeau*) occupies a particular position due to its easy comprehensibility. Its clear structure, which can also be characterized as simplicity, has been the main reason for its widespread use. Although providing a precise explanation of the term's origin is problematic, it should be noted that the connection between the medieval and Renaissance *rondeau* and the 17th and 18th century rondo is tenuous at best (Cole, 1995: 172).

In the conventional rondo form, the principal theme (typically denoted as 'A') functions as the central motif, also termed the refrain. This core theme interchanges with subordinate sections identified as couplets or episodes (notated as 'B,' 'C,' etc.) before circling back towards the conclusion to finalize the movement (Wolf, 1986: 717). The refrain consistently resides in the tonic key throughout the piece, while the couplets or episodes explore contrasting tonalities.

> The rondo form emerged in the Baroque period and became increasingly popular during the Classical period. The earliest examples of compositions employing rondo form are found within Italian opera arias and choruses of the first years of the 17th century. These examples use a multi-couplet rondo or chain rondo (ABACAD) known as the Italian rondo (Cole, 1995: 172).

Typical forms of this formal structure, in which the main theme is constantly returned to and contrasting musical sections are heard in between (Bennett, 1995: 280), are as follows: 'ABACA', 'ABACADA,' 'ABACAB,' 'ABACBA,' or 'ABACABA' (Wolf, 1986: 717).

The 'sonata-rondo,' which is a combination of classical 'sonata' and 'rondo' structures in various degrees, follows an ABACAB'A plan in which the first A and B are treated as the first and second themes of an Exposition (B is usually in the dominant or related tonality), the C section is a Development (Dev.), and the second A and B (AB') correspond to a Recapitulation (A and B' in the tonic) (Wolf, 1986: 717). This hybridization of rondo and sonata elements in Op. 59 resonates with Hepokoski & Darcy's (2006: 388) discussion of the flexible boundaries between classical forms. Their concept of 'dialogic form' suggests that formal sections engage in a dynamic reinterpretation rather than adhering to rigid paradigms. Similarly, Kabalevsky's approach to form in Op. 59 explores new structural possibilities by incorporating recursive formal elements within a larger rondo framework, reflecting the evolving nature of form in 20th century compositional practice. Although Gauldin (2004: 446) classifies rondos as 'five-part,' 'seven-part,' and 'sonata-rondo,' and Caplin (1998: 231) classifies rondos as 'five-part rondo' and 'sonata-rondo' in the Classical period, it is possible to speak of three types of rondo, valid for the entire Common Practice Period:

- Type 1 Rondo: Italian Rondo or Theme and Variations Type Rondo – ABACADA...A
- Type 2 Rondo: Seven-Part Rondo – ABA C ABA
- Type 3 Rondo: Sonata-Rondo – ABA Dev. ABA

[2] For the details of that competition see Isacoff, 2012; Riem, 2022.

Apart from the rondo types mentioned above, the study has identified another rondo approach, and this formal organization will be explained through a 20th century rondo: Russian composer Dmitry Kabalevsky's *Rondo* in A minor (Op. 59), composed in 1958 for the First International Tchaikovsky Competition.

This study explores Kabalevsky's reinterpretation of the rondo form in his *Rondo* in A Minor, Op. 59, highlighting its structural innovations and musical significance. This research seeks to demonstrate how Kabalevsky reinterprets traditional rondo form by incorporating smaller rondo structures within its episodes, thereby expanding formal possibilities in 20th century piano music. Rather than focusing solely on traditional rondo models, this analysis explores how Kabalevsky's formal design enriches our understanding of compositional techniques. The findings provide insight into how classical forms can be adapted and reinterpreted in modern contexts.

These formal complexities in Kabalevsky's work necessitate a detailed structural and motivic analysis, which will provide the foundation for a new interpretative framework: 'Rondo^{Squared}' or 'R^2.'

Methodology

This study employs a formal and motivic analysis approach to examine the structural and thematic organization of Kabalevsky's *Rondo*. The methodology is based on structural segmentation, thematic recurrence, tonality shifts, and motivic transformation. To ensure transparency, this section explicitly defines the criteria used for identifying form sections and motifs.

Criteria for Determining Form Sections

Cadences:[3] The identification of structural boundaries is primarily based on cadence types and their placement within the piece. Authentic and half cadences play a crucial role in segmenting the form into its principal and subordinate sections.[4]

Thematic Recurrence: The presence of recurring thematic material in the same or transposed keys helps delineate large-scale sections.

Tonality and Modulation: Changes in tonality, particularly between tonic and closely related keys, contribute to the demarcation of episodic sections.

Phrase Structure: The phrase design (e.g., period, sentence, or hybrid forms) influences the segmentation of formal units.

Motivic Variation: Instances of significant motivic transformation or development serve as indicators of transitions and structural shifts.

Criteria for Identifying Motifs

Melodic Contour: The shape of the melody and its intervallic characteristics serve as primary distinguishing features of motifs.

Rhythmic Identity: Recurrent rhythmic patterns, even in different pitch contexts, contribute to the recognition of motifs.

Harmonic Context: The harmonic progression surrounding motif aids in establishing its distinct identity.

Textural Prominence: Motifs appearing in prominent textural positions (e.g., right-hand melodic lines in piano compositions) are prioritized in the analysis.

By employing these criteria, this study ensures a structured and consistent approach to analyzing the formal and motivic aspects of Op. 59. The methodological framework enhances clarity in distinguishing between primary themes, episodic content, and motivic development, thereby reinforcing the validity of the Rondo^{Squared} [R^2] concept.

[3] For the types of cadences see Gauldin, 2004: 133-134.

[4] Cadences serve as primary structural markers, delineating formal sections as outlined by Laitz (2012: 106). In Op. 59, the alternation between authentic and half cadences reinforces sectional boundaries, contributing to the overall coherence of the Rondo^{Squared} design.

Analysis

Form Analysis

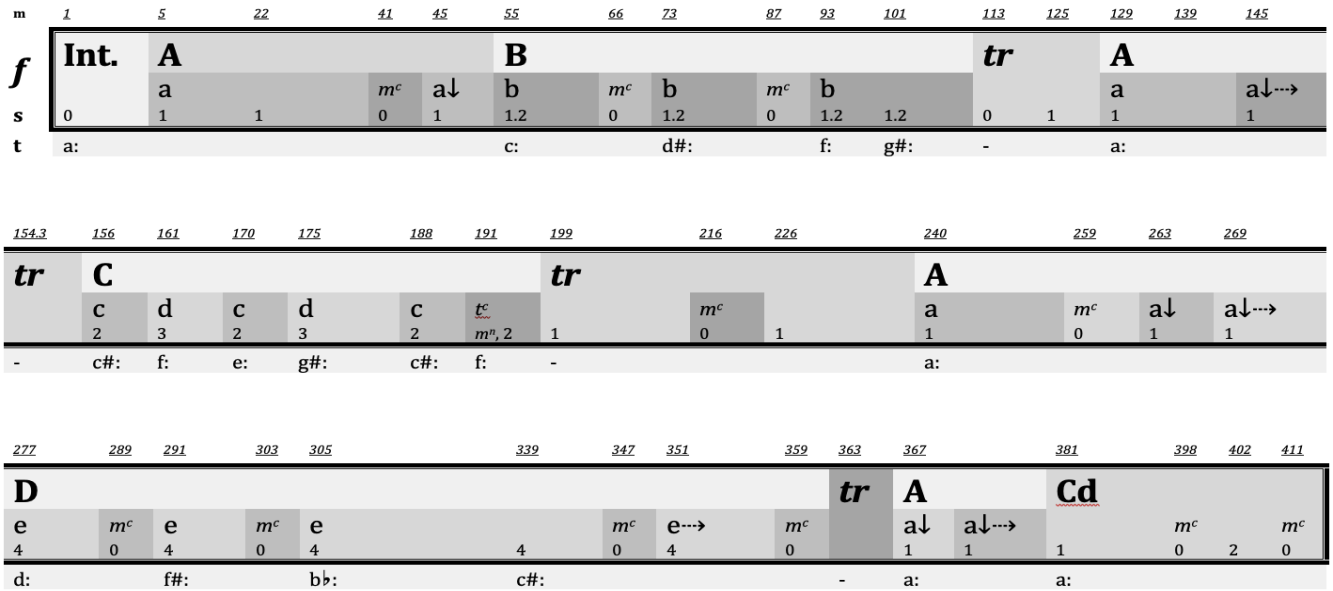
In general, cadences play an essential role in determining the boundaries of the form, and the boundaries defined by these cadences shape the internal dynamics of the section as well as the external framework of the form. The analysis reveals the main divisions of the 1958 work (Kabalevsky, n.d.: 3-17) in order. The abbreviations and symbols in the table have the following meanings respectively:

Table 1. Abbreviations, symbols, and their meanings throughout the study

Abbreviations and symbols	Meanings
m	measure number
f	form section
s	sentence type
t	tonality
Int.	introduction
tr	transition
Cd	coda
m^c	closing material
t^c	closing theme
m^n	new material
↓	descending part
⇢	prolongation

The data obtained as a result of the analysis of the work can be expressed as follows:

Table 2. Form Analysis: Kabalevsky, Op. 59



Motivic Analysis

The word 'motif' is explained with the following sentences in the sources: "A brief melodic and/or rhythmic musical idea – often a small but significant fragment of a theme, with recognizable shape and musical character and identity" (Bennett, 1995: 197). "A short musical idea, be it melodic, harmonic, or rhythmic, or all three. A motif may be of any size, though it is most commonly regarded as the shortest subdivision of a theme or phrase that still maintains its identity as an idea" (Drabkin, 1995: 648). Motivic transformation plays a crucial role in structural coherence, as described by Schoenberg (1967: 16-19). Kabalevsky's approach demonstrates a balance between thematic recurrence and variation, aligning with Rothstein's (1989: 102) discussion on phrase rhythm and motivic development.

As a result of the analysis, the presence of nine different motifs in the work has been determined, and it is possible to show them in the order in which they appear as follows:

Material #1

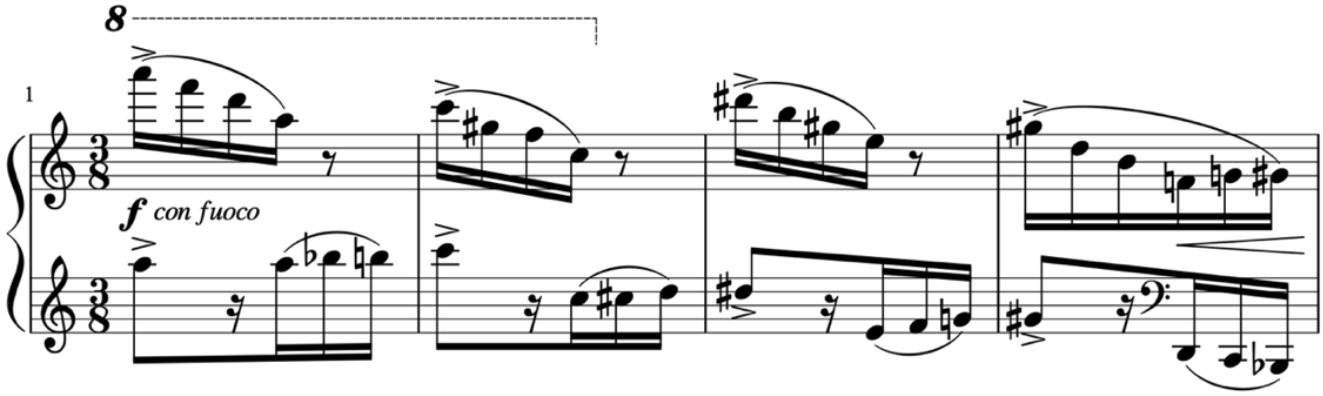


Figure 1. Material #1 ➤ *f*: Int. ➢ *s*: 0

Material #2

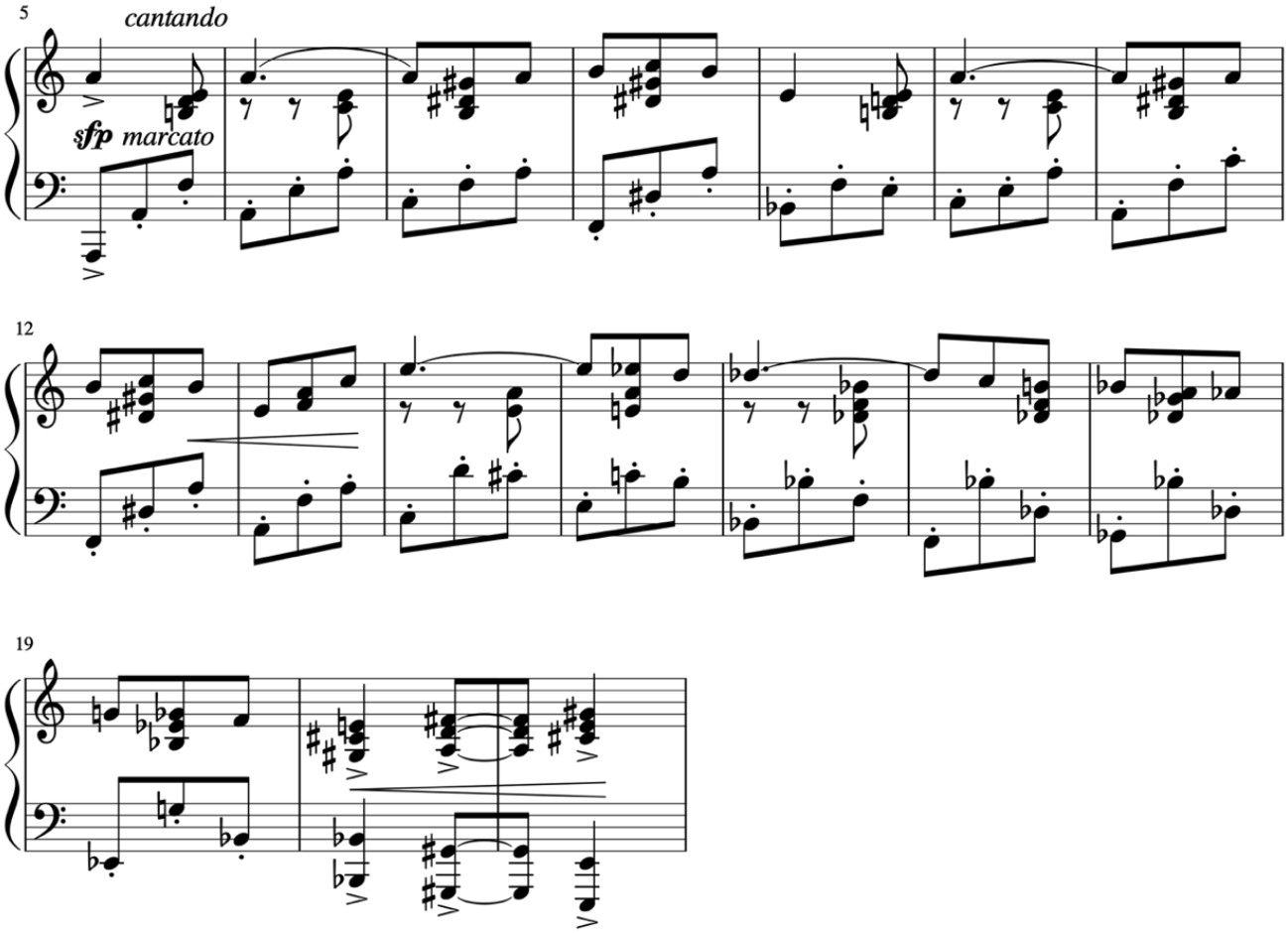


Figure 2. Material #2 ➤ *f*: A/a ➢ *s*: 1

Material #3

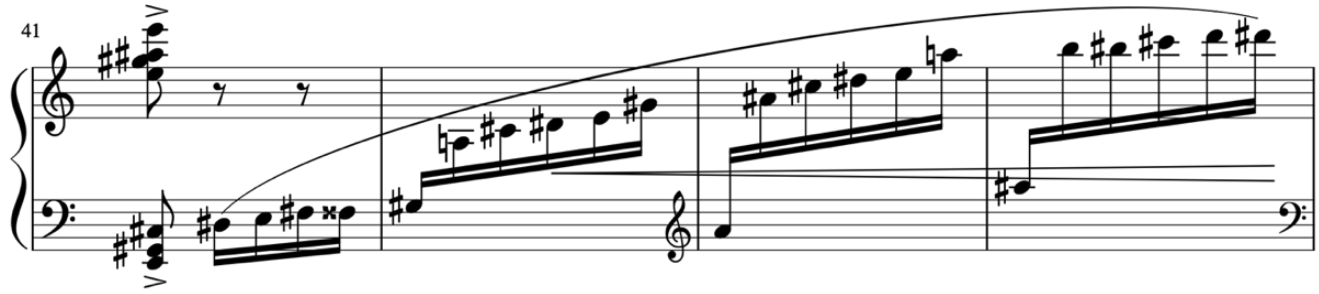


Figure 3. Material #3 ➤ *f*: A/m^{c} ➢ *s*: 0

Material #4

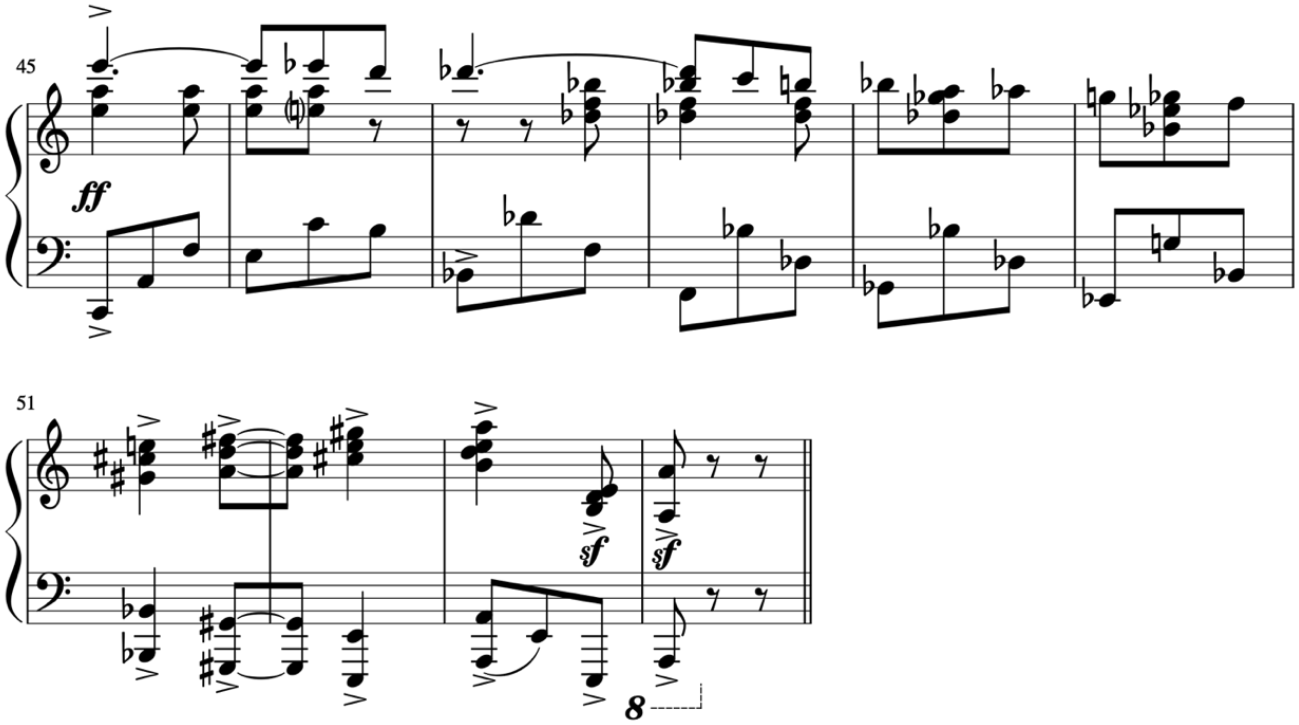


Figure 4. Material #4 ➤ *f*: A/a↓ ➢ *s*: 1

Material #5

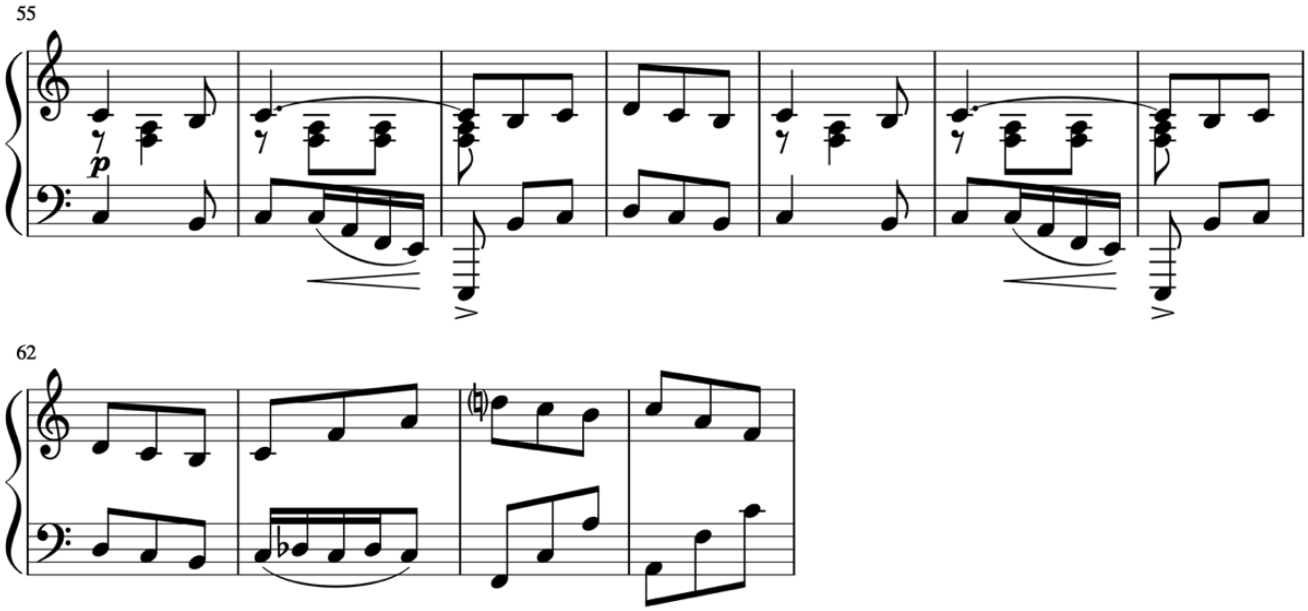


Figure 5. Material #5 ➤ *f*: B/b ➢ *s*: 1.2

Material #6

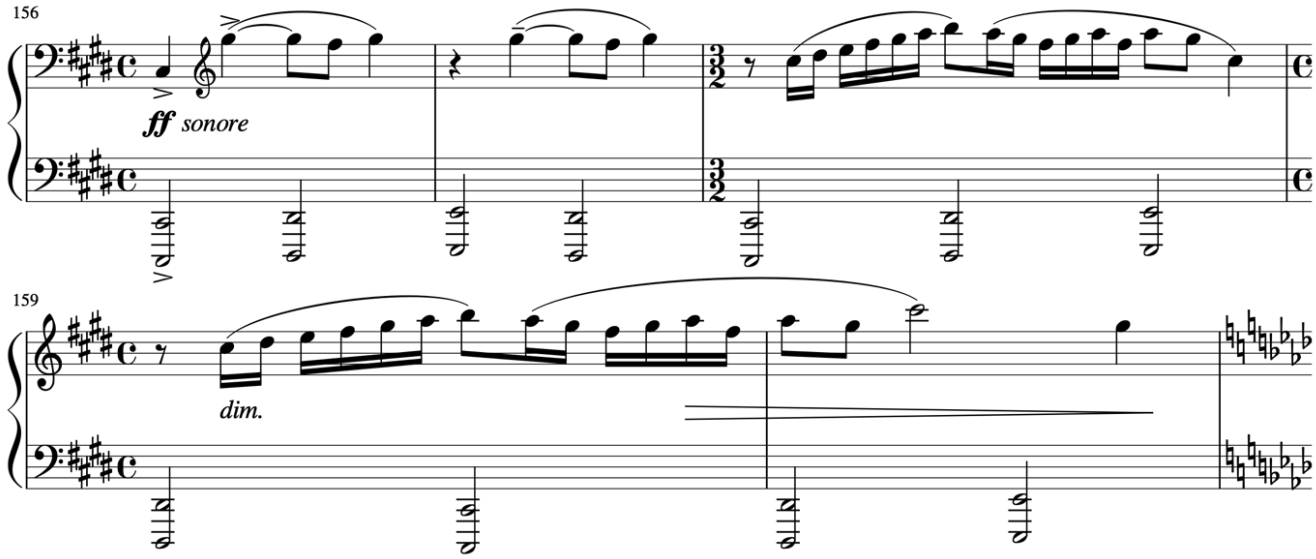


Figure 6. Material #6 ➤ *f*: C/c ➢ *s*: 2

Material #7

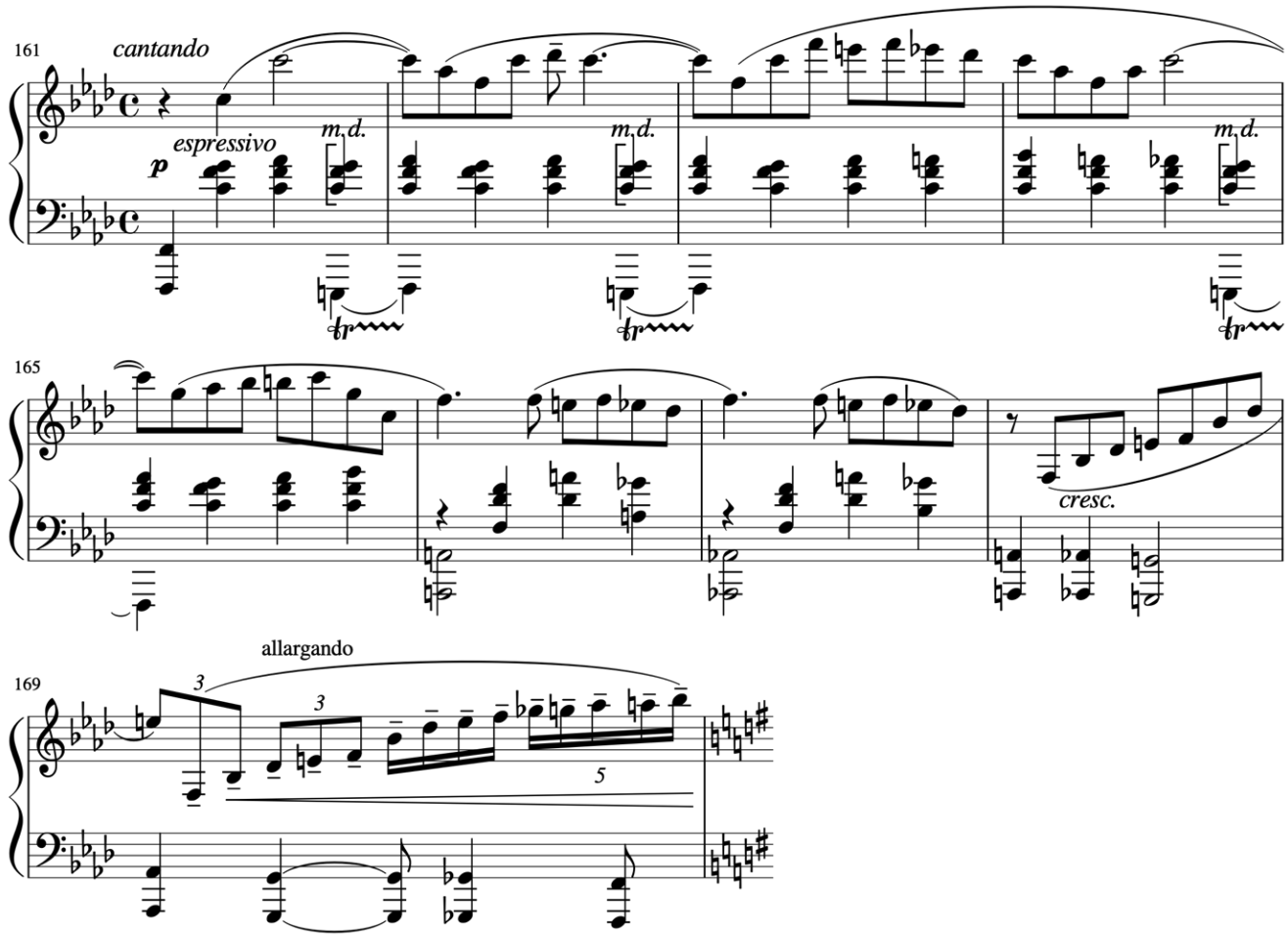


Figure 7. Material #7 ➤ *f*: C/d ➢ *s*: 3

Material #8

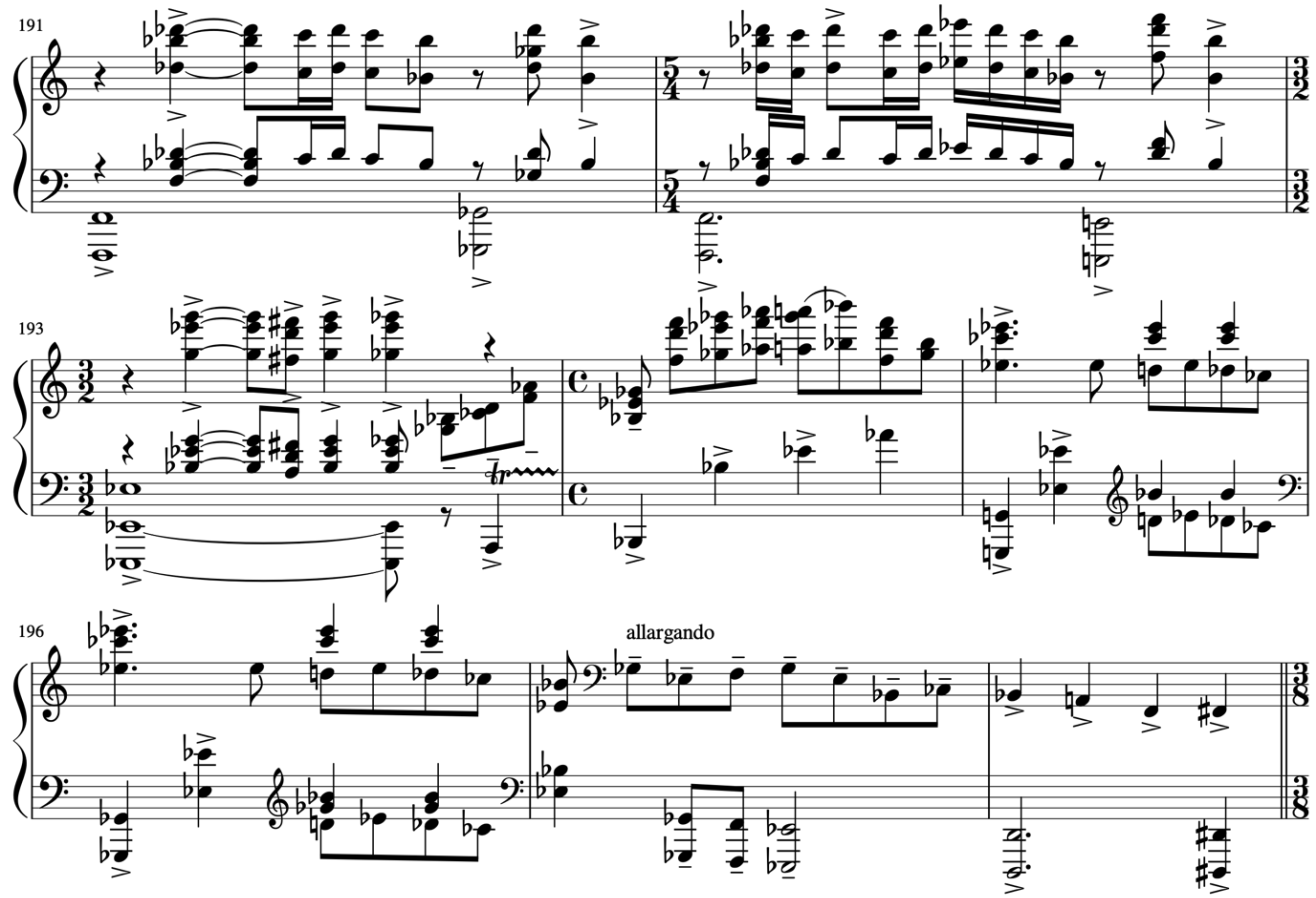


Figure 8. Material #8 ➤ *f*: C/t^{c} ➢ *s*: m^{n}, 2

Material #9

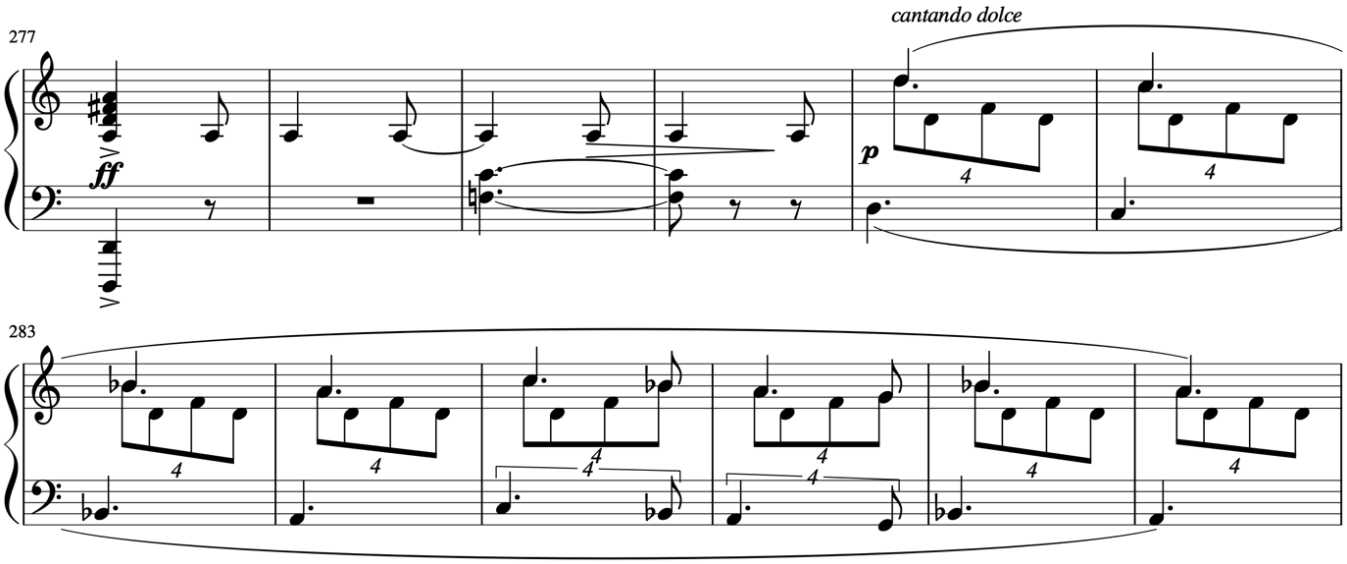


Figure 9. Material #9 ➤ *f*: D/e ➢ *s*: 4

A New Suggestion: Rondo$^{\text{Squared}}$ [R^{2}]

According to the analysis, it was revealed that the piece has the form of Type 1 Rondo – Italian Rondo: ABACADA. Although Shen (2019: 364) suggested that the work is a typical rondo in terms of playing, he could not help but draw attention to its similarity with the sonata-rondo:

> "Rondo in a Minor Op.59" is a piano piece for the first Tchaikovsky International Piano Competition in 1958 against the background of war. This piece is a typical Rondo for playing. It not merely boasts a structure in

which the principal part and the inserting part of the Rondo alternate, but possesses the characteristics of the principal part, the unfolding part and the reproduction part of the sonata form (Shen, 2019: 364).

Shen (2019: 364) provides an important perspective on the performance aspects of Kabalevsky's *Rondo* in A Minor, Op. 59, describing it as a 'typical rondo' while also acknowledging its structural similarities with the sonata-rondo form. This duality aligns with the findings of the present study, where the Rondo^{Squared} [R^2] concept further clarifies how the piece operates on multiple structural levels beyond traditional rondo expectations. It would be appropriate to mention another type of rondo that can exemplify unusualness:

Although the rondo was used less frequently in the 19th century (compared to the end of the 18th century), it was still very much in vogue, especially in concertos. Many composers retained the formal structure perfected by Haydn, Mozart, and Beethoven. At this point, however, Schubert should be recognized as a notable exception: Schubert favored the ABABA design in his early years (Cole, 1995: 176), rarely using the more common ABACA structure or the sonata-rondo.

Now that we have mentioned Schubert's favorite, we can focus on Kabalevsky's rondo design from this perspective: The work's repeated (or 'rounded') sections are not limited to the A sections. New classifications need to handle this type of rondo. Although the structure in question points to a seven-part rondo in ABACADA form and is of the Type 1 Rondo, it is no coincidence that the C section also exhibits a structure of 'c-d-c-d-c + t^c (as a coda)', in line with Schubert's favorite ABABA form structure.[5] In fact, a similar approach was taken in the B and D sections of the composition: While the subfields of section B are 'b-m^c-b-m^c-b,' section D is designed as 'e-m^c-e-m^c-e-m^c-e-m^c-e⋯→ + m^c (as a coda).'

Table 3a. Detail from the Table 2: Sub-rondo in C part

156	161	170	175	188	191
C					
c 2	d 3	c 2	d 3	c 2	t^c *, 2
c#:	f:	e:	g#:	c#:	f:

Table 3b. Detail from the Table 2: Sub-rondo in B part

55	67	73	87	93	101
B					
b 1.2	m^c 0	b 1.2	m^c 0	b 1.2	1.2
c:		d#:		f:	g#:

Table 3c. Detail from the Table 2: Sub-rondo in D part

277	289	291	303	305	339	347	351	359
D								
e 4	m^c 0	e 4	m^c 0	e 4	4	m^c 0	e⋯→ 4	m^c 0
d:		f#:		b♭:	c#:			

[5] Kabalevsky, who uses a similar form structure in his *Sonatina* (Op. 13, No. 1) in the form of AA'BABA (see Blakley, 1982: 53), has an approach that follows tradition when it comes to 'musical form' (Lindsey, 1964: 14).

There is a 'sub-rondo' in each of the three sections. This intertwined form structure, in which the composer reinforces the alternating structure of the rondo form as much as possible and, in a sense, memorizes it, is named Rondo^{Squared} [R^2] in this study. R^2 refers to Kabalevsky's unique approach of embedding smaller rondo structures within the main rondo framework, creating a multi-layered form. Traditional rondo form is characterized by a principal theme (A) alternating with contrasting episodes (B, C, etc.). In R^2, however, these episodes themselves contain internal rondo-like structures, creating a multi-tiered, self-referential design. Just as squaring in mathematics results in exponential growth, this compositional approach amplifies the cyclic nature of the form, reinforcing both repetition and contrast on multiple levels. By explicitly layering rondo elements within the main structure, Kabalevsky transforms a traditionally linear form into an intricate, recursive system. This squared effect enhances thematic coherence while expanding formal complexity, making R^2 a fitting term for this unique structural innovation. This titling proposal should be treated as a super-category of the other types of rondos. This is because a work (or movement) can be a R^2 and any of the three types of rondos. The distinguishing feature here is that the formal structure reflects the rondo in all subdivisions.

Kabalevsky's R^2 concept stands out when compared to other modern rondo forms. While Prokofiev's *Piano Sonata No. 7, Op. 83* (III. Precipitato), emphasizes relentless rhythmic drive and harmonic boldness, Kabalevsky embeds recursive structural layering within a more classical framework. Similarly, Bartók's use of rondo elements in *Out of Doors, Sz. 81* (IV. The Night's Music: Lento) incorporates folk influences and irregular phrasing, contrasting with Kabalevsky's methodical approach.

Unlike these more linear or atmospheric interpretations, R^2 distinguishes itself by embedding complete sub-rondo cycles within secondary episodes, making it a unique fusion of tradition and innovation. This comparison underscores its significance as both a theoretical model and a compositional technique.[6] The structured recurrence within R^2 enhances both formal clarity and performance interpretation.[7]

Conclusion

The Rondo^{Squared} [R^2] concept proposed in this study presents a novel approach to analyzing multi-tiered rondo structures, exemplified in Kabalevsky's *Rondo* in A Minor, Op. 59. However, to establish a more robust theoretical foundation, this concept should be situated within a broader musicological and theoretical discourse.

Rondo forms have undergone significant transformations since their early iterations in Baroque and Classical periods. The Italian rondo (ABACADA) and seven-part rondo (ABACABA) have been widely used in Western music, while the sonata-rondo form (ABA Dev. ABA) reflects a fusion of thematic development and cyclic repetition (Wolf, 1986: 717). The R^2 structure can be understood as an evolution within this lineage, integrating sub-rondo formations into the secondary episodes of the primary rondo structure. A precedent for multi-layered rondo structures can be found in certain works by Beethoven, such as the final movement of his *Piano Sonata No. 8, "Pathétique", Op. 13*; where the central rondo theme undergoes embedded developmental transformations. Similarly, Schubert's preference for ABABA structures, particularly in his early piano works, provides another historical touchpoint that aligns with the R^2 approach (Cole, 1995: 176).

While Kabalevsky's Op. 59 provides a primary case study for Rondo^{Squared} [R^2], similar formal constructions can be identified in other compositions. For example:

Chopin's Scherzos: These works exhibit recursive thematic returns with embedded secondary developments, suggesting a rondo-like expansion within sections.

Prokofiev's Piano Sonatas: Many of Prokofiev's works employ rondo elements with interwoven motivic recurrences, particularly in *Piano Sonata No. 7*.

[6] Beyond its structural role, Rondo^{Squared} [R^2] shapes the listener's experience by enhancing expectation and familiarity. The nested rondo cycles reinforce cyclicality, making the form more engaging and memorable. Depending on thematic variation, sub-rondo sections may feel like intensified contrast or structural reinforcement. The interplay between return and deviation adds dynamism, transforming Kabalevsky's traditional form into a multidimensional listening experience.

[7] Dmitry Kabalevsky's dual role as composer and educator is evident in *Rondo* in A Minor, Op. 59. His emphasis on accessibility, technical growth, and expressiveness shapes the piece's design. The rondo form reinforces memory through thematic repetition, while sub-rondo sections introduce formal complexity. Varied articulation, dynamic contrasts, and technical demands further develop control and interpretation, making Op. 59 both a concert work and a valuable teaching tool.

Bartók's Contrasts and Bulgarian Rhythms: These compositions feature cyclical structures with embedded thematic returns, a characteristic shared with R^2.

By framing R^2 within these examples, it is possible to view it as an analytical tool applicable beyond Kabalevsky's Op. 59. This approach emphasizes the potential of rondo structures to encapsulate hierarchical recursivity, furthering discussions on form perception and compositional innovation in the 20th century. In conclusion, positioning R^2 within this expanded theoretical and musicological context enhances its applicability and relevance. Further research may explore how similar structural principles manifest in non-Western musical traditions and contemporary compositions.

This study meticulously dissects Kabalevsky's Op. 59 (1958), revealing its intricate relationship with the traditional rondo form. The motifs in all tonal zones (and transitions) are painstakingly identified, and their distribution within the basic form parts is meticulously revealed. This detailed analysis aims to elucidate the composer's use of motif structures and the innovations in this Modern period work.

The formal structure, contours, and internal dynamics of a work of art are equivalent to our first steps in understanding the work from a hermeneutical perspective. At the same time, the receptors required for the intended connection with the work and the targeted transformation are directly proportional to how much meaning we are loaded with while walking around the work. Just as concepts such as rhythm, phrase, period, or development are not only components of music theory but also valid for all fictional works of art, similarly, formal structure is not the monopoly of music, and it constitutes the first area of union with the receiver of all works of art that contain narration.

Beyond its theoretical contributions, this study also has practical implications for music education and performance. The R^2 concept provides a valuable framework for analyzing complex formal structures, making it a useful pedagogical tool in both theory and performance studies. Additionally, a deeper understanding of Kabalevsky's form and motivic strategies allows performers to make more informed interpretative choices, enhancing the clarity and expressiveness of their playing.

The composer's educator aspect is very prominent in his biographies (see Roizman, 1962; Daragan, 2001; Caliga, 2019; Jiang, 2020). Kabalevsky, who designed a rondo that has some similarities with the sonata-rondo but generally shows an example of Type 1 Rondo, seems to have composed one more form in the lower compartments of his work. In addition to being an Italian Rondo in this form, constructing a new 'rounded form' in each section draws attention. For this reason, it is considered appropriate to call this type of rondo 'Rondo$^{\text{Squared}}$,' indicating the result of 'rondo multiplying with rondo.'

Rondo$^{\text{Squared}}$ [R^2] represents a structural approach where each section of the rondo form embeds its own internal rondo structure, creating a multi-layered design. This recursive approach reinforces the cyclic nature of the form, metaphorically making it a '*rondo* raised to the power of *two*.'

Acknowledgment

First and foremost, I would like to thank my family for always being there for me. I also extend my gratitude to the journal editor and the reviewers who contributed to the development of this study, as well as to all my professors for their guidance and support throughout my academic journey, and to my students for their involvement and interest in my work.

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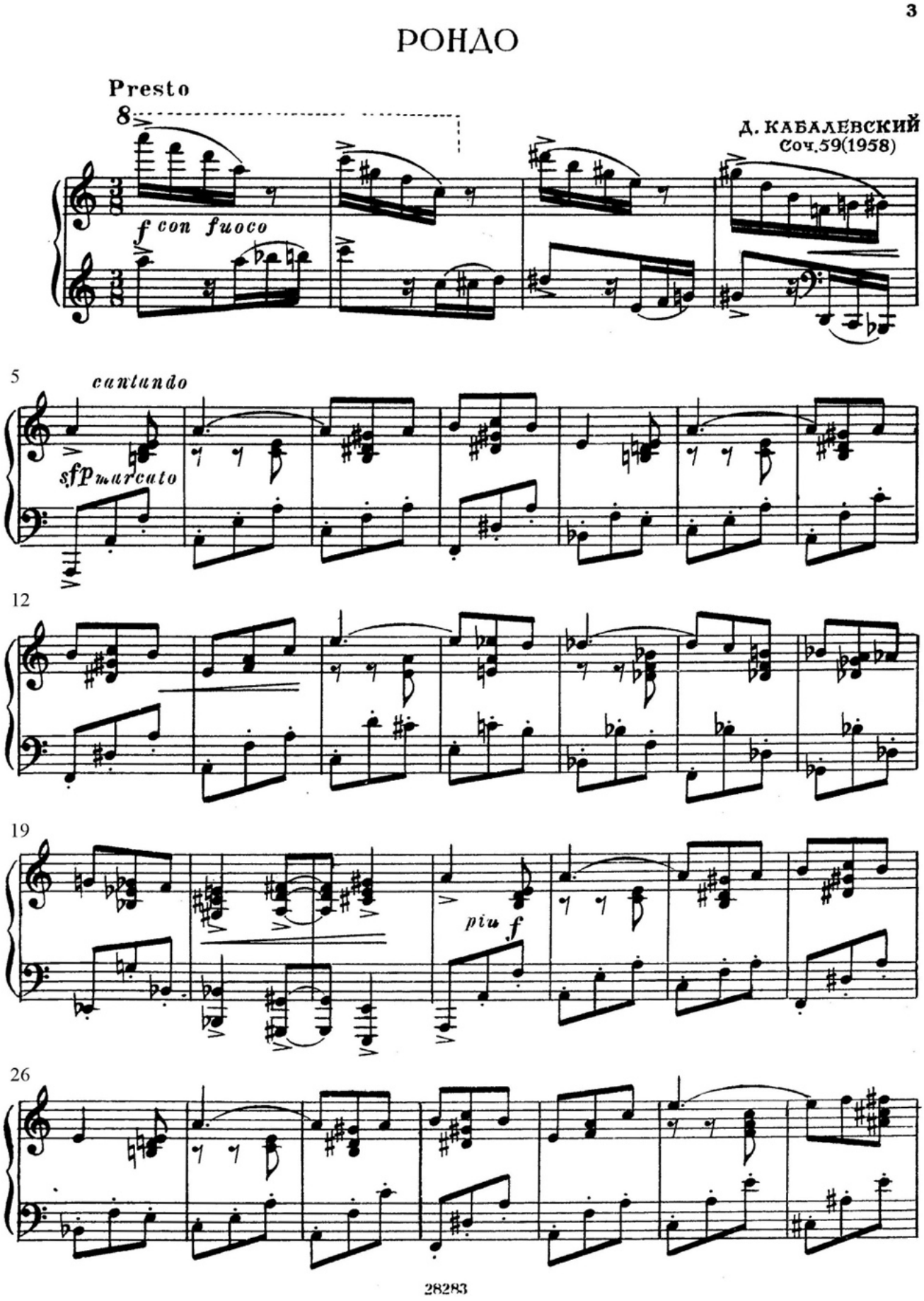
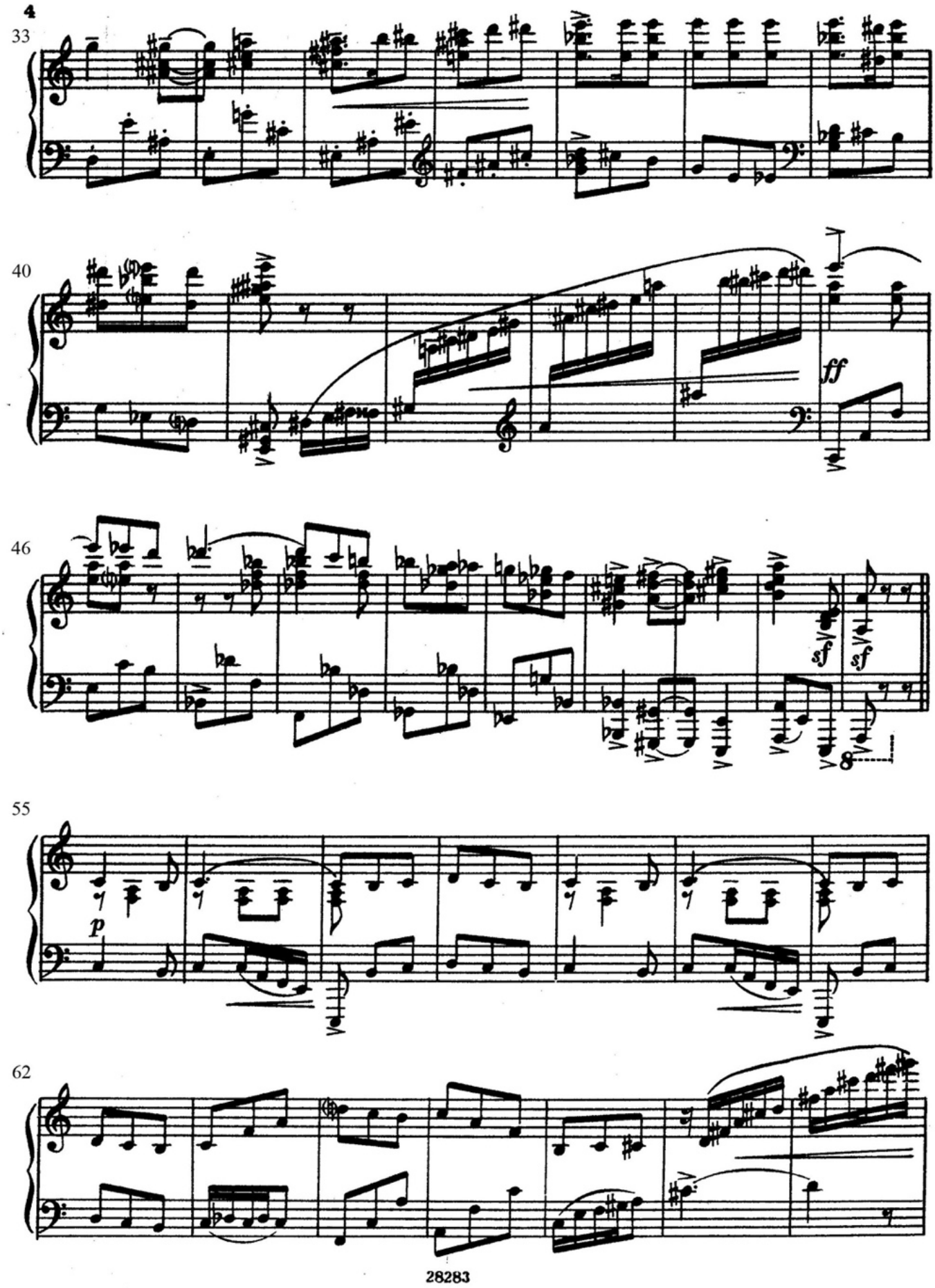
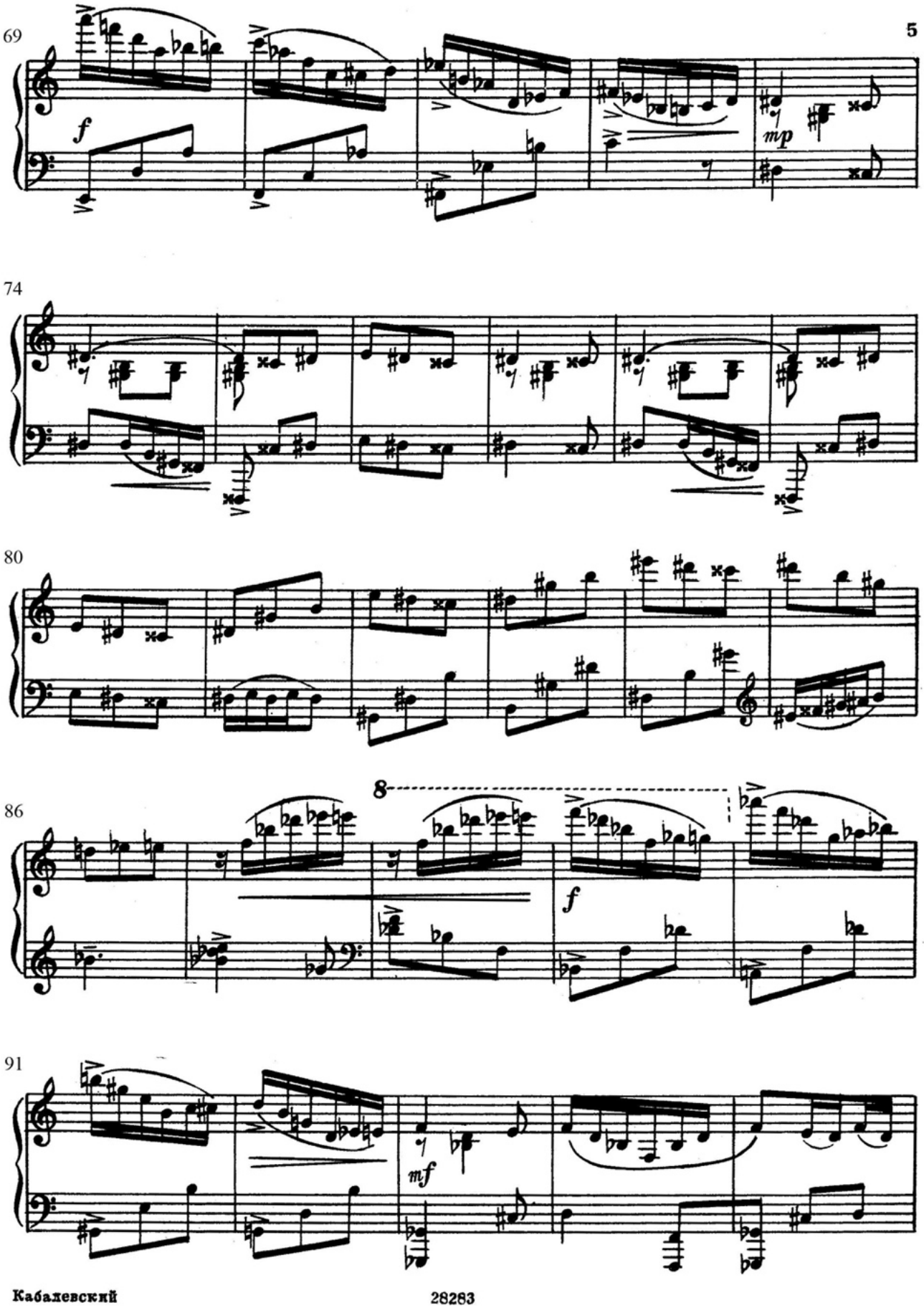
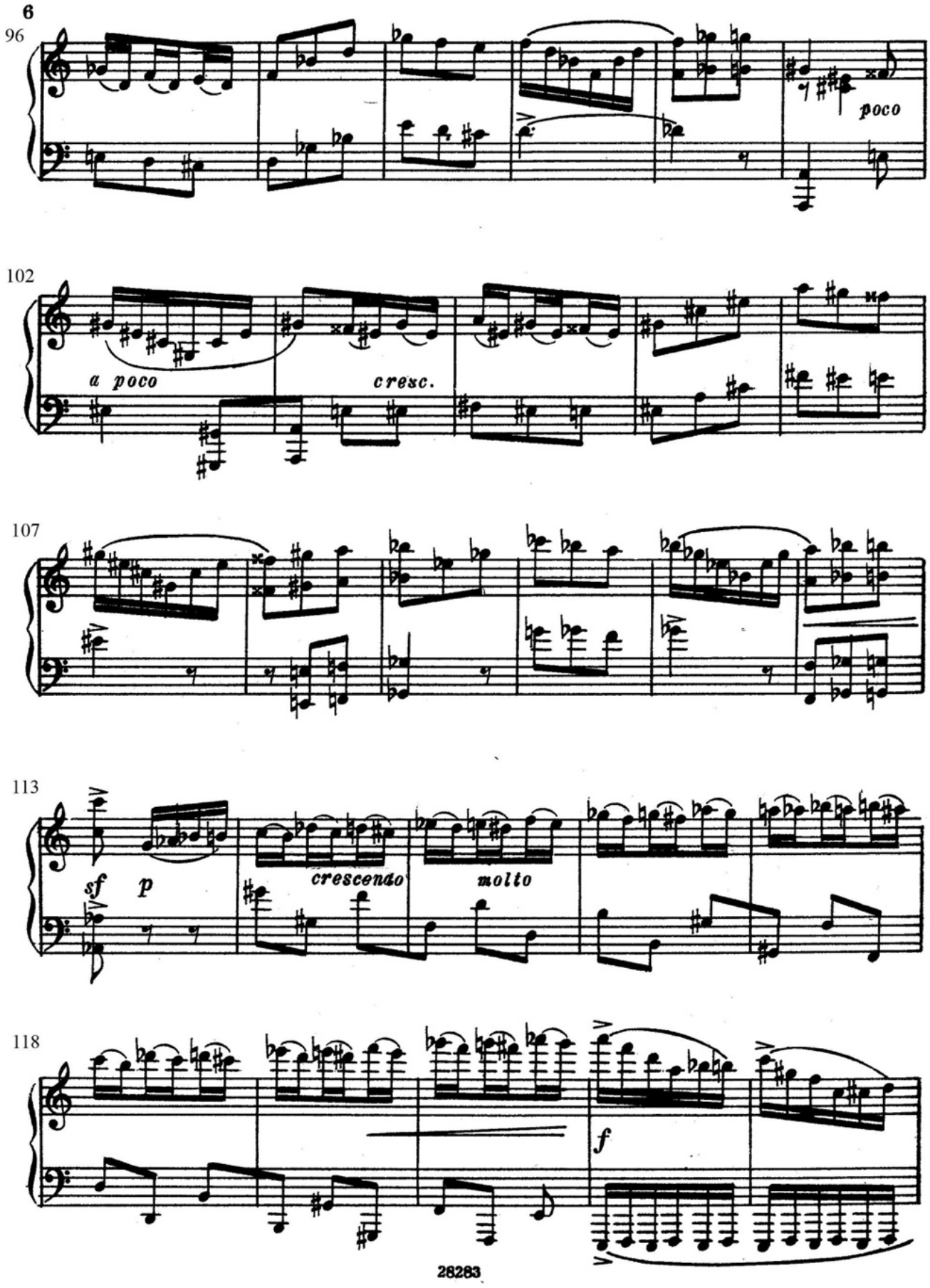
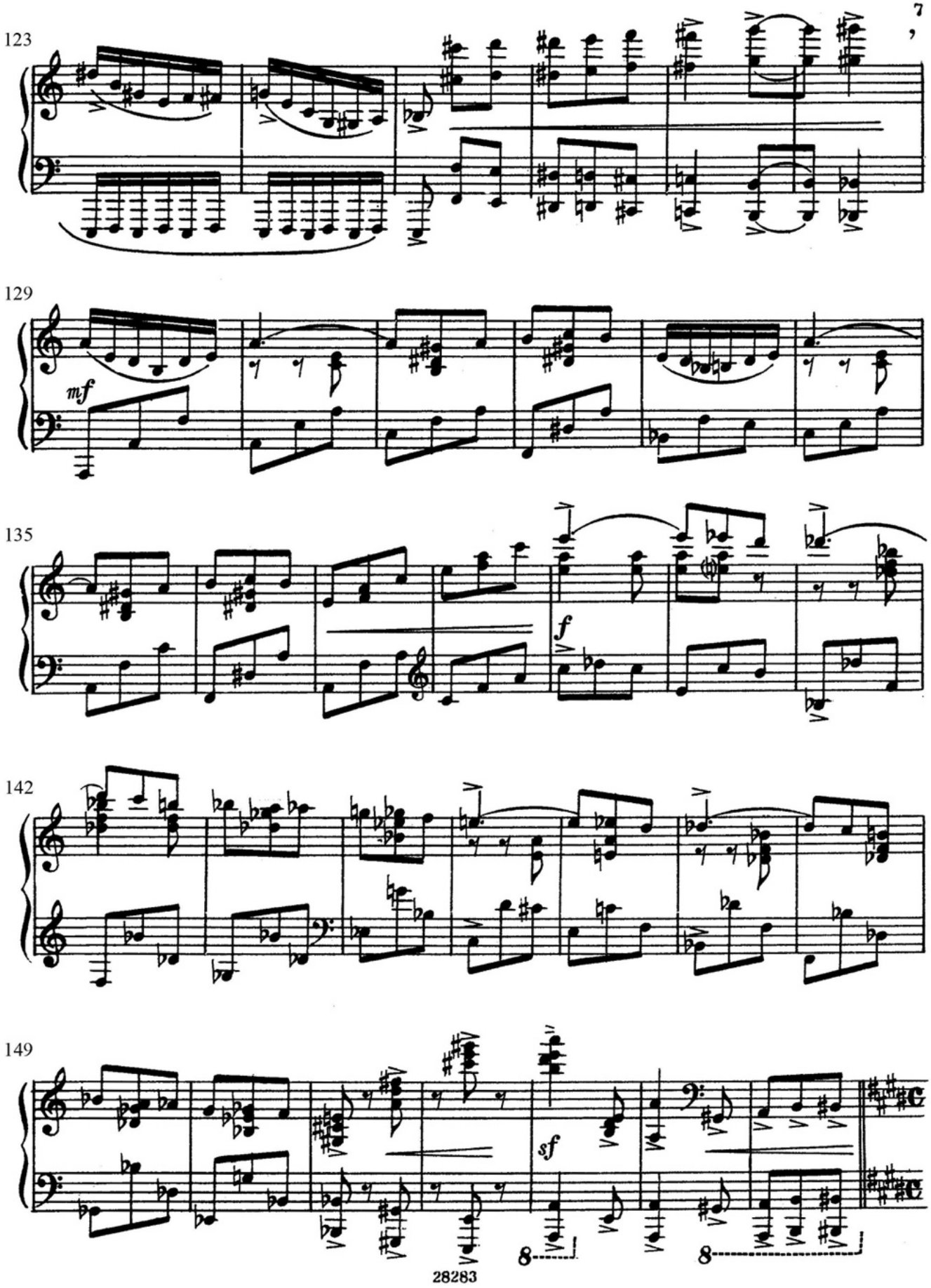
Appendix 1. Kabalevsky, Rondo, Op. 59 (Score)

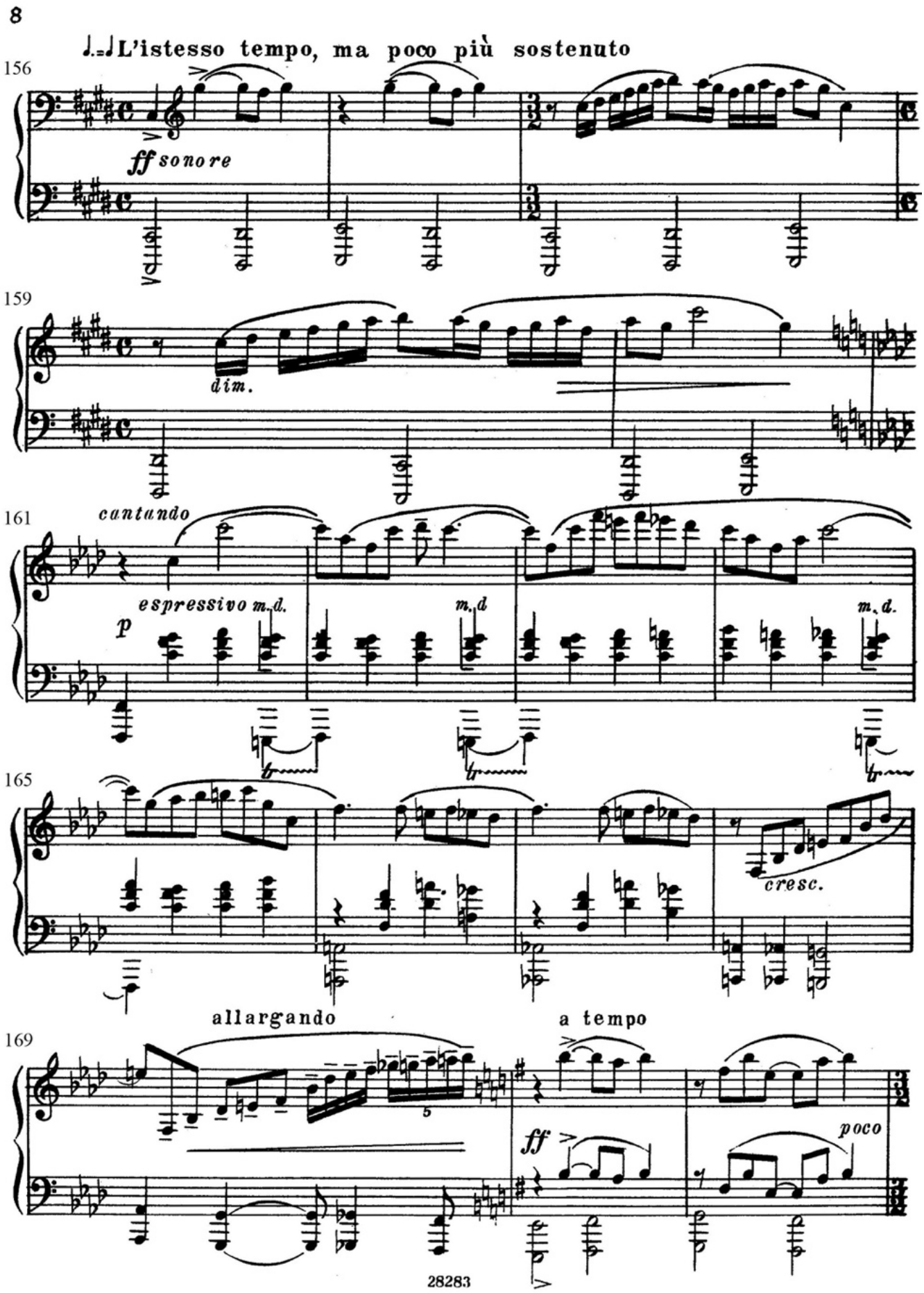


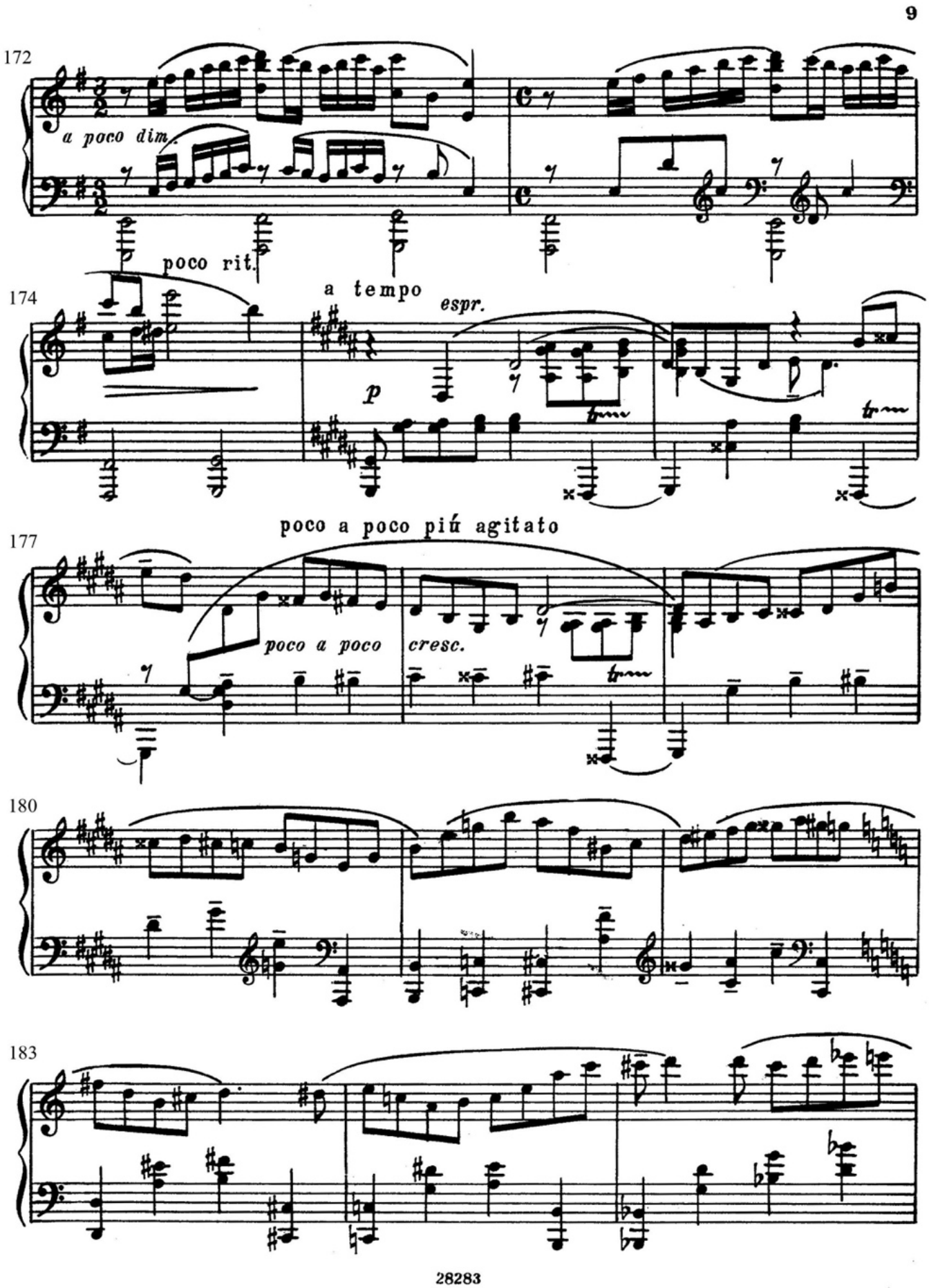

4
33
40
ff
46
sf
sf
55
p
62
28283

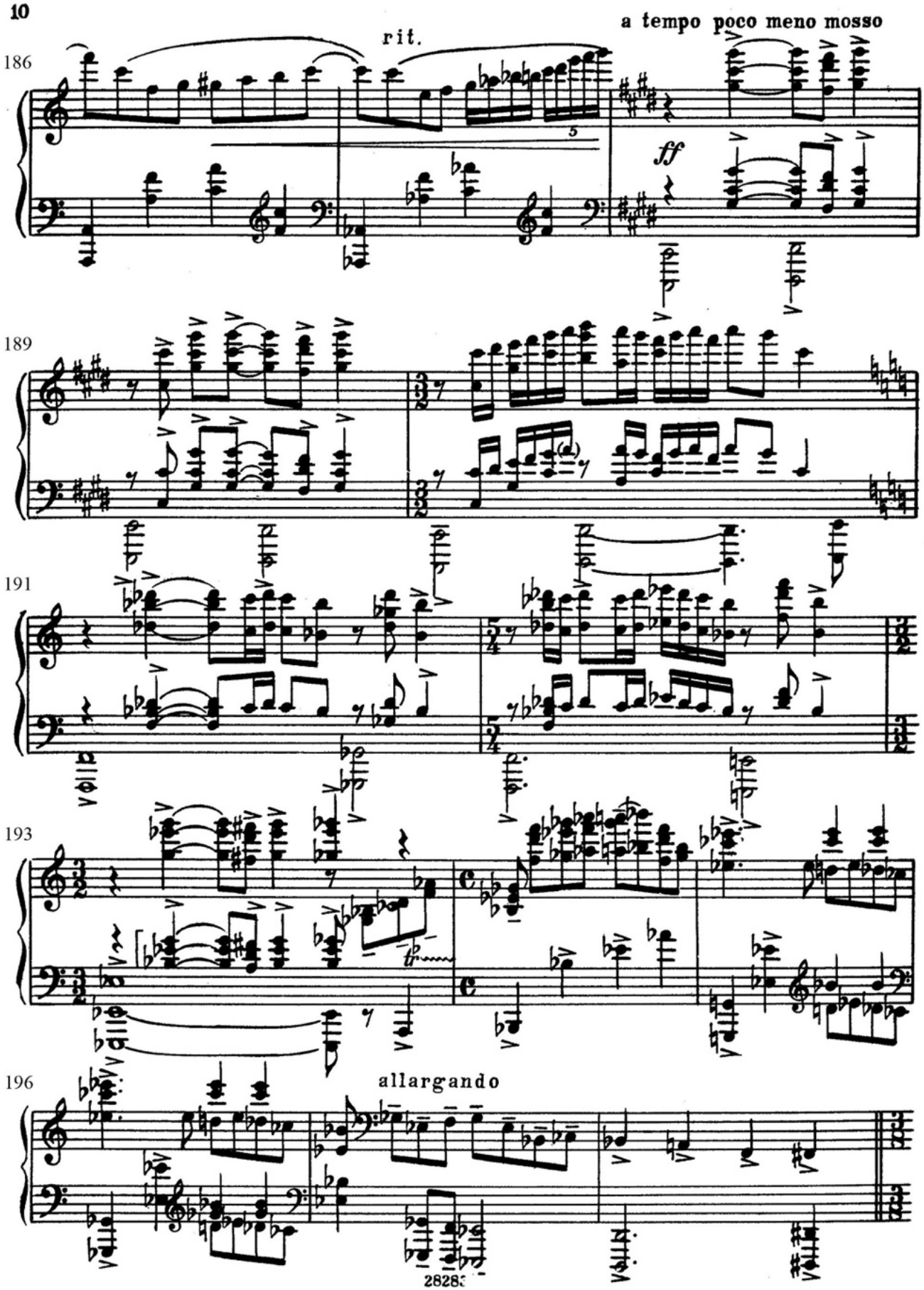

69
5
f
mp
74
80
86
8
f
91
mf
Кабалевский
28283

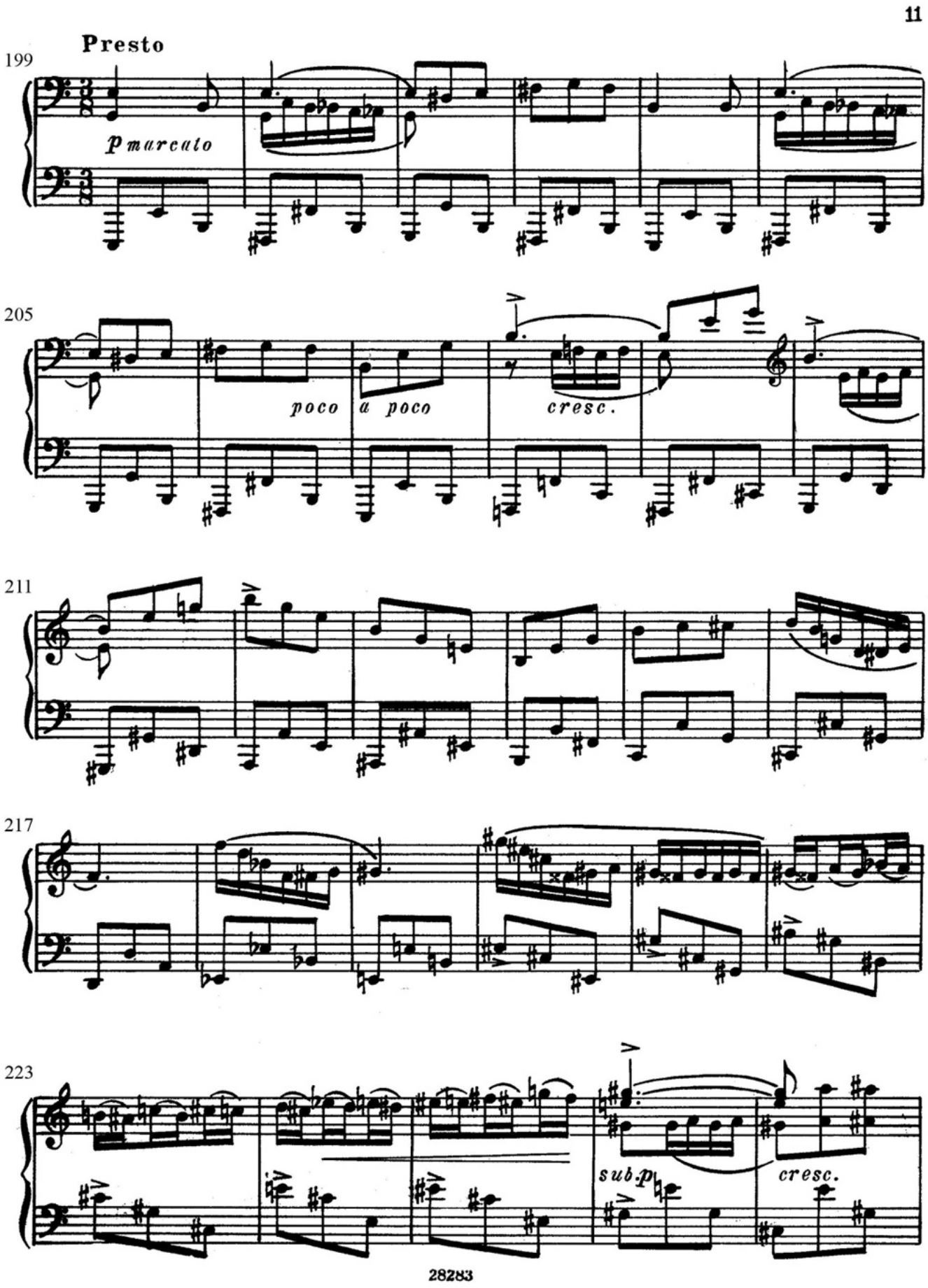

6
96
poco
102
a poco
cresc.
107
113
sf
p
crescendo
molto
118
f
28283

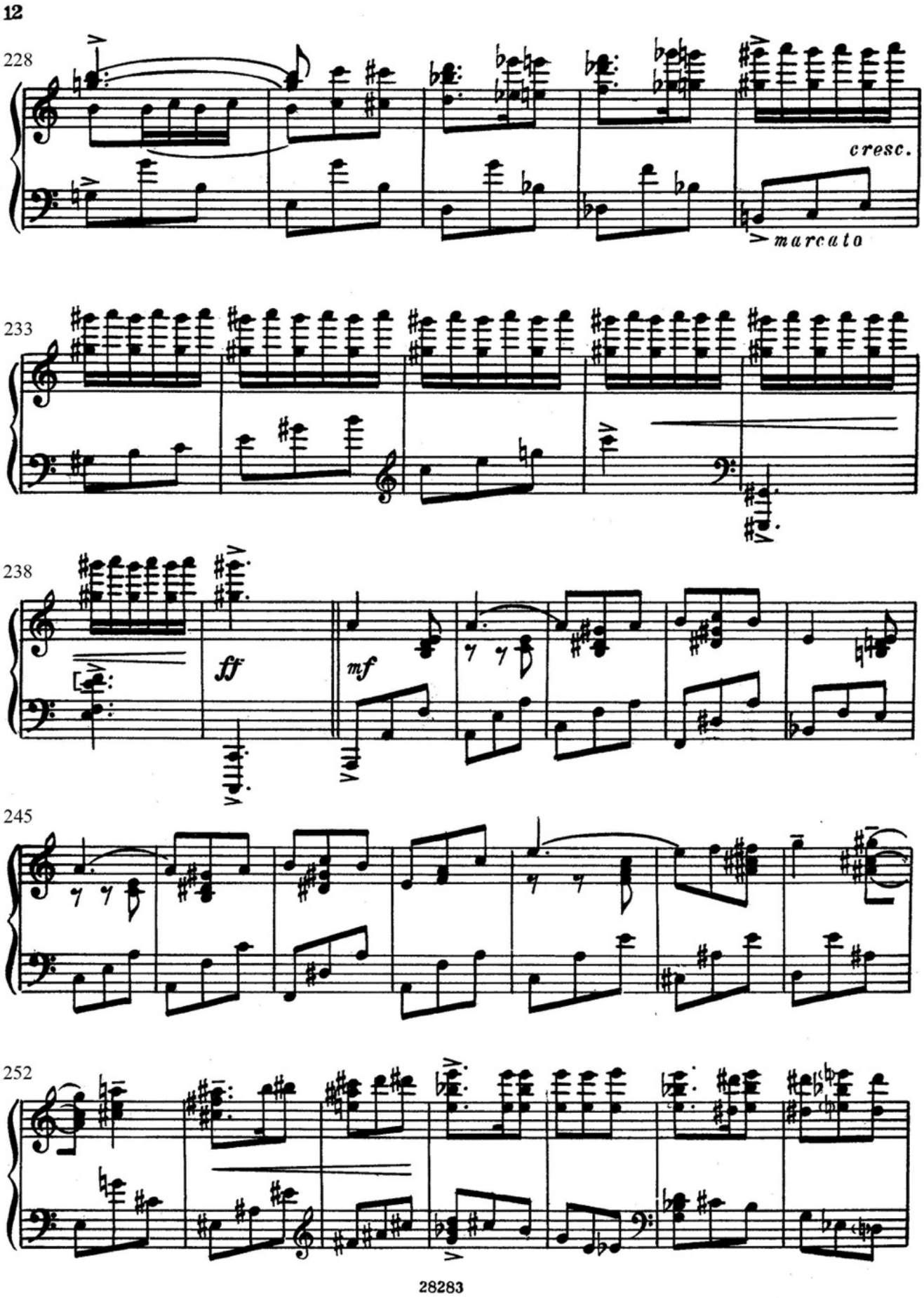

123
7
129
mf
135
f
142
149
sf
8
8
28283

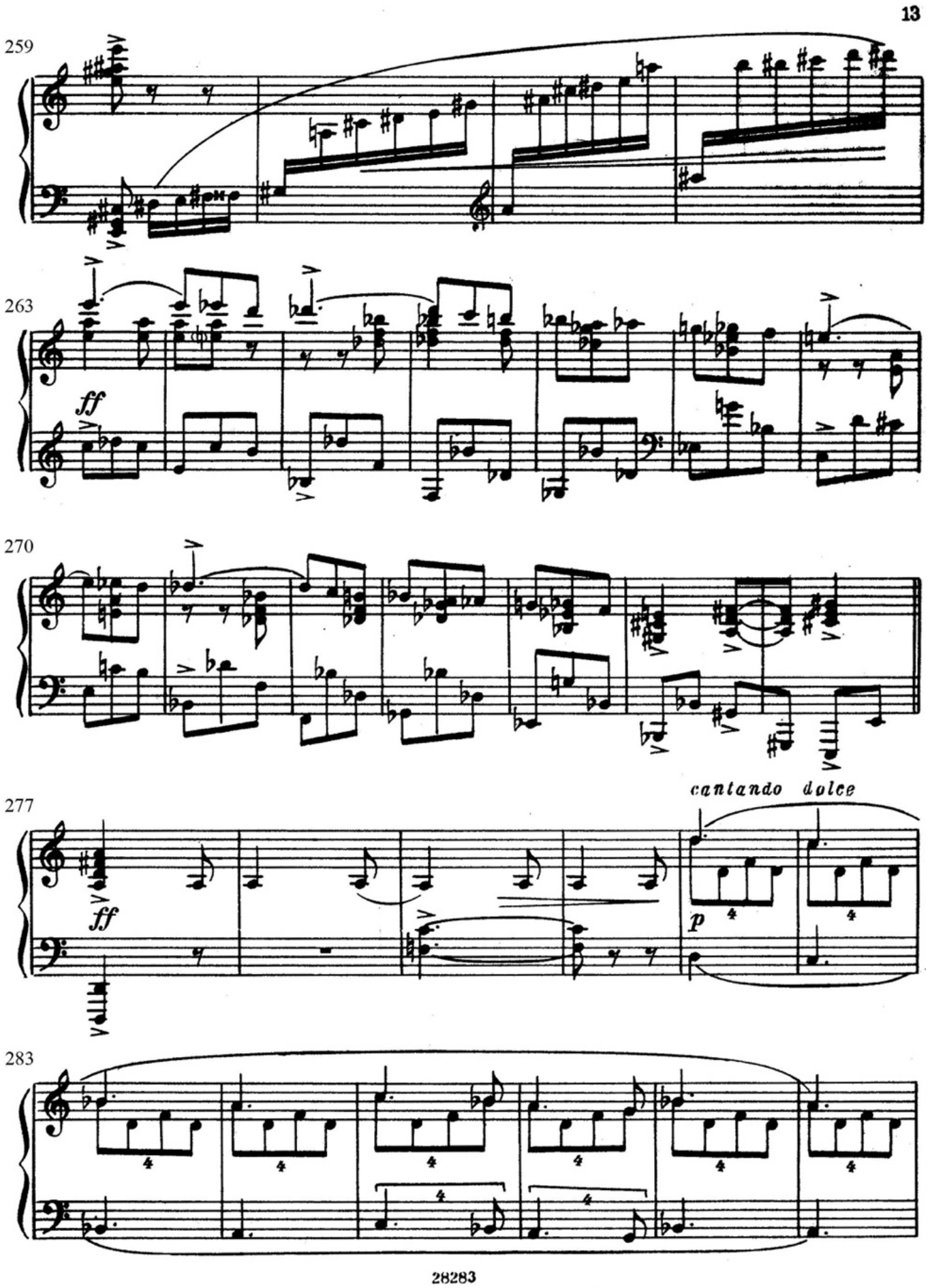

8
L'istesso tempo, ma poco più sostenuto
156
ff sonore
159
dim.
161
cantando
espressivo m.d.
p
m.d
m.d.
165
cresc.
allargando
169
a tempo
ff
poco
28283

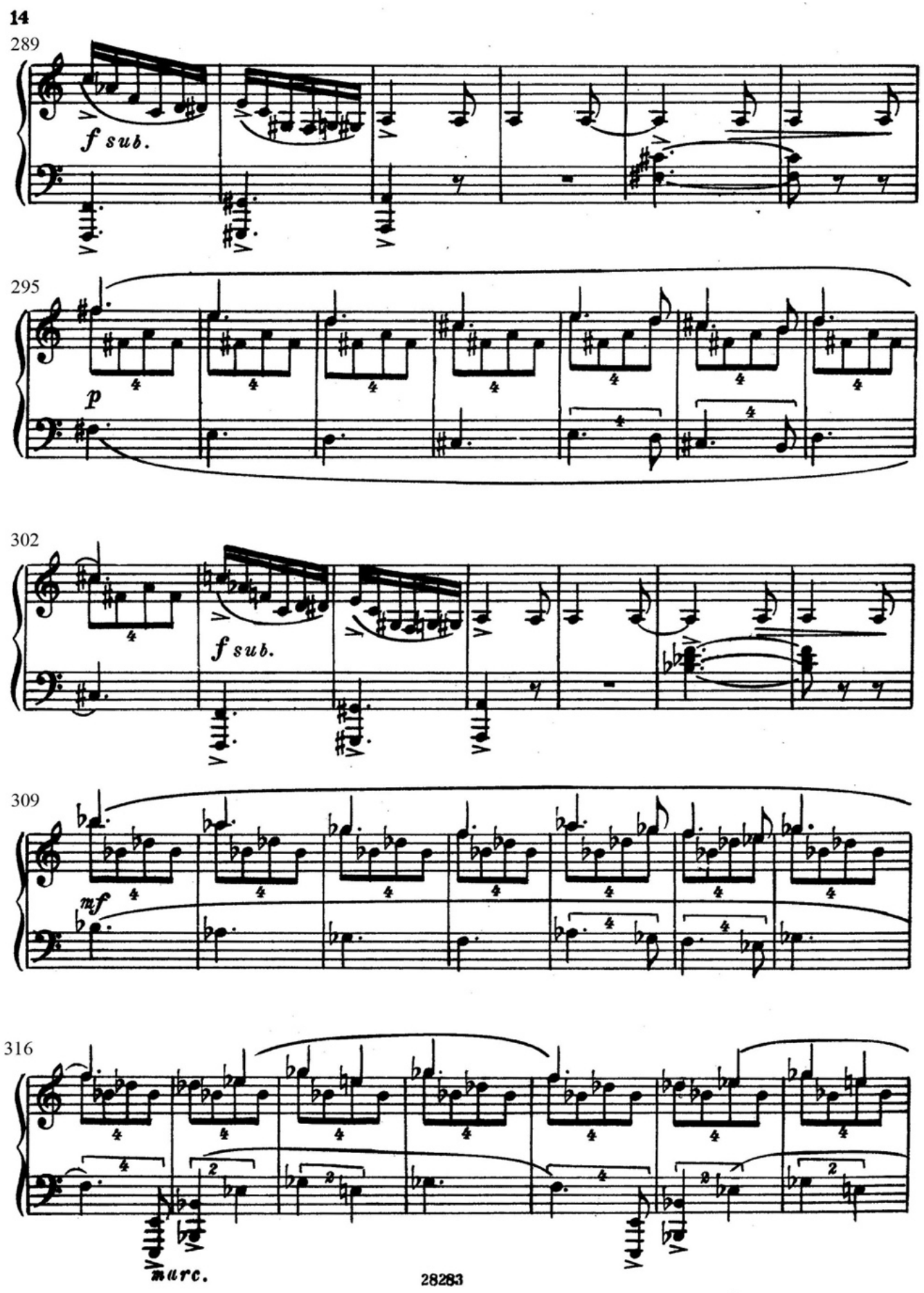

9
172
a poco dim.
poco rit.
a tempo
174
espr.
p
poco a poco più agitato
177
poco a poco
cresc.
180
183
28283

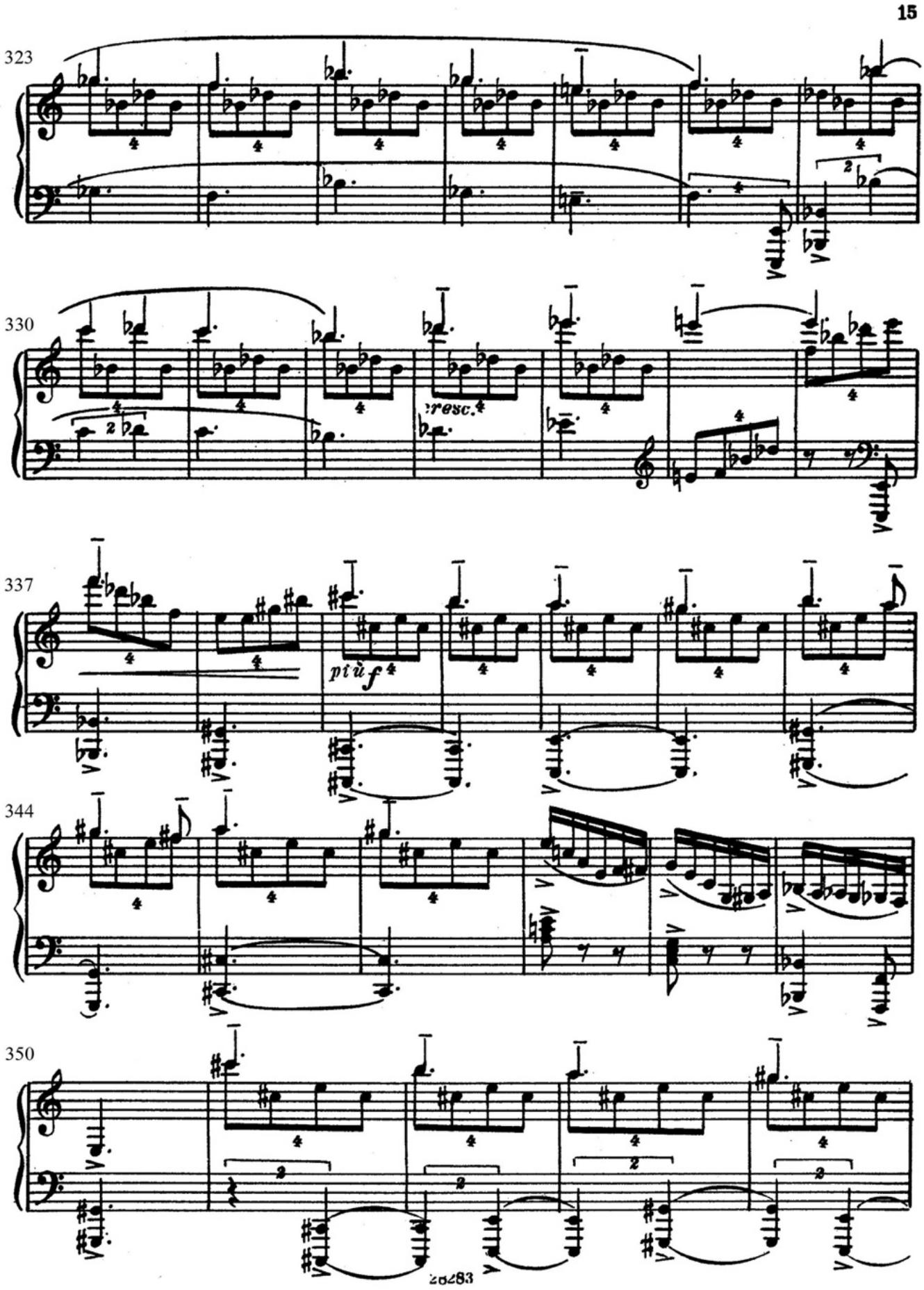

10
a tempo poco meno mosso
rit.
186
ff
189
191
193
196
allargando

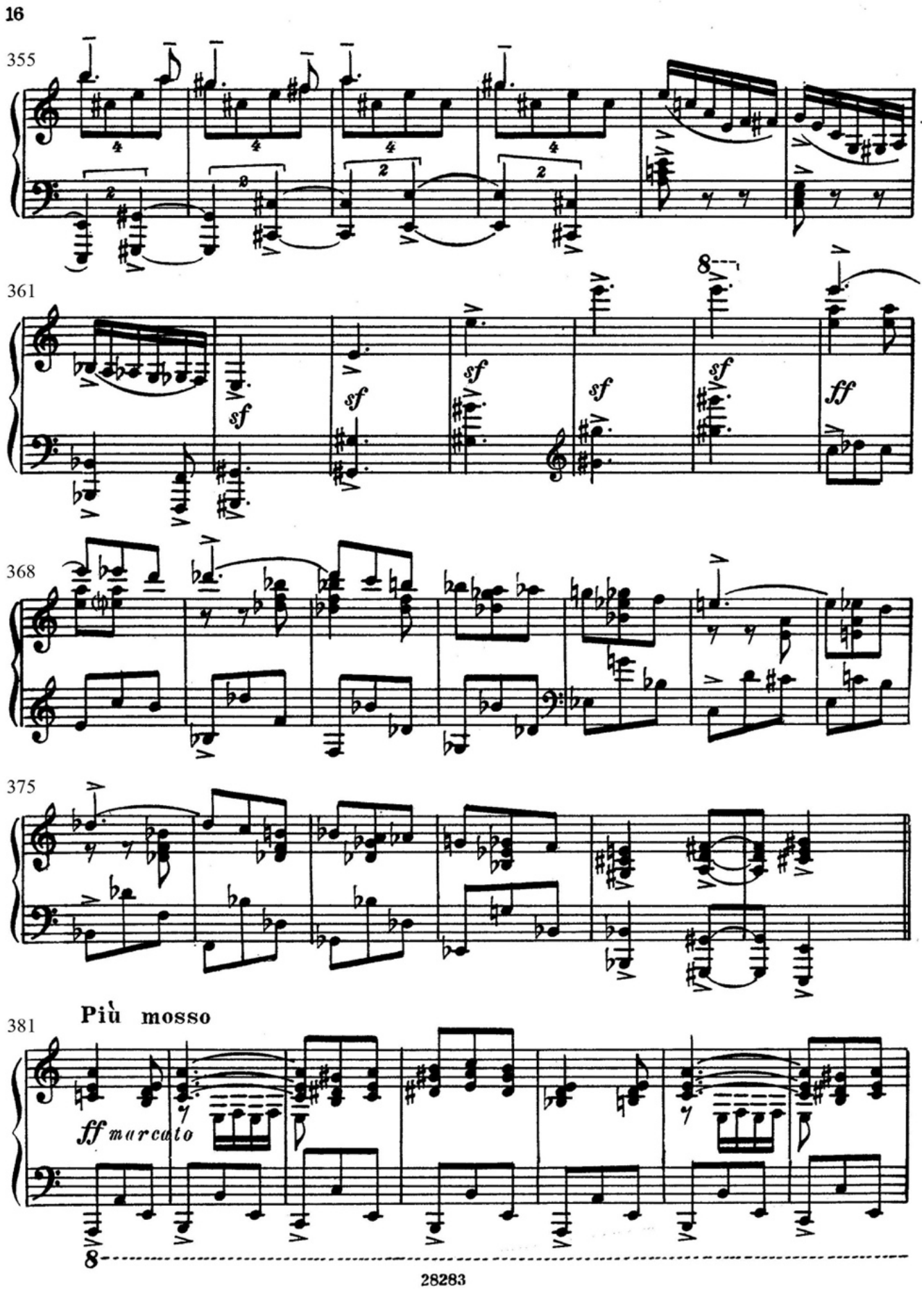

11
Presto
199
p marcato
205
poco a poco
cresc.
211
217
223
sub.p
cresc.
28283

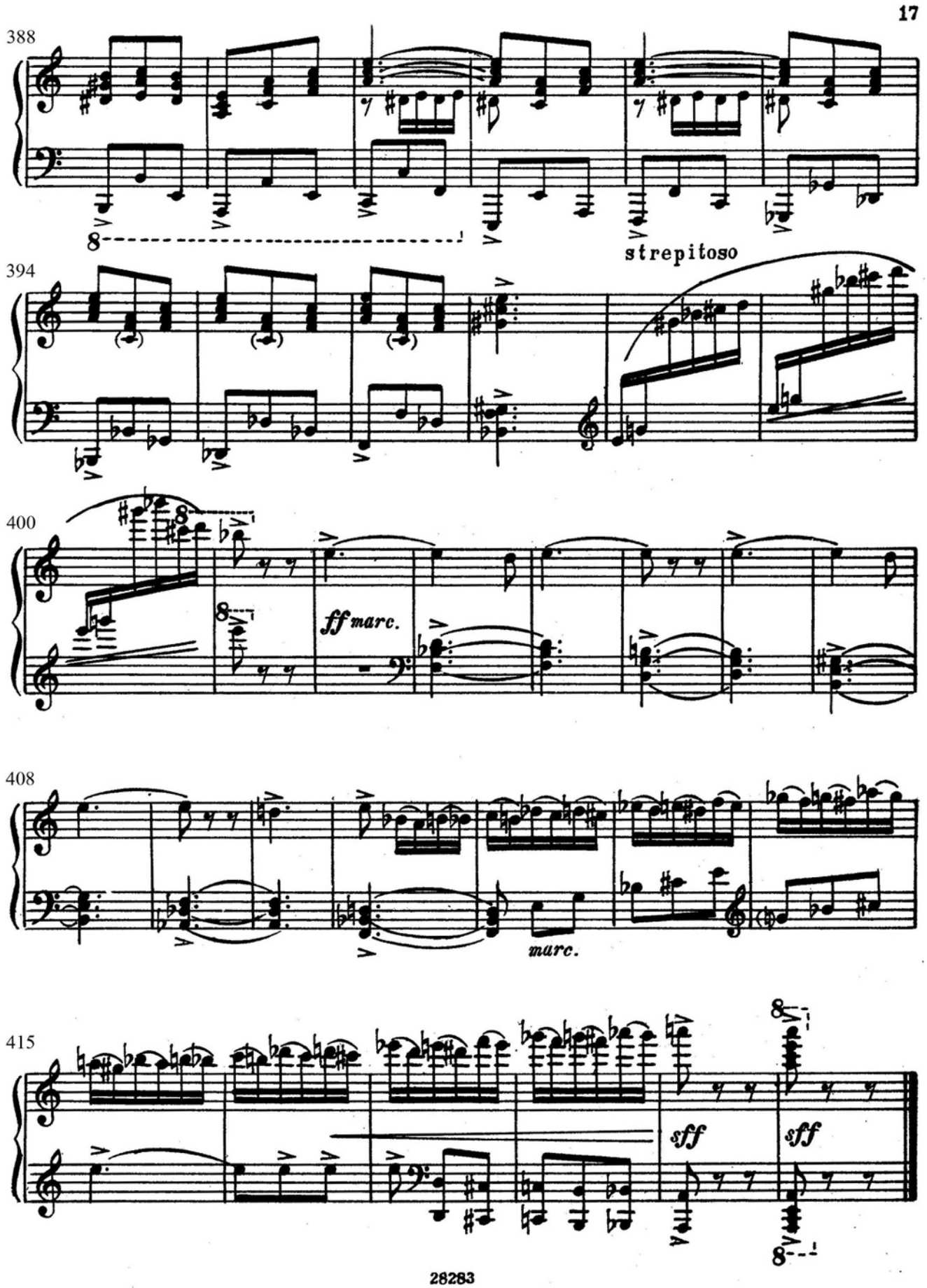

12
228
cresc.
marcato
233
238
ff
mf
245
252
28283


13
259
263
ff
270
277
ff
cantando dolce
p
283
28283


14
289
f sub.
295
p
302
f sub.
309
mf
316
marc.
28283


15
323
330
cresc.
337
più f
344
350


16
355
361
sf
ff
368
375
381
Più mosso
ff marcato
28283


17
388
8
394
strepitoso
400
8
ff marc.
408
marc.
415
sff
sff
8
28283

Journal for the Interdisciplinary Art and Education, 6(2), 117-132, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

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Research Article

Investigation of Artificial Intelligence literacy levels of music teachers

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Article Info

Received: 2 December 2024
Accepted: 3 May 2025
Available online: 30 June 2025

Keywords
Artificial Intelligence
AI literacy
Music
Music education
Teacher education

Abstract

The aim of this study is to determine the artificial intelligence literacy levels of music teachers. The research was conducted using the survey model under the quantitative research paradigm. While determining the study group, easily accessible case sampling technique, which is one of the purposeful sampling methods, was used and 132 music teachers working in public schools constituted the study group. In the data collection process, "Artificial Intelligence Literacy Level Scale" was used to measure the artificial intelligence literacy levels of music teachers. For the analysis of the data, normality analyses were performed first and accordingly, it was decided which statistical analyses to use and independent groups t-test and one-way Analysis of Variance (Anova) were used in the study. The artificial intelligence literacy levels of the teachers were examined in terms of various variables and the data were tabulated and reported. As a result of the research, it was determined that the average level of artificial intelligence literacy of music teachers was at a medium level. In terms of gender variable, it was determined that the artificial intelligence literacy levels of music teachers were higher than those of female music teachers in the "Artificial Intelligence Literacy Scale" general total and "Awareness" sub-dimension. According to the marital status variable, in the "Evaluation" sub-dimension, it was seen that single music teachers had higher levels of AI literacy compared to married teachers. However, there was no significant difference according to professional seniority, graduation status, faculty of graduation and frequency of internet use. However, it was concluded that the artificial intelligence literacy levels of music teachers who have knowledge about artificial intelligence, artificial intelligence programs and use artificial intelligence programs and these programs in music and music education are significant. It has been observed that there is a direct relationship between artificial intelligence literacy, knowledge and frequency of use, and as the level of knowledge and awareness increases, teachers' skills in evaluating and using artificial intelligence increase.

To cite this article

Üçer, Ö., Yılmaz, H., and Açar, Y. (2025). Investigation of Artificial Intelligence literacy levels of music teachers. *Journal for the Interdisciplinary Art and Education, 6*(2), 117-132. DOI: https://doi.org/10.5281/zenodo.15510414

Introduction

Although it is difficult to determine the exact starting point of any movement, but the Dartmouth Summer Research Project, which took place in America in 1956, is considered the event that started artificial intelligence as a research field (Moor, 2006). The concept of artificial intelligence is a computer system that performs cognitive tasks such as learning and problem solving (Loder & Nicholas, 2018), which are generally associated with the human brain (Russell & Norvig, 2010), and improves itself by utilising experiences (Obschonka & Audretsch, 2020). Although there are different

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definitions of artificial intelligence, the common view can be based on two basic concepts: "intelligent programming" and "humanoid responses" (Arslan, 2020).

With the advancement of global science and technology, artificial intelligence technology is expanding at a great pace, constantly updated and used in various fields (Pannu, 2015). Technological progress and changing the way society functions in the globalised world make it vital that modern technology, especially artificial intelligence, is used in education as it is used in other fields (Bamigbola, 2021). Artificial intelligence enables effective and efficient teaching through a variety of applications such as smart tutors for content delivery, providing feedback and progress monitoring (Roll & Wylie, 2016) and personalised instruction used to provide tailored support and increase awareness of knowledge gaps (Guan et al., 2020). In this direction, the fact that artificial intelligence offers personalised teaching applications for students and plays a supportive role in the educational process has made the integration of artificial intelligence applications into education inevitable.

Today, there are artificial intelligence tools that are widely used in schools and universities. It is possible to group some of them into three broad categories as student, teacher and system oriented by accepting that they combine more than one categorical feature. Student-oriented artificial intelligence tools are software that students use to receive and understand new information and respond to their individual needs. It is often referred to as 'intelligent tutoring systems' or 'applicable' and can be explained as organising and grading learning materials according to a student's needs; selecting strengths, weaknesses or gaps in knowledge; providing automatic feedback and facilitating collaboration between students (Baker & Smith, 2019). The most common examples of artificial intelligence systems for students can also be explained as online tutors or smart teaching systems (Miwa et al., 2014). Therefore, incorporating AI techniques into educational technologies can identify students' learning needs and make it possible to provide differentiated content, feedback and instruction (Luckin et al., 2022).

Teacher-oriented AI can help teachers reduce their workload, gain insights about students, and innovate in their classrooms. It allows teachers to automate tasks (assessment, plagiarism detection, management, feedback), gain insights into the progress of a class or student, and enable teachers to develop new teaching tools (Baker & Smith, 2019). Artificial intelligence training tools have been developed to help teachers focus on organising and reflecting on the use of classroom technology, helping teachers to effectively allocate their valuable time to the students who need it most and to analyse student work to identify what are the common problems of students in the classroom (Deshpande et al., 2023).

The most widely used category of system-oriented artificial intelligence in education is the systems that help to inform and make decisions made by those who manage and administer institutions or our education system as a whole (Baker & Smith, 2019; Khoalenyane & Ajani, 2024; Xu & Ouyang, 2022).

Artificial intelligence, which is now used in almost all fields, has started to be widely used in music education. The use of artificial intelligence technology in music education and developments in this field significantly affect traditional teaching approaches and methods and make them more diverse (Zhang et al., 2024). These advances may enable the emergence of new methods and trends in music education in the future. The use of artificial intelligence in music education provides opportunities for independent teaching, intelligent electronic musical instruments, intelligent music software, and online teaching and online assistance (Yu et al., 2003). Artificial intelligence-based music education can offer students the opportunity to improve their performance and better understand musical abilities while learning to play an instrument. It can also provide a personalised education process for students learning to play instruments (Arıcı, 2023).

There are various applications for the use of artificial intelligence in music education (Jiang, 2022). Some of these applications are Earmaster, Meludia for hearing education, Yousician, Musescore for instrument education, Vanido, Vacaloid, SingSharp for voice education, Tenuto, Chord Al for music theory, and AIVA and Amper Music to support general music education.

Purpose of the Study

The aim of this study is to evaluate music teachers' artificial intelligence literacy levels in terms of various variables. In this context, answers to the following sub-problems were sought;

- How are music teachers' artificial intelligence literacy levels?
- How is the distribution of music teachers' artificial intelligence literacy according to demographic variables (gender, marital status, professional seniority, faculty of graduation, daily internet use)?
- How is the artificial intelligence literacy of music teachers who have knowledge about artificial intelligence?
- How is the artificial intelligence literacy of music teachers who have knowledge about artificial intelligence programmes?
- How is the artificial intelligence literacy of music teachers who have knowledge about artificial intelligence programmes used in music and music education?
- How is the artificial intelligence literacy of music teachers who use artificial intelligence programmes used in music and music education?
- How is the frequency of use of artificial intelligence programmes by music teachers who use artificial intelligence programmes used in music and music education?
- How is the artificial intelligence literacy of music teachers according to their frequency of using artificial intelligence programmes?

Method

Research Model

This research, in which the artificial intelligence literacy levels of music teachers were examined, was structured with the survey model, one of the quantitative research method models. Survey research typically determines participants' views on a topic, event or its characteristics (Büyüköztürk et al., 2015, p. 177).

Working Group

While determining the study group of the research, convenience sampling, one of the purposeful sampling techniques, was used. Convenience sampling is "related to the fact that it is easier to include the individuals or groups to be researched in the research process or it is easier to access them" (Yıldırım & Şimşek, 2008). The study group of the research consisted of 132 music teachers working in public institutions. The demographic data of the study group are given in Table 1.

Table 1. Study group demographic information and knowledge and use of artificial intelligence

Gender	**f**	**%**	**Marital Status**	**f**	**%**
Female	77	58,3	Married	65	49,2
Male	55	41,7	Single	67	50,8
Total	132	100	**Total**	**132**	**100**
Graduation Status	**f**	**%**	**Graduated Faculty**	**f**	**%**
Bachelor's Degree	97	73,5	Faculty of Education	76	57,6
Master's Degree	33	25,0	Conservatory	34	25,8
Doctorate	2	1,5	Faculty of Fine Arts	22	16,7
Total	132	100	**Total**	132	100
Professional Seniority	**f**	**%**	**Daily Internet Usage**	f	**%**
1-3 years	42	31,8	0-60 Minutes	6	4,5
4-6 years	27	20,5	61-120 Minutes	28	21,2
7-9 years	17	12,9	121-180 Minutes	43	32,6
10 years and above	46	34,8	181-240 Minutes	30	22,7
Total	**132**	**100**	240 minutes and over	25	18,9
			Total	132	100
Having Knowledge About Artificial Intelligence	**f**	**%**	**To Have Knowledge About Artificial Intelligence Programmes**	**f**	**%**
Yes	53	40,2	Yes	52	39,4
Partially	70	53,0	Partially	45	34,1
No	9	6,8	No	35	26,5

Total	**132**	**100**	**Total**	**132**	**100**
To Have Knowledge About Artificial Intelligence Programmes Used in Music/Music Education	**f**	**%**	**Using Artificial Intelligence Programmes Used in Music/Music Education**	**f**	**%**
Yes	19	14,4	Yes	20	15,2
Partially	32	24,2	Partially	27	20,5
No	81	61,4	No	85	64,4
Total	**132**	**100**	**Total**	**132**	**100**
Artificial Intelligence Programme Usage	**f**	**%**			
1 programme usage	74	56,1			
2 programme usage	16	12,1			
3 programme usage	23	17,4			
4 programme usage	12	9,1			
5 or more programme usage	7	5,3			
Total	**132**	**100**			

Data Collection Tools

In the study, data were collected through Google Form. Data collection tool "Artificial Intelligence Literacy Scale" developed by Wang et al. (2022) and adapted into Turkish by Çelebi et al. (2023) and 'Demographic Information Form' created by the researchers were used.

Artificial Intelligence Literacy Scale

The scale consists of 12 items and 4 sub-dimensions. In the reliability analysis of the "Artificial Intelligence Literacy Scale" adapted into Turkish by Çelebi et al. (2023), Awareness; 0.72, Use; 0.74, Evaluation; 0.76, and Ethics; 0.72 values were obtained for the sub-dimensions of the scale in the calculation of Cronbach's Alpha internal consistency coefficient. For the overall total reliability of the scale, a coefficient of 0.85 was calculated. The items in the scale were scored from 1 to 7. A seven-point Likert scale consisting of 'Strongly Disagree' and 'Strongly Agree' options was used in the scale. Since the 2nd, 5th and 7th items were 'negative items', they were reversed during the analysis. The overall total reliability coefficient of the 'Artificial Intelligence Literacy Scale' of this study was determined as α .82.

Data Analysis

Normality distribution was examined in the analysis of the data. In the normality distribution analysis, it was seen that the values for the overall total of the artificial intelligence literacy scale were Skewness -,167 and Kurtosis -,686, and for the sub-dimensions; Awareness; Skewness -,071 and Kurtosis -,347, Usage; Skewness -,340 and Kurtosis -,252, Evaluation; Skewness -,845 and Kurtosis ,080, and Ethics; Skewness -,459 and Kurtosis -,603, respectively. Normally distributed data are between -1 and +1; -1.5 and +1.5; -2.0 and + 2.0 (Büyüköztürk, 2012; George & Mallery, 2010; Tabachnik & Fidell, 2015). In the analysis of the data, t-Test for independent groups and One Way Analysis of Variance (One-way ANOVA) test were performed.

Ethics Committee

Before the data collection phase, ethical approval was obtained from the Ethics Committee of the Social and Human Sciences Research and Publication Ethics Committee of Kafkas University on 09/07/2024 with approval number 59.

Findings

Findings on Artificial Intelligence Literacy Levels of Music Teachers

Table 2. Artificial Intelligence Literacy Levels of Music Teachers

Item		**n**	$\bar{X}$	**SD**
1	I can distinguish between smart devices and non-smart devices.	132	6,40	1,23
2	*I don't know how Artificial Intelligence technology will help me.	132	4,30	1,97
3	I can define the artificial intelligence technology used in the applications and products I use.	132	4,33	1,85
4	I can skilfully use artificial intelligence applications or products to help me in my daily work.	132	4,16	1,95
5	*Learning to use a new AI application or product is often difficult for me.	132	4,96	1,81

6	I can use artificial intelligence applications or products to improve my work efficiency	132	5,24	1,76
7	After using an AI application or product for a while, I can evaluate its capacity and limits.	132	5,16	1,74
8	I can choose the most appropriate one from a variety of AI applications or products for a given task.	132	5,00	1,77
9	I can choose the appropriate one among the various solutions offered by artificial intelligence	132	5,12	1,78
10	I always follow ethical principles when using AI applications or products.	132	5,44	1,76
11	*I never pay attention to privacy and information security issues when using artificial intelligence applications or products.	132	5,46	1,83
12	I am always careful not to misuse artificial intelligence technology.	132	5,33	1,88
Total		**132**	**5,07**	**1.77**

When Table 2 was analysed, it was determined that the mean artificial intelligence literacy level of music teachers was at a medium level with a rate of 5.07.

Findings Related to Music Teachers' Gender and Artificial Intelligence Literacy

Table 3. t-Test results according to gender of music teachers

Scale	Gender	n	$\bar{X}$	SD	df	t	p
Artificial Intelligence Literacy Scale Total	Female	77	59,10	11,77	130	-2,160	,030*
	Male	55	63,80	13,03			
Awareness	Female	77	14,45	3,09	130	-2,899	,000*
	Male	55	16,10	3,41			
Usage	Female	77	13,80	3,95	130	-1,959	,052
	Male	55	15,18	4,01			
Evaluation	Female	77	14,67	4,90	130	-1,690	,096
	Male	55	16,16	5,10			
Ethics	Female	77	16,16	3,72	130	-0,269	,789
	Male	55	16,34	3,72			

*p<.05

When the artificial intelligence literacy levels of teachers are analysed in Table 3, a significant difference was found in the "Artificial Intelligence Literacy Scale General Total" and "Awareness" sub-dimension, except for the "Usage", "Evaluation" and "Ethics" sub-dimensions of the artificial intelligence literacy scale, according to the gender variable. This result was found to differ significantly in favour of male teachers ($t_{general\_total(130)}$=-2,160; p<.05). According to these findings, male teachers' artificial intelligence literacy levels are higher than female teachers.

Findings Related to Marital Status and Artificial Intelligence Literacy of Music Teachers

Table 4. t-Test Results According to Marital Status of Teachers

Scale	Marital Status	n	$\bar{X}$	SD	df	t	p
Artificial Intelligence Literacy Scale Total	Married	65	59,24	13,28	130	-1,656	,100
	Single	67	62,82	11,47			
Awareness	Married	65	14,86	3,59	130	-,962	,338
	Single	67	15,41	3,03			
Usage	Married	65	14,16	3,87	130	-,588	,558
	Single	67	14,58	4,18			
Evaluation	Married	65	14,40	5,22	130	-2,041	,043*
	Single	67	16,16	4,70			
Ethics	Married	65	15,81	4,04	130	-1,306	,194
	Single	67	16,65	3,33			

*p<.05

In Table 4, when the artificial intelligence literacy levels of the teachers were analysed according to marital status, no significant difference was found in the "Artificial Intelligence Literacy Scale" overall total, and in the "Awareness", "Usage" and "Ethics" sub-dimensions of the scale, and a significant difference was found only in the "Evaluation" sub-

dimension of the scale. According to this result, the artificial intelligence literacy levels of single teachers are higher ($t_{general\_total(130)}$=-2,041; p<.05).

Findings Related to Music Teachers' Professional Seniority and Artificial Intelligence Literacy

Table 5. One-Way Variance (Anova) Analysis Results According to Teachers' Professional Seniority

Scale	Professional Seniority	n	$\overline{X}$	SD	F	p
Artificial Intelligence Literacy Scale Total	1-3 years	42	60,83	10,78	,639	,591
	4-6 years	27	61,48	13,21		
	7-9 years	17	64,58	10,80		
	10 years and above	46	59,71	14,09		
Awareness	1-3 years	42	15,19	2,74	2,332	,078
	4-6 years	27	15,18	3,76		
	7-9 years	17	16,88	3,51		
	10 years and above	46	14,43	3,32		
Usage	1-3 years	42	14,19	3,63	,693	,558
	4-6 years	27	13,85	4,67		
	7-9 years	17	15,58	3,41		
	10 years and above	46	14,41	4,19		
Evaluation	1-3 years	42	15,45	4,00	,971	,408
	4-6 years	27	16,18	5,81		
	7-9 years	17	16,00	4,85		
	10 years and above	46	14,34	5,41		
Ethics	1-3 years	42	16,00	3,76	,158	,925
	4-6 years	27	16,25	3,40		
	7-9 years	17	16,05	3,73		
	10 years and above	46	16,52	3,91		

p>.05

When the artificial intelligence literacy levels of the teachers are analysed in Table 5, no significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale according to the professional seniority variable **(p>.05)**.

Findings on music teachers' graduation status and Artificial Intelligence literacy

Table 6. One-way variance (ANOVA) analysis results according to teachers' graduation status

Scale	Graduation Status	N	$\overline{X}$	SD	F	p
Artificial Intelligence Literacy Scale Total	Bachelor's Degree	97	60,37	13,09	,598	,552
	Master's Degree	33	62,81	10,45		
	Doctorate	2	65,50	16,26		
Awareness	Bachelor's Degree	97	15,04	3,25	1,788	,171
	Master's Degree	33	15,18	3,45		
	Doctorate	2	19,50	2,12		
Usage	Bachelor's Degree	97	14,28	4,35	,173	,841
	Master's Degree	33	14,69	2,92		
	Doctorate	2	13,50	4,94		
Evaluation	Bachelor's Degree	97	15,12	5,13	,233	,792
	Master's Degree	33	15,72	4,77		
	Doctorate	2	16,50	6,36		
Ethics	Bachelor's Degree	97	15,91	3,79	1,514	,224
	Master's Degree	33	17,21	3,41		
	Doctorate	2	16,00	2,82		

p>.05

When the artificial intelligence literacy levels of the teachers were analysed in Table 6, no significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale according to the graduation status variable **(p>.05).**

Findings Related to Music Teachers' Faculty of Graduation and Artificial Intelligence Literacy

Table 7. One-way variance (anova) analysis results according to the faculty of graduation of teachers

Scale		SS	df	MS	Graduated Faculty	n	$\bar{X}$	SD	F	p	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	254,725	2	127,363	Faculty of Education	76	61,67	12,44			
	W.G	20162,790	129	156,301	Conservatory	34	61,70	12,49	,815	,445	-
	Total	20417,515	131		Faculty of Fine Arts	22	57,95	12,69			
Awareness	B.G	27,882	2	13,941	Faculty of Education	76	15,52	3,36			
	W.G	1418,383	129	10,995	Conservatory	34	14,76	2,99	1,268	,285	
	Total	1446,265	131		Faculty of Fine Arts	22	14,40	3,59			
Usage	B.G	5,590	2	2,795	Faculty of Education	76	14,50	3,87			
	W.G	2115,471	129	16,399	Conservatory	34	14,02	4,64	,170	,843	
	Total	2121,061	131		Faculty of Fine Arts	22	14,50	3,63			
Evaluation	B.G	70,288	2	35,144	Faculty of Education	76	14,90	5,12			
	W.G	3237,189	129	25,094	Conservatory	34	16,52	4,43	1,400	,250	
	Total	3307,477	131		Faculty of Fine Arts	22	14,72	5,42			
Ethics	B.G	100,703	2	50,352	Faculty of Education	76	16,73	3,59			
	W.G	1703,539	129	13,206	Conservatory	34	16,38	3,71	3,813	,025*	**1-3**
	Total	1804,242	131		Faculty of Fine Arts	22	14,31	3,64			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

When the artificial intelligence literacy levels of the teachers are analysed in Table 7, no significant difference was found according to the graduated faculty variable except for the 'ethics' sub-dimension of the artificial intelligence literacy scale ($F = 3,813$; $p < 0.5$). According to the result of Scheffe post-hoc test, a significant difference was found between teachers who graduated from the faculty of education (16,73±3,59) and the faculty of fine arts (14,31±3,64) in the "ethics" sub-dimension.

Findings on music teachers' frequency of daily internet use and Artificial Intelligence literacy

Table 8. One-Way Variance (Anova) Analysis Results According to Teachers' Frequency of Daily Internet Use

Scale	Daily Internet Usage	n	$\bar{X}$	SD	F	p
Artificial Intelligence Literacy Scale Total	0-60 Minutes	6	54,83	12,98		
	61-120 Minutes	28	59,64	10,65		
	121-180 Minutes	43	61,04	12,26	,636	,638
	181-240 Minutes	30	62,66	11,87		
	240 minutes and over	25	62,24	15,41		
Awareness	0-60 Minutes	6	12,16	2,92		
	61-120 Minutes	28	14,78	2,60		
	121-180 Minutes	43	15,46	3,63	1,497	,207
	181-240 Minutes	30	15,33	3,11		
	240 minutes and over	25	15,48	3,65		
Usage	0-60 Minutes	6	12,83	4,21	,690	,600
	61-120 Minutes	28	13,60	4,51		

	121-180 Minutes	43	14,46	4,09		
	181-240 Minutes	30	14,80	3,48		
	240 minutes and over	25	14,96	3,98		
Evaluation	0-60 Minutes	6	14,16	3,54		
	61-120 Minutes	28	15,89	3,45		
	121-180 Minutes	43	14,90	4,85	,246	,912
	181-240 Minutes	30	15,33	5,60		
	240 minutes and over	25	15,52	6,43		
Ethics	0-60 Minutes	6	15,66	3,88		
	61-120 Minutes	28	15,35	3,81		
	121-180 Minutes	43	16,20	3,84	,933	,447
	181-240 Minutes	30	17,20	2,96		
	240 minutes and over	25	16,28	4,12		

p>.05

When the artificial intelligence literacy levels of the teachers are analysed in Table 8, no significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale according to the daily internet usage frequency variable (p>.05).

Findings related to artificial intelligence literacy levels of music teachers who have knowledge about Artificial Intelligence

Table 9. One-way variance (ANOVA) analysis results regarding artificial intelligence literacy levels of music teachers who have knowledge about Artificial Intelligence

Scale		SS	df	MS	Having Knowledge About AI	n	$\bar{X}$	SD	F	p	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	4407,367	2	2203,684	Yes	53	67,88	10,89			**1-2**
	W.G	16010,148	129	124,110	Partially	70	57,15	11,23	17,756	,000*	**1-3**
	Total	20417,515	131		No	9	51,22	11,81			
Awareness	B.G	246,825	2	123,412	Yes	53	16,81	3,35			
	W.G	1199,440	129	9,298	Partially	70	14,05	2,79	13,273	,000*	
	Total	1446,265	131		No	9	13,77	3,03			
Usage	B.G	406,370	2	203,185	Yes	53	16,26	3,39			**1-2**
	W.G	1714,691	129	13,292	Partially	70	13,50	3,81	15,286	,000*	**2-3**
	Total	2121,061	131		No	9	10,11	3,75			
Evaluation	B.G	508,871	2	254,436	Evet	53	17,52	3,79			
	W.G	2798,606	129	21,695	Kısmen	70	14,12	5,17	11,728	,000*	
	Total	3307,477	131		Hayır	9	11,22	4,99			
Ethics	B.G	99,156	2	49,578	Evet	53	17,28	3,47			
	W.G	1705,086	129	13,218	Kısmen	70	15,47	3,65	3,751	,026*	**1-3**
	Total	1804,242	131		Hayır	9	16,11	4,40			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

When the artificial intelligence literacy levels of music teachers who have knowledge about artificial intelligence are examined in Table 9, a significant difference is seen in the "Artificial Intelligence Literacy Scale" overall total and other sub-dimensions **(*p<.05).** According to the Scheffe post-hoc test result, it is seen that there are significant differences between the general total, "Awareness", "Usage" and "Evaluation" sub-dimensions of the artificial intelligence literacy scale of teachers who have knowledge about artificial intelligence. It was determined that the mean scores of the teachers who had knowledge about artificial intelligence were higher than the teachers who said "partially" and "no", and those who had knowledge about artificial intelligence "partially" were higher than the teachers who had no knowledge. In terms of the "ethics" sub-dimension, there was a significant difference between the teachers who had knowledge about artificial intelligence and the teachers who had "partially" artificial intelligence, while there was no significant difference between the teachers who had no knowledge about artificial intelligence and the other groups.

Findings regarding the artificial intelligence literacy levels of music teachers who have knowledge about Artificial Intelligence programs

Table 10. One-way variance (anova) analysis results regarding artificial intelligence literacy levels of music teachers who have knowledge about Artificial Intelligence programs

Scale		SS	df	MS	Know. AI Programs	n	X̄	SD	F	P	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	5305,175	2	2652,587	Yes	45	69,02	9,79			
	W.G	15112,340	129	117,150	Partially	52	59,69	11,18	22,643	,000*	
	Total	20417,515	131		No	35	52,85	11,52			
Awareness	B.G	324,081	2	162,040	Yes	45	17,15	3,20			**1-2**
	W.G	1122,184	129	8,699	Partially	52	14,71	2,78	18,627	,000*	**2-3**
	Total	1446,265	131		No	35	13,20	2,83			
Usage	B.G	470,941	2	235,470	Yes	45	16,75	3,22			
	W.G	1650,120	129	12,792	Partially	52	13,96	3,68	18,408	,000*	
	Total	2121,061	131		No	35	11,94	3,82			
Evaluation	B.G	556,524	2	278,262	Yes	45	17,95	3,17			
	W.G	2750,953	129	21,325	Partially	52	14,67	5,04	13,048	,000*	
	Total	3307,477	131		No	35	12,80	5,44			
Ethics	B.G	99,819	2	49,910	Yes	45	17,15	3,35			
	W.G	1704,423	129	13,213	Partially	52	16,34	3,49	3,777	,025*	**1-2**
	Total	1804,242	131		No	35	14,91	4,16			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

When the artificial intelligence literacy levels of music teachers who had knowledge about artificial intelligence programs were examined in Table 10, a significant difference was found in the "Artificial Intelligence Literacy Scale", overall total and other sub-dimensions (*p<.05). According to the results of Scheffe post-hoc test, a significant difference was found in the general total and "Awareness", "Usage", and "Evaluation" sub-dimensions of the artificial intelligence scale, and it was revealed that the teachers who had knowledge about artificial intelligence programs had higher scores than the teachers who had 'partially' and had no knowledge about artificial intelligence, and the teachers who had "partially" knowledge about artificial intelligence had higher scores than the teachers who had no knowledge. In the "ethics" sub-dimension of the artificial intelligence scale, a significant difference was found between the teachers who answered "yes" and "no", and it was found that teachers who had knowledge about artificial intelligence programs had higher mean scores than teachers who did not have knowledge about artificial intelligence programs. Thus, as the level of artificial intelligence literacy increases, awareness, use, evaluation and ethical sensitivity increase significantly.

Findings regarding the artificial intelligence literacy levels of music teachers who have knowledge about AI programs used in music and music education

Table 11. One-way variance (ANOVA) analysis results regarding artificial intelligence literacy levels of music teachers who have knowledge about AI programs used in music and music education

Scale		SS	df	MS	Use AI Programs	n	X̄	SD	F	p	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	2321,087	2	1160,544	Yes	19	68,47	11,00			
	W.G	18096,428	129	140,282	Partially	32	64,78	11,87	8,273	,000*	
	Total	20417,515	131		No	81	57,85	12,01			
Awareness	B.G	189,398	2	94,699	Yes	19	17,31	3,11			**1-2**
	W.G	1256,867	129	9,743	Partially	32	16,15	3,19	9,720	,000*	**2-3**
	Total	1446,265	131		No	81	14,23	3,09			
Usage	B.G	236,324	2	118,162	Yes	19	16,52	3,33			
	W.G	1884,737	129	14,610	Partially	32	15,75	3,32	8,088	,000*	
	Total	2121,061	131		No	81	13,33	4,09			
Evaluation	B.G	253,308	2	126,654	Yes	19	17,47	4,23	5,350	,006*	

	W.G	3054,169	129	23,676	Partially	32	16,75	4,47			
	Total	3307,477	131		No	81	14,20	5,13			
	B.G	18,661	2	9,330	Yes	19	17,15	3,98			
Ethics	W.G	1785,582	129	13,842	Partially	32	16,12	3,37	,674	,511	-
	Total	1804,242	131		No	81	16,07	3,78			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

In Table 11, a significant difference was found in the overall total and other sub-dimensions, except for the "Ethics" sub-dimension in the artificial intelligence literacy level scale of teachers who have knowledge about artificial intelligence programs used in music and music education **(*p<.05).** According to the results of Scheffe post-hoc test, a significant difference was found between the teachers who answered "yes" and the teachers who answered "partially", and between the teachers who answered "partially" and the teachers who answered "no" in the artificial intelligence literacy levels, "Awareness", "Usage" and "Evaluation" sub-dimensions of teachers who have knowledge about artificial intelligence programs used in music education. Thus, it can be said that as artificial intelligence literacy increases, "Awareness", "Usage" and "Evaluation" will also increase.

Findings related to artificial intelligence literacy levels of teachers using artificial intelligence programs used in music and music education

Table 12. One-way variance (ANOVA) analysis results of artificial intelligence literacy of teachers using AI programs used in music and music education

Scale		SS	df	MS	Using AI Program	n	$\bar{X}$	SD	F	p	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	2907,999	2	1454,000	Yes	20	67,90	12,12			
	W.G	17509,516	129	135,733	Partially	27	66,96	9,49	10,712	,000*	
	Total	20417,515	131		No	85	57,57	12,13			
Awareness	B.G	245,739	2	122,869	Yes	20	16,95	3,31			
	W.G	1200,526	129	9,306	Partially	27	17,00	3,12	13,203	,000*	
	Total	1446,265	131		No	85	14,12	2,96			**1-2 2-3**
Usage	B.G	251,469	2	125,735	Yes	20	16,15	3,66			
	W.G	1869,591	129	14,493	Partially	27	16,29	2,79	8,676	,000*	
	Total	2121,061	131		No	85	13,35	4,09			
Evaluation	B.G	358,210	2	179,105	Yes	20	17,55	4,03			
	W.G	2949,267	129	22,863	Partially	27	17,48	3,11	7,834	,001*	
	Total	3307,477	131		No	85	14,07	5,33			
Ethics	B.G	24,465	2	12,233	Yes	20	17,25	3,97			
	W.G	1779,777	129	13,797	Partially	27	16,18	3,43	,887	,415	-
	Total	1804,242	131		No	85	16,02	3,73			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

In Table 12, the level of artificial intelligence literacy of teachers using artificial intelligence programs used in music and music education differed significantly in the general total and other sub-dimensions, except for the "ethics" sub-dimension (*p<.05). According to the results of Scheffe post-hoc test, there was a significant difference between the teachers who partially used and did not use the programs for music and music education compared to the teachers who partially used and did not use the programs for music and music education.

Findings of music teachers' artificial intelligence literacy levels according to the frequency of using AI programs

Table 13. One-way variance (ANOVA) analysis results of music teachers' artificial intelligence literacy according to frequency of use of AI programs

Scale		SS	df	MS	AI Programme Usage	n	$\bar{X}$	SD	F	p	Scheffe
Artificial Intelligence Literacy Scale Total	B.G	5238,975	4	1309,744	1 program	74	55,67	11,54	10,959	,000*	**5-1** **4-1** **3-1**
	W.G	15178,540	127	119,516	2 programs	16	64,87	12,02			
	Total	20417,515	131		3 programs	23	67,60	7,94			
					4 programs	12	69,83	9,36			
					5 programs	7	72,71	12,39			
Awareness	B.G	242,187	4	60,547	1 program	74	14,08	2,87	6,386	,000*	**4-1**
	W.G	1204,078	127	9,481	2 programs	16	15,93	3,66			
	Total	1146,265	131		3 programs	23	15,78	2,72			
					4 programs	12	18,00	3,01			
					5 programs	7	17,57	4,75			
Usage	B.G	452,397	4	113,099	1 program	74	12,83	3,91	8,608	,000*	**5-1** **4-1** **3-1**
	W.G	1668,663	127	13,139	2 programs	16	14,87	3,81			
	Total	2121,061	131		3 programs	23	16,60	2,23			
					4 programs	12	17,16	2,88			
					5 programs	7	17,42	4,68			
Evaluation	B.G	679,308	4	169,827	1 program	74	13,35	5,29	8,206	,000*	**5-1** **4-1** **3-1**
	W.G	2628,169	127	20,694	2 programs	16	16,93	4,15			
	Total	3307,477	131		3 programs	23	17,43	2,95			
					4 programs	12	18,50	2,93			
					5 programs	7	19,57	2,43			
Ethics	B.G	144,218	4	36,054	1 program	74	15,40	3,88	2,758	,031*	**3-1**
	W.G	1660,025	127	13,071	2 programs	16	17,12	2,72			
	Total	1804,242	131		3 programs	23	17,78	3,01			
					4 programs	12	16,16	4,23			
					5 programs	7	18,14	2,85			

*p<.05, B.G: Beetwen Groups, W.G: Within Groups, S.S: Sum of Squares, M.S: Mean Square

In Table 13, it is seen that there is a significant difference in the level of artificial intelligence literacy of teachers, general total and other sub-dimensions according to the frequency of use of artificial intelligence programs (*p<.05). According to the results of Scheffe post-hoc test, it was seen that teachers using artificial intelligence programs more than one and using more frequent programs had a positive effect on artificial intelligence literacy, usage and evaluation sub-dimensions. However, there was no significant difference in "Awareness" and "Ethics" sub-dimensions.

Conclusion and Discussion

It was determined that music teachers' artificial intelligence literacy was at a medium level. This may be related to both the recent widespread use of artificial intelligence technology and the fact that individuals have recently started to use this technology and the use of artificial intelligence technology in education is relatively new.

When the artificial intelligence literacy levels of music teachers were analyzed according to the gender variable, a significant difference was found in the "Artificial Intelligence Literacy Scale Total" and "Awareness" sub-dimensions of the artificial intelligence literacy scale, except for the "Usage", "Evaluation" and "Ethics" sub-dimensions. According to these results, it was concluded that the artificial intelligence literacy levels of male teachers were higher than the artificial intelligence literacy levels of female teachers. Elçiçek (2021) found that in the artificial intelligence literacy levels of high school, associate degree and undergraduate students, the artificial intelligence literacy levels of male students were higher than female students. However, Mart and Kaya (2024) found that there was no statistical difference in the attitudes towards artificial intelligence and artificial intelligence literacy levels of pre-service preschool teachers and Banaz and Maden (2024) found that there was no statistical difference in the attitudes towards artificial intelligence and artificial

intelligence literacy levels of pre-service Turkish teachers. In this direction, it can be said that gender differences vary depending on different variables such as participant groups, occupational fields and education levels. Although the finding that males have higher artificial intelligence literacy levels is evident in the research and literature, other studies have not found significant differences in the gender variable. It is thought that this situation can be explained by the effect of roles related to individual differences and interests.

When the artificial intelligence literacy levels of music teachers were analyzed according to marital status, a significant difference was found in the "Evaluation" sub-dimension of the "Artificial Intelligence Literacy Scale". According to this result, it was determined that the artificial intelligence literacy levels of single teachers were higher. Erbir (2021) found that the digital literacy levels of single nurses were higher in the digital literacy levels of nurses, and Kandemir and Azizoğlu (2024) found that the attitudes of single nurses towards artificial intelligence were higher in the attitudes of nurses towards artificial intelligence. However, Kalınkol and Anılan (2023) concluded that there was no difference in the digital literacy levels of classroom teachers regarding marital status. In this direction, the occupational groups of individuals and the contexts within these occupational groups may differ. Although it has been determined in the related research and literature that single individuals have high levels of both artificial intelligence and digital literacy/attitudes, marital status has not been seen as a specific factor in other studies on occupational groups.

When the artificial intelligence literacy levels of music teachers were examined according to the professional seniority variable, no significant difference was found in the total and other sub-dimensions of the artificial intelligence literacy scale. Aksakal et al. (2024) found no significant difference in classroom teachers' attitudes towards artificial intelligence and Irgatoğlu et al. (2024) found no significant difference in school administrators' digital literacy levels according to seniority variable. However, Erbir (2021) found that the digital literacy levels of nurses with less than 10 years of seniority, Korkmaz and Akçay (2024) found that the digital literacy levels of preschool teachers with a professional seniority between 12-17 years, and Pitel and Turcanu (2024) found that the digital competencies of young Moldovan doctors were higher. In this direction, it can be said that the impact on artificial intelligence, digital literacy and digital competencies of individuals working in different professional groups varies. Individuals who are newer in their profession may have grown up more intertwined with technological developments in the current technological age. In addition, individual differences and the impact of occupations on technology use may allow individuals to use technology in a more advantageous way.

When the artificial intelligence literacy levels of music teachers were analyzed according to the graduation status variable, no significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale. Similarly, Uygun et al. (2024) did not find a significant difference in the graduation status of teachers. However, Aksu (2024) found that teachers with postgraduate education are more knowledgeable about artificial intelligence, Üretmen (2024) found that English teachers with master's and doctorate degrees use artificial intelligence more effectively, and Zhao et al. (2022) found that primary and secondary school teachers with master's and doctorate degrees have higher artificial intelligence literacy levels. Graduation status of artificial intelligence literacy and more effective use of artificial intelligence have varied in different studies. In this direction, it is thought that individuals with more advanced education can increase their ability to understand technology, use technology, and adopt and use technology more effectively.

When the artificial intelligence literacy levels of music teachers were examined according to the faculty of graduation variable, no significant difference was found except for the ethical sub-dimension of the artificial intelligence literacy scale. Similarly, Taşkıran et al. (2024) found that there was no significant difference in the artificial intelligence attitudes of classroom teachers in the type of faculty they graduated from, and Tor et al. (2022) found that there was no significant difference in the digital literacy levels of students receiving undergraduate education and formation education. However, Buzkurt (2021) found that the digital school literacy levels of preschool teachers who graduated from the faculty of education were higher than the teachers who graduated from the faculty of open education. In line with these results, the quality of the trainings received by individuals and the trainings they received for the development of their digital skills may be an important factor for the type of faculty they graduated from.

When the artificial intelligence literacy levels of music teachers were analyzed according to the frequency of internet use variable, no significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale. Similarly, Banaz and Maden (2024) concluded that there was no significant difference in the frequency of internet use in the artificial intelligence attitudes of prospective Turkish teachers. However, Karacan-Doğan, Doğan, and Çetinkayalı (2024) concluded that those who use the internet for 241 minutes or more daily have higher attitudes towards artificial intelligence than students who use the internet for 61-120 minutes; Yüksekkaya (2023) concluded that preschool teachers who use the internet for three hours or more daily have higher digital literacy levels than teachers who use the internet for three hours or less daily; similarly, Sarıkaya (2024) concluded that Turkish teachers who use the internet for 6 hours or more have higher digital literacy levels. However, Elçiçek (2024) found that students who used the internet for 0-2 hours had higher artificial intelligence literacy levels than students who used the internet for 3 or more hours. In some studies, it was observed that the frequency of internet use did not affect the levels of artificial intelligence and digital literacy, and in some studies, although it was seen that it was in favor of individuals who used the internet longer, in some studies, it was seen that those who used the internet less had higher levels of artificial intelligence and digital literacy than individuals who used the internet more. In this direction, it is thought that the effect of frequency of internet use on artificial intelligence and digital literacy may vary depending on the duration of daily internet use, how and why individuals use the internet.

When the artificial intelligence literacy levels of music teachers who have knowledge about artificial intelligence and artificial intelligence programs were examined; a significant difference was found in the general total and other sub-dimensions of the artificial intelligence literacy scale. The fact that music teachers who use artificial intelligence and artificial intelligence programs have higher levels of artificial intelligence literacy than teachers who do not have knowledge about artificial intelligence and artificial intelligence programs shows that awareness in education and training can significantly increase their ability to use application knowledge effectively for the technological age. Similarly, Salas-Piclo et al. (2022) found that teachers trained in using artificial intelligence and artificial intelligence technologies in order to update their knowledge, practices and digital competencies before and after service benefited students as a result of the training, Chounta et al, (2022) stated that Estonian K-12 teachers have limited knowledge about artificial intelligence, but teachers perceive artificial intelligence as a tool that supports them in accessing, implementing and using multilingual content, Han et al. (2020) stated that artificial intelligence technology is a suitable method to help primary school teachers' classroom activities and problem-based learning. In today's digital age, it is thought that teachers' effective use of artificial intelligence technology in the teaching process will increase the knowledge and skills of teachers and may have an impact on the teaching process in classroom activities. However, developing strategies to support teachers' use of artificial intelligence technology in education and training processes can maximize its potential in education when ethical rules are taken into consideration.

A significant difference was found in the artificial intelligence literacy levels of music teachers who have knowledge about artificial intelligence programs used in music and music education and who use artificial intelligence programs for music and music education, except for the ethical sub-dimension of the artificial intelligence literacy scale, in the overall total and other sub-dimensions of the scale. In addition, a significant difference was observed in the overall total and sub-dimensions of the artificial intelligence literacy scale in the variable of music teachers' frequency of using artificial intelligence programs. Li and Wang (2022) used artificial intelligence-supported music education for students to learn musical instruments, and as a result of the study, their academic performance was higher than students studying in traditional classes, similarly, Yang (2020) proposed an artificial intelligence-based teaching method to overcome the shortcomings of traditional music teaching methods, and in his experimental research, artificial intelligence-supported music education can effectively improve the quality of traditional music teaching method and effectively promote the development of music education, Again, Li (2024) integrated artificial intelligence technology support into university music education and training systems and concluded that students' academic performance, sight reading, ear training and music theory success increased, while Jamal (2023) concluded that artificial intelligence has the potential to transform teacher education given careful implementation and ethical requirements. It can be said that teachers who

have knowledge about artificial intelligence programs in music and music education and use these programs will have higher artificial intelligence literacy levels, use technology effectively and innovatively in classroom lessons and education and training processes, and increase the performance of both teachers and students by exceeding the limits of traditional methods. In this direction, it reveals the necessity of including artificial intelligence technology in education and training processes in order to increase the quality of music education.

Recommendations

Artificial intelligence applications in education offer a personalized education opportunity unlike traditional education. In this direction, for the results obtained within the scope of the research;

- Organizing supportive training programs for teachers to recognize and use artificial intelligence technologies
- Making artificial intelligence technology-supported music education practices a part of both undergraduate and graduate education curricula
- Organizing trainings, seminars and workshops in order to increase music teachers' skills in the use of artificial intelligence technology and applications
- Providing music teachers with access to artificial intelligence-supported music programs in schools
- Music teachers using artificial intelligence-supported digital materials in classroom activities.

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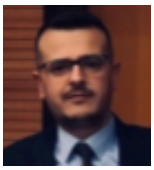

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Journal for the Interdisciplinary Art and Education, 6(2), 133-151, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

Genc Bilge Publishing Ltd.
(Young Wise) © 2025
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Research Article

Development of a mobile learning application for pattern teaching in fashion design[1]

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Article Info

Received: 17 March 2025
Accepted: 6 May 2025
Available online: 30 June 2025

Keywords
ADDIE model
Fashion design
Flipped learning
Mobile learning
Pattern making

Abstract

This study was conducted to develop a mobile learning application for the instruction of the Pattern Making Course, a skill-based fundamental course in the field of fashion design. Utilizing the Flipped Learning Method, which supports active student participation, the mobile learning application was used by students in the course for a duration of two weeks. In the study, the Multi-Stage Mixed Design Method, one of the mixed-method designs, was employed. During the development phase of the mobile learning application, the ADDIE instructional design model was utilized. In the analysis phase of ADDIE, a survey was conducted with instructors teaching the course to determine the topics to be included in the mobile application. The survey aimed to identify the most challenging topics for students in the Pattern Making Course. During the design phase, the content of the application, instructional materials to be used in the course, pre-test and post-test questions, and evaluation forms for instructors and students at the end of the application were prepared. In the development phase, the mobile learning application was programmed to be compatible with Android and iOS operating systems. In the implementation phase, the mobile learning application was utilized for two weeks in the "Introduction to Pattern Making" course in a flipped learning environment with 51 students and instructors in the sample. In the evaluation phase, data collected from instructors and students were analyzed by calculating arithmetic mean, standard deviation, percentage, and frequency values. Additionally, the responses to the semi-structured questions were evaluated through descriptive analysis. As a result of the study, students' evaluations of the developed mobile learning application, PaMa, yielded positive outcomes. Students expressed that having access to information via their mobile devices without time and space constraints provided great convenience and freedom. This study is considered significant as it introduces a technology-based instructional design for the Introduction to Pattern Making Course, a crucial subject in the field.

To cite this article

İnci, A., and Çileroğlu, B. (2025). Development of a mobile learning application for pattern teaching in fashion design. *Journal for the Interdisciplinary Art and Education, 6*(2), 133-151. DOI: https://doi.org/10.5281/zenodo.15510431

Introduction

In traditional teaching models, instruction is delivered within the classroom during a limited timeframe. However, with the evolving requirements and innovations of the modern era, education has taken a different direction. The opportunities provided by technology have expanded the horizons of both educators and students in teaching and learning activities. Among these opportunities, mobile learning applications have increasingly emerged as instructional tools in contemporary education.

[1] The article is derived from a doctoral dissertation with the same title.

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Mobile Learning

Mobile learning emerged as a new paradigm in education at the end of the 20th century and has attracted the attention of scholars since the early 2000s with the widespread adoption of mobile devices (Sharples, 2000). It is defined as a form of learning that enables students to learn independently of time and place by utilizing wireless technology. Traxler (2020) defines mobile learning as "a type of learning that helps learners acquire knowledge, attitudes, skills, and processes through connectivity and portability." Similarly, Saran (2016) describes it as "a process in which individuals are mobile, utilizing high-capacity mobile devices and broadband internet connections to access information resources at any time."

Portability, proximity, individuality, connectivity, and accessibility, which lie at the core of mobile learning, are among the key features of mobile devices (Ally, 2009:1). Mobile technologies and applications serve as promising tools for creating collaborative learning environments, as they facilitate the easy sharing of materials and provide new communication channels, thereby enhancing student engagement (Hsu & Ching, 2013). Fundamental advantages of mobile devices—such as unlimited mobility, flexibility, and compact size—offer new opportunities to improve learning environments in different settings, particularly given that students are assumed to be constantly on the move. These devices enable continuous interaction with educational content across various contexts (Oyelere, Suhonen, Wajiga & Sutinen, 2017). Examining the advantages of mobile learning, students can access course materials anytime and anywhere while tracking their own progress. Additionally, mobile learning supports individual learning, collaborative learning, informal learning, and situated learning (Gimenez Lopez, Magal Royo, Laborda & Garde Calvo, 2009; Cheon, Lee, Crooks & Song, 2012). Students can engage with mobile applications in a highly personalized manner, which ultimately fosters greater participation and enhances learning outcomes (Diacopoulos, Crompton & Education, 2020; Oliveira, Pedro & Santos, 2021). These advantages not only allow students to learn at their own pace but also provide diverse and inclusive learning experiences through multimedia content within applications. The intensive use of mobile devices and technologies is increasingly transforming the nature of knowledge and discourse, leading to changes in both formal and informal learning processes as well as in the ways information is distributed and accessed (Traxler, 2007).

Özsarı and Saykılı (2020: 121) conducted a content analysis of postgraduate academic studies on trends, potentials, and challenges in mobile learning in Türkiye between 2010 and 2019. The findings of the study revealed that mobile learning positively impacts academic achievement, that students develop a favorable attitude toward mobile learning, and that mobile learning enhances students' motivation toward the course. Additionally, the results indicated that mobile learning is beneficial for providing flexibility in terms of time and space, is easy to use, enjoyable, and effective in enhancing interaction. However, the study also identified several challenges associated with mobile learning, including infrastructure issues, software and hardware limitations, and content deficiencies.

In Algabsi's (2021) comprehensive analysis of mobile learning applications, it was found that the majority of studies in this field have been conducted within computer sciences. However, when examining research in higher education, mobile learning applications have been widely integrated into courses across various disciplines, including medical education, nursing education, language learning, and sciences such as chemistry, biology, and mathematics. Findings from academic studies in these fields indicate that educational content and videos delivered via mobile devices facilitate student learning, enhance engagement, and provide an enjoyable and stimulating experience. In anatomy courses, students who used mobile learning applications demonstrated lower anxiety levels and higher success rates compared to those receiving traditional instruction. Similarly, research has shown that mobile-supported e-books are effective in language learning, and that students using mobile applications in classroom activities achieved higher success rates than those who did not. The study results further revealed that mobile learning applications positively impact students' learning outcomes (Willemse, Jooste & Bozalek, 2019; Bolatlı & Kızıl, 2021; Xodabande & Hashemi, 2023; Arain, Hussain, Rizvi & Vighi, 2018; Madang, Tibrani & Santoso, 2019).

As evidenced by studies in different disciplines, the integration of mobile learning applications in higher education leads to increased student achievement and motivation. Fashion Design Education in higher education consists of a curriculum that includes both theoretical courses and skill-based practical courses. Research findings from various fields suggest that mobile learning applications—one of today's increasingly popular and even demanded educational

technologies—enable students to engage more effectively in learning activities. This highlights the significance of developing mobile application content and software specifically tailored for the field of fashion design. Furthermore, given the focus on skill-based learning, this study is among the first to develop mobile application designs for skill training, further emphasizing its importance.

Pattern Making in Fashion Design

The Pattern Making Course is one of the fundamental courses included in both associate and undergraduate degree programs in the field of Fashion Design. Çeğindir (2017) defines pattern making as a two-dimensional or three-dimensional template of a garment, primarily in applied industrial production fields that combine both art and science, such as clothing design. In its simplest form, pattern making refers to the process of creating a garment based on specific proportions in either two or three dimensions.

The Pattern Making Course is one of the key subjects in skill-based instruction within the fashion design field. Skill is defined as "a person's ability to successfully complete a task and achieve an intended outcome based on aptitude and learning, demonstrating proficiency and mastery" (tdk.gov.tr). Today, the primary responsibility for educating fashion designers—who are knowledgeable about scientific research processes, capable of designing innovative, creative, aesthetic, and original garments that meet the needs of their target audience, and possess the necessary skills to produce their designs (Çınar, 2021: 16)—lies largely with Fashion Design undergraduate programs at universities. Fashion design curricula consist of courses that provide students with professional competencies, covering both design and the technical infrastructure of design. Competency can be defined as an individual's capacity to perform professional tasks according to a specific standard (Çelik & Kılınç, 2022: 265). Competency-based education, on the other hand, refers to the entirety of processes that prioritize what an individual can accomplish as a result of education (outcome-based), focusing on the development of the necessary skills, knowledge, and attitudes required to meet competency standards (Guthrie, 2009: 18). When designing a garment, a fashion designer must have a thorough understanding of the socio-economic structure of the target group, the ergonomic suitability of the design for the human body, the feasibility of the production process, the materials intended for use, and a sufficient level of pattern-making knowledge.

When examining undergraduate curricula in Fashion Design, it is observed that the Pattern Making Course is typically allocated 3 to 4 hours per program. Pattern-making education begins with fundamental pattern knowledge, where students are introduced to basic pattern techniques for garments such as skirts, trousers, blouses, and jackets through demonstration methods. Additionally, students engage in hands-on applications to learn how to create patterns for garments with diverse design features. The ultimate goal of pattern-making education is for students to transform their drafted patterns into three-dimensional garments and observe the final outcomes.

In large-scale production companies, the accuracy and quality of pattern-making processes performed by qualified professionals are of critical importance. In the fashion industry, the demand for skilled pattern makers—who possess extensive knowledge of pattern preparation—is continuously increasing. This highlights the necessity of improving both pattern-making expertise and its practical application. Given the significance of pattern-making education for the industry, it is essential to identify the learning challenges students encounter during pattern-making training and develop appropriate solutions to enhance their learning experience.

In the garment design process, which involves numerous stages, computer technologies play a significant role (Vural & Çoruh, 2012). With advancements in software, computer-aided pattern-making (CAD) systems have become increasingly prevalent in pattern-making processes, leading to faster product development, enhanced production efficiency, and shortened time-to-market for fashion products (Liu & Geng, 2003; Meng, Mok & Jin, 2010; Ural, 2019). The use of digital technologies in the fashion design industry has notably improved production efficiency, cost management, time management, model diversity, and, consequently, the support for creativity. The textile and fashion industry ranks among the top sectors in terms of natural resource consumption in raw materials and production processes. In this regard, 3D technologies offer promising innovations for reducing costs and waste generation. To effectively utilize these technologies, users must have a strong foundation in pattern-making, supported by high-quality training and the integration of technology into the learning process.

Importance of Study

In traditional teaching methods, learners remain passive as the instructor plans and delivers the lesson. As stated by Ataş and Delialioğlu (2016), shortcomings in instructional approaches encourage researchers and educators to integrate technology into learning environments. This need became even more evident during the COVID-19 pandemic, when remote education was mandated across all educational levels during lockdown periods. The importance of distance learning materials that enhance the quality of instruction became increasingly apparent during this time. The mobile learning application developed for the Introduction to Pattern Making Course is expected to positively contribute to the field by allowing students to engage with course-related applications independently of classroom hours and physical learning spaces. This would enable them to gain more hands-on experience and actively participate in their learning process outside of class, thereby internalizing the instruction. This study is considered significant because it introduces an innovative approach to the Pattern Making Course, both by employing a different instructional method and by integrating a curriculum-aligned mobile learning application into the course structure. Thus, it has the potential to enhance fashion design education by providing a technology-supported learning model.

Aim of the Study

This study aims to develop a mobile learning application for the instruction of the Pattern Making Course, which is one of the skill-based fundamental courses in the field of Fashion Design. In line with this objective, the following research questions were explored:

- What should be the content structure of the mobile learning application?
- How should the interface design, process sequence, and workflow of the mobile learning application be structured?
- What are the perceptions of instructors and students regarding the developed mobile learning application and flipped learning supported by mobile learning?
- How does student achievement change in flipped learning supported by a mobile learning application?

Method

The method of this study was systematically planned in stages based on the study's aim, the methods followed to achieve this aim, and the data to be collected. Accordingly, a Mixed-Methods Approach was employed. Mixed-Methods Research is defined as an approach in which the researcher collects and analyzes data, incorporates findings, and draws inferences by using both qualitative and quantitative approaches or methods within a single study or research program (Tashakkori & Creswell, 2007: 4). In conducting the study, one of the six different designs of Mixed-Methods Research, as defined by Creswell and Clark (2015), was adopted: the Multi-Stage Mixed Design Method. This design is described as "a cyclical approach in which one or a group of researchers examines a central program objective through sequentially connected quantitative and qualitative research phases, where each new approach builds upon previous findings". The Multi-Stage Mixed Design Method provides a comprehensive methodological framework for developing a general research or evaluation program, particularly for long-term, multi-phase projects (Creswell & Clark, 2015: 108).

In this study, the ADDIE instructional design model was utilized during the development of the mobile application and the design of the instructional environment for the Introduction to Pattern Making Course. Branch (2016) describes ADDIE as one of the most effective product development models, particularly for guiding complex situations and developing various learning resources. The ADDIE model consists of five phases:

- Analysis,
- Design,
- Development,
- Implementation, and
- Evaluation.

The ADDIE model, which follows a systematic instructional design approach, is widely used in processes such as distance education, educational website design, and interactive material development (Li, 2003; Branch, 2016; Shibley, Amaral, Shank & Shibley, 2020).

Analyze

In the analysis phase, the Introduction to Pattern Making course curricula in undergraduate Fashion Design programs were examined. This review included course semesters, weekly course topics, course duration, and ECTS (European Credit Transfer and Accumulation System) information. The analysis revealed that the course content is largely standardized across most universities. Based on this common content, a survey was developed to gather instructor opinions, with the aim of identifying the topics students find most challenging in learning and preparing content accordingly. The target population of the study consisted of instructors teaching pattern-making courses in Fashion Design undergraduate programs in Türkiye during the 2021-2022 academic year. Within this population, the sample group was composed of 22 instructors teaching the Introduction to Pattern Making course. The survey was sent online to all 22 instructors, and responses were received from 17 of them. An analysis of the demographic characteristics of the participating instructors showed that they held a range of academic titles, and more than 70% had over ten years of professional and teaching experience in the field. According to the frequency analysis, the topics that students struggled with the most were identified as "dart manipulation in skirts" and "pleat construction in skirts". Since dart manipulation serves as a fundamental topic for other aspects of pattern-making and is essential for knowledge transfer, it was selected—based on expert opinions—as the primary content focus for the mobile application design. The survey findings indicated that 82.35% of the instructors identified "pleat construction in skirts" as a difficult topic for students, while 76.47% pointed to "dart manipulation in skirts" as another major challenge (Çileroğlu & İnci, 2023)[4].

Design

During the design phase, the implementation of the flipped classroom system was planned. A two-week period was allocated for teaching dart manipulation content. Additionally, the detailed content structure for dart manipulations in skirts—covering the fundamental applications of the Introduction to Pattern Making Course—was determined. Based on the learning objectives and expected competencies, decisions were made regarding the information notes, audio narrations, video demonstrations, and interactive exercises to be included in the mobile application. The survey results guided the selection of specific subtopics related to dart manipulation, ensuring a structured and comprehensive content flow.

Given the practice-oriented nature of the course, a procedural instructional approach was employed in designing the content. In this approach, the instructor sequences the procedural steps for a task, allowing students to follow the steps systematically and complete the process. Smith and Ragan (2005) emphasize that subsequent procedural steps should build upon previous ones, enabling students to apply the learned procedure in unfamiliar and varied situations. They further state that procedural knowledge must be both demonstrated and practiced in real-life scenarios. Following a simple-to-complex progression, each topic was structured accordingly. After learning the content through the mobile application, students were required to share their completed activities via a social media-based interaction platform to facilitate a more interactive learning experience. WhatsApp was chosen as the preferred sharing platform due to the moderate sample size and the fact that students were already accustomed to using it in coursework. Additionally, a short end-of-topic assessment was designed within the mobile application, featuring multiple-choice and true/false questions.

The mobile application aimed to help students acquire basic concepts and techniques related to dart manipulation. More complex skirt pattern-making tasks were planned to be completed in face-to-face sessions under instructor supervision. At this stage, evaluation forms for both the flipped classroom model and the mobile application were developed. The mobile application evaluation form was structured under three categories: content, design, and usability. The questions within each category were prepared using a five-point Likert scale, drawing upon existing research

[4] Çileroğlu and İnci (2023) presented the research data in the paper titled "Topics Challenging for Students in Pattern Making-I Course in Fashion Design" at the 10th Akdeniz International Social Sciences Congress.

instruments for mobile application evaluation (Kalınkara, 2017; Demir & Akpınar, 2016). Additionally, instructor and student interview forms were designed to assess:

- The instructional flow in the flipped classroom model,
- The adequacy of mobile learning content,
- The number and scope of examples and exercises,
- The effectiveness of reinforcement activities,
- The overall contribution of the mobile application and flipped classroom to skill development.
- The final version of the evaluation forms was developed based on both literature review and expert opinions obtained within the scope of the study.

Development

In the development phase, the mobile application was programmed to be compatible with smartphones and tablets, ensuring alignment with the pre-designed content. Due to the financial support required for software development, a TÜBİTAK 1002-A project application was submitted and approved. To ensure full participation of students, the software was designed to be compatible with both iOS and Android-based smartphones. For the development of interactive features and gamified elements, the Unity game engine was utilized. Additionally, the flipped classroom model was implemented during this phase to integrate the developed material into the instructional process. Branch (2016:82) defines the key steps of the development phase as follows: Content production, Selection and development of supporting media, Preparation of a student guide, Preparation of an instructor guide, Process revisions, and Pilot testing. During this phase of the study, the content determined in the design stage was fully developed. The mobile application content was structured to break down information into smaller segments, following the step-by-step instructional approach (Bradly, Haynes, Cook, Boyle & Smith, 2009). The mobile application was designed to allow students to: Select measurements, Observe pattern alterations, and Engage in interactive activities to visualize and practice changes in patterns dynamically.

During the development phase, the mobile application was fully completed, and activities for both in-class and out-of-class use within the flipped classroom environment were planned. These activities included: Instructional materials for face-to-face lessons, Analysis tasks for students in the classroom, including the first-week and second-week skirt models, and Other in-class activities to reinforce learning. Additionally, the pilot testing of the mobile application was conducted in this phase. The pilot study was carried out with 42 students at Istanbul Arel University, all of whom had previously taken the Introduction to Pattern Making Course. Students were asked to use the mobile application for one week, after which their feedback was collected online using the mobile application evaluation form. The evaluation form included Likert-scale questions assessing: The content of the application, The design of the application and The usability of the application. The pilot test data collected from students indicated that they strongly agreed with the statements regarding content, design, and usability, with average scores ranging between 4.20 and 5.00 ($\bar{x}$=4.20-5.00). Based on the frequency, percentage, and standard deviation analyses, it was determined that the content was sufficient. Consequently, the same content was implemented in the classroom setting for further testing and evaluation.

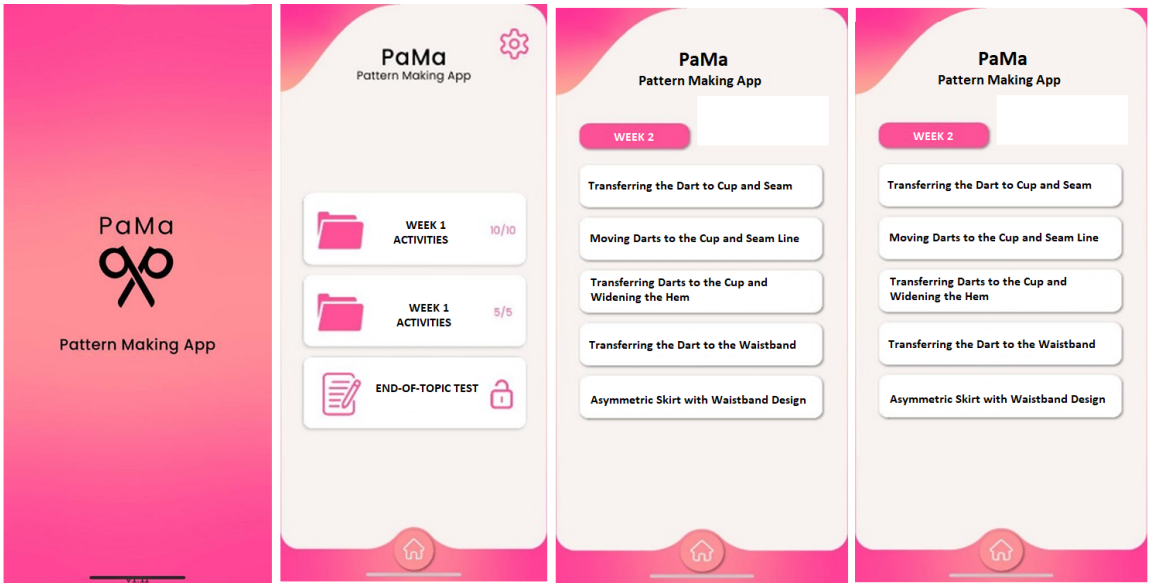

Figure 1. Logo design, application launch screen, and main menu

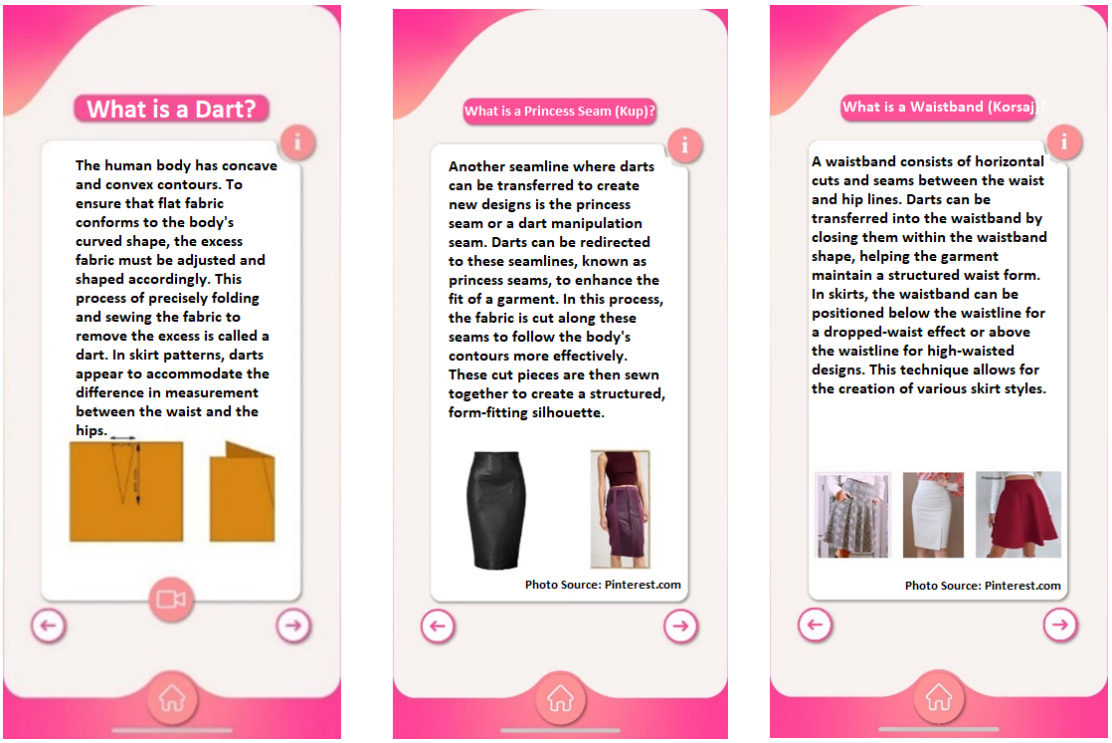

Figure 2. Examples of information notes in the application

When users click on each heading, they can access the corresponding content. The topic contents include: Information notes, Audio narration (represented by a speech bubble icon), Videos (indicated by a camera icon), A skirt visual representation (activated by clicking the eye icon), and An interactive feature that allows students to perform hands-on exercises (activated by the scissors icon). In the information notes, key concepts are defined and briefly explained, supported by visual illustrations.

When a student clicks the scissors icon, they can perform cutting operations on the screen, simulating the manual cutting process of traditional methods. The icons are color-coded: if an audio or video recording is available for a topic, the icon appears in a darker shade; if not, it is displayed in a lighter shade. Clicking the eye icon enlarges the skirt drawing on the screen. This function is designed to help students visualize the final skirt model by demonstrating how the pattern pieces come together after assembly.

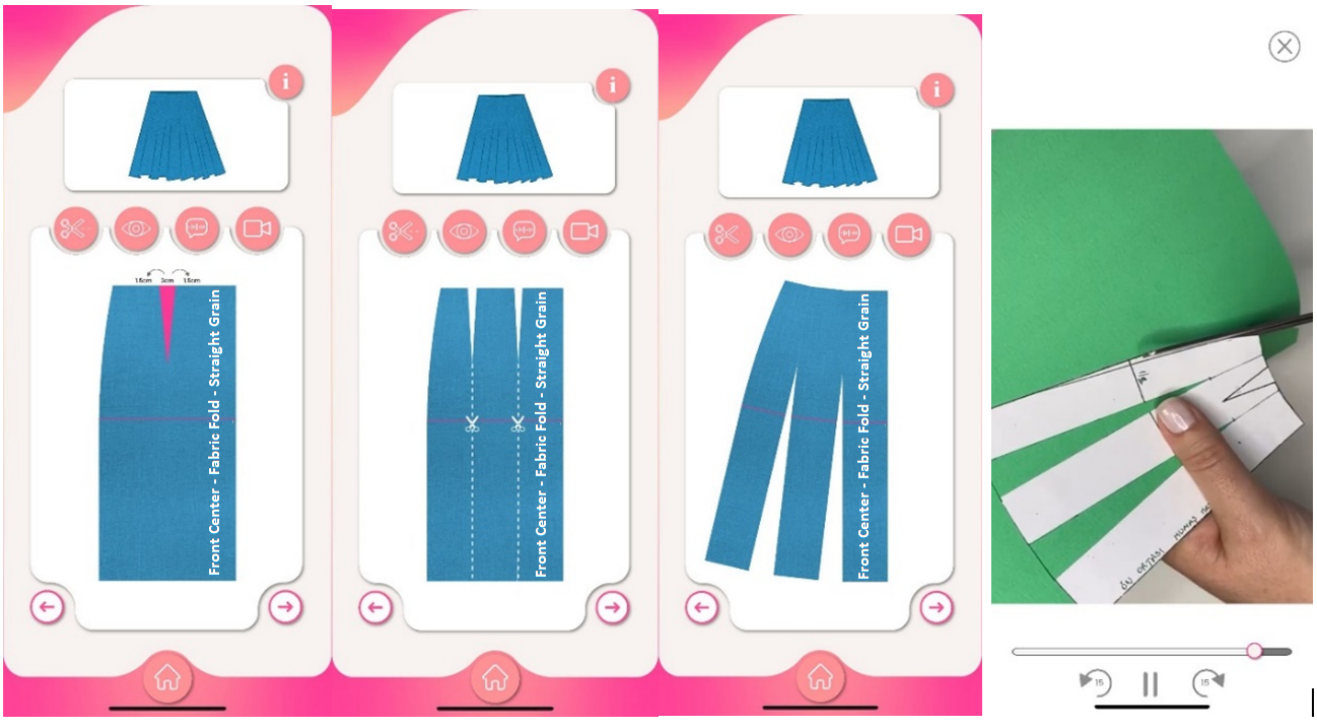

Figure 3. Interactive application and video of the two-point dart manipulation process

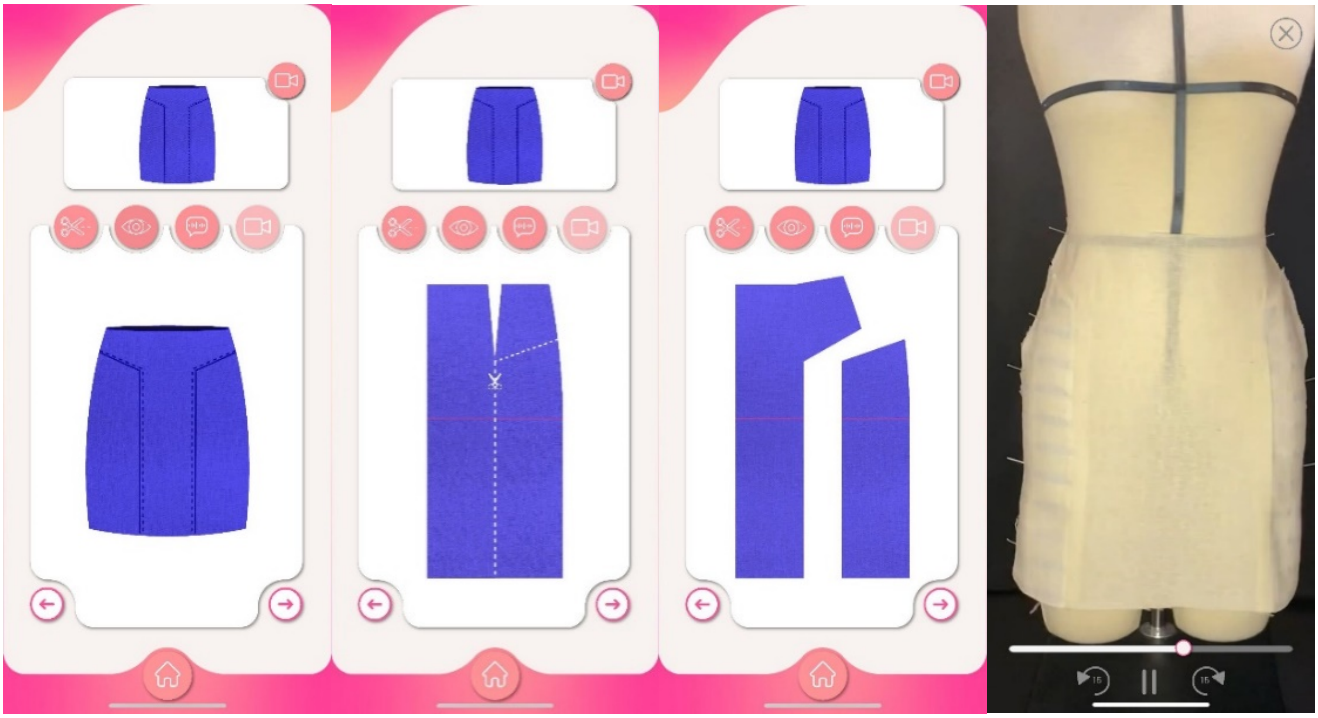

Figure 4. Princess-seamed skirt study screen and assignment video

When the camera icon on the screen is clicked, students can watch instructional videos that demonstrate the step-by-step process of the topic. The video player interface includes functions that allow students to: Fast-forward or rewind the video, and Pause the video at any desired point for better comprehension.

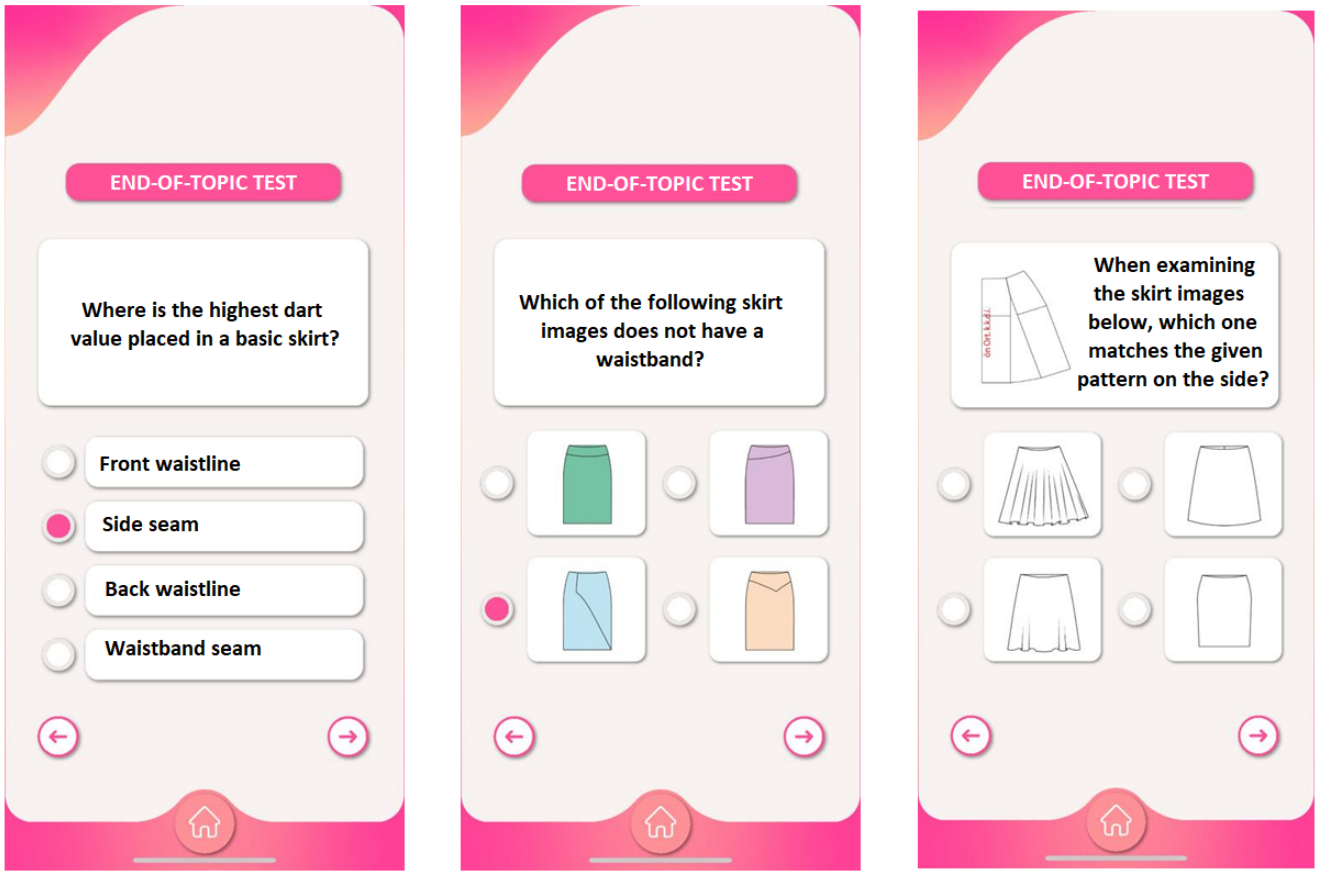

Figure 5. Examples of end-of-topic tests

The final test in the application is designed to allow students to review their correct and incorrect answers. Additionally, students receive a score out of 100 based on their performance.

Implementation

After the mobile application was developed, the students taking the Pattern Making Course in undergraduate Textile and Fashion Design Department in Turkey constituted the population of the research. From this population, 51 students who took the Pattern Preparation course for the first time in the Model Technical Drawing and Pattern Making Course in the Textile and Fashion Design Department of the Faculty of Fine Arts of Istanbul Haliç University in the Fall 2023-24 semester were determined as the sample of the research with the purposeful sampling method. While selecting the sample, the large number of students, the fact that the topics of skirt and trousers are given in the Model Technical Drawing and Pattern Making Course and the researcher's easy access to the university were taken into consideration.

During the implementation phase, the PaMa mobile learning application was used by students in a flipped learning environment for a two-week period as part of the Introduction to Pattern Making Course (offered under the course title Model Technical Drawing and Pattern Making) in the Textile and Fashion Design Department at Haliç University. The course consisted of two sections, both taught by the same instructor. Before the implementation, a preliminary briefing was provided by the researcher to the participating instructor and students, explaining: How the flipped classroom environment would be structured, How the mobile application would be integrated into the instructional design, and How the application should be used effectively within the course. This informational session on mobile application usage was conducted one week before the in-class implementation. For each student group, a WhatsApp group was created, including the instructor and the researcher, where students could share their work, ask questions, and engage in discussions about their assignments. During the implementation phase, students were required to complete mobile application activities related to each week's topic before attending class and to share their completed exercises in the WhatsApp group. Students used the mobile application for one week prior to the class session, allowing them to:

Practice pattern-making activities, Share their pattern exercises in the WhatsApp group, Ask questions to the instructor and Engage in discussions on alternative pattern solutions.

A meeting was held with the course instructor to plan the face-to-face component of the course. During the in-class instruction, the instructor was tasked with: Assessing students' prior knowledge through question-and-answer sessions at the beginning of the lesson, Answering students' questions related to the topic, and Evaluating students' understanding by assigning a skirt model analysis task that incorporated the knowledge and skills acquired through the mobile application. At this stage, the researcher provided the instructor with a model-based skirt visual, specifically designed to align with the mobile application content and activities. During the activity, the instructor: Distributed the visual to students, Asked students to write down the key characteristics of the model in the designated section on the worksheet and Posed questions about the pattern analysis and how the pattern should be structured. The instructor's role in the face-to-face sessions was designed as a facilitator, guiding students and supporting their progress throughout the learning process.

Evaluation

In the evaluation phase, the pre-test and post-test data collected from students who used the application for two weeks were analyzed. Additionally, semi-structured interview forms were administered to both instructors and students to assess their experiences with the mobile learning application and the flipped classroom model. The collected data were examined to evaluate perceptions of mobile learning and the flipped learning approach, as well as to determine the effectiveness of integrating mobile learning into the instructional process.

Findings

Below are the findings regarding instructor and student opinions on the flipped learning environment supported by the mobile application.

Instructor Opinions on the Flipped Learning Environment Supported by the Mobile Application

The instructor fully agreed with all statements related to the conceptual information provided in the mobile application. Regarding the design of the mobile learning application, the instructor expressed entirely positive opinions. Similarly, responses to questions about the usability of the application were generally positive. However, when asked about the ease of downloading the application, the functionality of animations and videos, and the application's stability during activities, the instructor partially agreed with these statements. The instructor noted that their mobile device was relatively old and had limited storage capacity, which was likely the cause of the technical issues experienced.

Regarding the flipped classroom environment supported by mobile learning, the instructor stated that it was their first time implementing an alternative teaching method in the course. The instructor observed that students engaged more actively in class since they completed the applications before attending the lesson and arrived better prepared for in-class model analysis tasks. One of the instructor's key observations was that the combination of conceptual explanations with visual support, followed by reinforcement through instructional videos, was one of the most beneficial aspects of the mobile learning application. Additionally, the instructor emphasized that the integration of mobile learning with the flipped classroom model significantly enhanced student motivation.

Student Opinions on the Flipped Learning Environment Supported by the Mobile Application

Below are the data collected from 51 students who participated in the study and used the mobile application in class for two weeks, along with the findings derived from these data.

Table 1. Student opinions on the ınformation provided in the application

Information Provided in the Application	N=51		SD		D		N		A		SA	
	M	SD	%	f	%	f	%	f	%	f	%	f
The information is clear and precise.	4,00	0,77			1,96	1	21,5	11	50,8	26	25,4	13
The information notes are sufficient.	3,98	0,75			3,92	2	19,6	10	54,9	28	21,5	11
The content of the example models is complete.	3,90	0,76			7,84	4	19,6	10	47,0	24	25,4	13
The reinforcement activities for the topics are comprehensive.	3,72	0,89	1,96	1	3,92	2	29,4	15	49,0	25	15,6	8
The video content is sufficient.	3,80	0,85	5,88	3	3,92	2	21,5	11	41,1	21	27,4	14
The video content is understandable.	3,98	1,09	3,92	2	1,96	1	13,7	7	52,9	27	27,4	14
The audio narrations are sufficient.	3,90	0,92	1,96	1	3,92	2	15,6	8	54,9	28	29,4	12
The audio narrations are clear.	4,86	0,86	1,96	1			15,6	8	52,9	27	29,4	15
The short quizzes are clear and understandable.	4,03	0,79	1,96	1	1,96	1	11,76	6	58,8	30	25,4	13

Note: 1.00–1.79 → **SD**: Strongly Disagree. 1.80–2.59 → **D**:Disagree, 2.60–3.39 →**N**: Notral, 3.40–4.19 → **A**:Agree, 4.20–5.00 → **SA**: Strongly Agree, **Sd**: Standard Deviation, **M**: Mean

Examining student opinions on the information provided in the application, the most notable findings are as follows: For the statement "The information notes are sufficient," 54.90% of students responded "Agree," while 21.56% selected "Strongly Agree." Meanwhile, 3.92% of students disagreed with this statement. The overall mean score for this item was $\bar{x} = 3.98$, indicating that students generally agreed with the sufficiency of the information notes.

For the statement "The video content is understandable," 52.94% of students responded "Agree," while 27.45% selected "Strongly Agree." Meanwhile, 1.96% of students disagreed with this statement. The mean score for this item was $\bar{x} = 3.98$, indicating that students generally agreed with the clarity of the video content.

For the statement "The audio narrations are sufficient," 52.94% of students responded "Agree," while 29.41% selected "Strongly Agree." In contrast, 1.96% of students strongly disagreed with this statement. The mean score for this item was $\bar{x} = 3.90$, showing that students agreed with the sufficiency of the audio narrations.

For the statement "The audio narrations are clear," 54% of students responded "Agree," while 24% selected "Strongly Agree." Meanwhile, 2% of students strongly disagreed with this statement. Since this question was answered by 50 students, the results were calculated based on n = 50. The mean score for this item was $\bar{x} = 4.86$, indicating that students strongly agreed with the clarity of the audio narrations.

For the statement "The short quizzes are clear and understandable," 58.82% of students responded "Agree," while 25.49% selected "Strongly Agree." Meanwhile, 1.96% of students strongly disagreed with this statement. The mean score for this item was $\bar{x} = 4.03$, indicating that students generally agreed with the clarity and understandability of the quizzes

In Table 1, which presents student opinions on the information provided in the application, the combined percentage of "Agree" and "Strongly Agree" responses for the short quizzes item reached 84%, demonstrating a predominantly positive perception.

The arithmetic mean values in Table 1 range from 3.40 to 4.19, indicating that most responses were concentrated in the "Agree" category. The only exception was the "The audio narrations are clear" item, where the arithmetic mean was 4.86, aligning with the "Strongly Agree" category.

Considering these findings, it can be concluded that the information provided in the application is adequate and appropriate.

Table 2. Student opinions on the design of the mobile application

Application Design	N=51		SD		D		N		A		SA	
	M	SD	%	f	%	f	%	f	%	f	%	f
The colors used in the mobile application interface are visually appealing.	3,88	0,69	1,96	1	1,96	1	21,5	11	54,9	28	19,6	10
The colors are harmoniously integrated.	3,94	0,81			1,96	1	19,6	10	60,7	31	17,6	9
The font type and size used in the application are appropriate.	4,03	0,68	1,96	1			13,7	7	60,7	31	23,5	12
The selection of visuals in the application is suitable.	4,07	0,74			1,96	1	13,7	7	58,8	30	25,4	13
The placement of animations and videos within the interface is appropriate.	4,05	0,68			1,96	1	13,7	7	60,7	31	23,5	12
The design of the drawing activities is well-structured.	3,90	0,69			3,92	2	19,6	10	58,8	30	17,6	9
The drawing activities are clear and understandable.	4,00	0,73			1,96	1	15,6	8	62,7	32	19,6	10
The placement of buttons required to complete tasks in the application is suitable.	3,84	0,68	1,96	1	1,96	1	21,5	11	58,8	30	15,6	8
The language used in the application interface is clear and comprehensible.	4,15	0,84					17,6	9	49,0	25	33,3	17

Note: 1.00–1.79 → **SD**: Strongly Disagree. 1.80–2.59 → **D**:Disagree, 2.60–3.39 →**N**: Notral, 3.40–4.19 → **A**:Agree, 4.20–5.00 → **SA**: Strongly Agree, **Sd**: Standard Deviation, **M**: Mean

Examining student opinions on the design of the mobile application, the most notable findings are as follows:

For the statement "The colors are harmoniously integrated," 60.78% of students responded "Agree," while 17.64% selected "Strongly Agree." Meanwhile, 1.96% of students disagreed with this statement. The mean score for this item was $\bar{x} = 3.94$, indicating that students generally agreed with the harmonious use of colors in the application.

For the statement "The font type and size used in the application are appropriate," 60.78% of students responded "Agree," while 23.52% selected "Strongly Agree." Meanwhile, 1.96% of students strongly disagreed with this statement. The mean score for this item was $\bar{x} = 4.03$, indicating that students generally agreed with the appropriateness of the font type and size used in the application.

For the statement "The placement of animations and videos within the interface is appropriate," 60.78% of students responded "Agree," while 23.58% selected "Strongly Agree." Meanwhile, 1.96% of students somewhat agreed with this statement. The mean score for this item was $\bar{x} = 4.05$, indicating that students generally agreed with the placement of animations and videos in the interface.

For the statement "The drawing activities are clear and understandable," 62.74% of students responded "Agree," while 19.60% selected "Strongly Agree." Meanwhile, 1.96% of students disagreed with this statement. The mean score for this item was $\bar{x} = 4.00$, indicating that students generally agreed with the clarity and understandability of the drawing activities.

Looking at Table 2, which presents student opinions on the design of the mobile application, it can be observed that the total percentage of "Agree" and "Strongly Agree" responses exceeded 75%, indicating a highly positive perception of the application's design.

The arithmetic mean values in Table 2 ranged between 3.40 and 4.19, showing that most responses were concentrated in the "Agree" category. Based on these findings, it can be concluded that students found the design of the application satisfactory and well-structured.

Table 3. Student opinions on the usability of the mobile application

Usability of the Application	N=51		SD		D		N		A		SA	
	M	SD	%	f	%	f	%	f	%	f	%	f
The application can be easily downloaded to a mobile device	4,45	0,80					9,8	5	35,2	18	54,9	28
The application pages load quickly	4,37	0,67					7,8	4	47,0	24	45,0	23
Animations and videos in the application open without issues	4,20	0,65	3,92	2			11,7	6	41,1	21	43,1	22
The forward, rewind, and pause functions in videos work smoothly	3,88	0,99	5,88	3	5,88	3	11,7	6	47,0	24	29,4	15
Audio narrations in the application play without difficulty	4,07	1,10	1,96	1			21,5	11	43,1	22	33,3	17
The forward, rewind, and pause functions in audio narrations work properly	3,90	0,87	3,92	2	3,92	2	17,6	9	47,0	24	27,4	14
Drawing activities can be performed without any issues	4,21	1,05					11,7	6	54,9	28	33,3	17
The forward and backward navigation between pages works smoothly	4,17	0,64	1,96	1			13,7	7	47,0	24	37,2	19
The application runs without errors during activities	4,05	0,82	3,92	2			15,6	8	47,0	24	33,3	17
The steps required to access content within the application are sufficiently clear	4,21	0,93			1,96	1	11,7	6	40,0	25	37,2	19
Accessing the desired content is easy	4,21	0,73	1,96	1			7,8	4	54,9	28	35,2	18

Note: 1.00–1.79 → **SD**: Strongly Disagree. 1.80–2.59 → **D**:Disagree, 2.60–3.39 →**N**: Notral, 3.40–4.19 → **A**:Agree, 4.20–5.00 → **SA**: Strongly Agree, **Sd**: Standard Deviation, **M**: Mean

Examining student opinions on the usability of the mobile application, the most notable findings are as follows:

For the statement "The application can be easily downloaded to a mobile device," 54.90% of students responded "Strongly Agree," while 35.29% selected "Agree." The combined percentage of these responses indicates that 90% of students expressed a positive opinion, suggesting that the majority of students did not encounter issues while downloading the application. The mean score for this item was $\bar{x} = 4.45$, indicating strong agreement.

For the statement "The application pages load quickly," 47.09% of students responded "Agree," while 45.08% selected "Strongly Agree." The mean score for this item was $\bar{x} = 4.37$, indicating strong agreement with the ease of page loading.

For the statement "Drawing activities can be performed without issues," 54.90% of students responded "Agree," while 33.33% selected "Strongly Agree." The mean score for this item was $\bar{x} = 4.21$, indicating strong agreement that the drawing activities functioned smoothly.

For the statement "Accessing the desired content is easy," 54.90% of students responded "Agree," while 35.29% selected "Strongly Agree," and 1.96% responded "Strongly Disagree." The mean score for this item was $\bar{x} = 4.21$, indicating strong agreement that students found it easy to access the desired content.

Examining the table data on application usability, the arithmetic mean values for six items ranged between 3.40 and 4.19, corresponding to the "Agree" category. Meanwhile, the arithmetic means for five other items ranged between 4.20 and 5.00, falling within the "Strongly Agree" category.

Based on these findings, it can be concluded that the usability features of the application align with user expectations and are effectively designed for instructional purposes.

Additionally, students were asked open-ended questions regarding their experiences with flipped learning supported by mobile learning. Responses to the first four questions were analyzed, and frequent similar expressions were identified to perform a frequency analysis for clearer data interpretation.

Table 4. Student opinions on whether the mobile application helped them understand the subject better

Student Opinions:	**f**	**%**
Clear, precise, and understandable	13	27
Helped reinforce the topic	15	31,25
Facilitated learning and enabled more effective learning	25	52
Provided visual learning support	7	14,58
Accessible at any time	6	12,5

**Students expressed multiple opinions. (n = 48)*

For the question *"Did the developed mobile application help you understand the topic better?",* 52% of students who responded "Yes, it helped" stated that the application made learning easier and enabled more effective learning. Additionally, 31.25% of students indicated that the application helped reinforce the topic. The feature of being accessible at any time was mentioned last, with 12.5% of students highlighting this aspect.

Table 5. Student opinions on which features of the mobile application were most beneficial for learning

Student Opinions	**f**	**%**
Video and audio narration	26	51
Interactive applications	18	35,29
Accessibility	5	9,80
Clarity of in-app activities	17	33,33

**Students expressed multiple opinions. (n = 51)*

For the question *"Which features of the mobile application do you find most beneficial for learning?"*, 51% of students identified video and audio narration as the most helpful feature, while 35.29% stated that the interactive student applications within the app were the most beneficial. Accessibility was mentioned the least, with 9.80% of students highlighting it as a key feature.

Table 6. Student opinions on the positive aspects of flipped learning supported by the mobile application

Student Opinions	**f**	**%**
Facilitates learning	16	47
Helps in coming to class prepared	7	20,58
Accessibility	12	35,29
Supports individual learning	17	50

**Students expressed multiple opinions. (n = 34)*

For the question *"What do you think are the positive aspects of flipped learning supported by the mobile application?"*, 50% of students stated that flipped learning supports individual learning, while 47% indicated that it facilitates learning.

Students were also asked, *"What additional features would you like to see in the mobile application?"*. Their suggestions included: Increasing the number of videos, introducing small rewards upon completing a topic, adding forums within the app for real-time support, incorporating adjustable playback speed for audio and video content, expanding topics to include different pattern-making techniques, enhancing existing features and adding measurement markings directly onto the patterns.

Table 7. Contribution of the mobile application to course motivation

Student Opinions:	**f**	**%**
Increased my interest in the course	32	62,74
Made learning easier	45	88,23
Increased my curiosity about the course	25	49,01
Provided easy access to course-related information anytime and anywhere	51	100
Made learning activities and the course more enjoyable	28	54,90
Allowed me to engage in learning activities at my own pace	28	54,90
Stimulated my motivation to learn the topic	31	60,78
Encouraged my sense of discovery about the topic	23	45,09

**Participants selected multiple options. (n = 51)*

For the question *"How did the mobile application contribute to your motivation for the course?"*, 100% of students stated that it provided easy access to course-related information anytime and anywhere. Additionally, 88.23% reported that it made learning easier, 62.74% stated that it increased their interest in the course, and 60.78% indicated that it stimulated their motivation to learn the topic.

The percentage distribution of responses demonstrates that the mobile application positively influenced students' motivation for the course.

Below are the average scores and *t-Test* results of the 47 students who completed both the pre-test and post-test.

Table 8. Comparison of participants' pre-test and post-test scores

Measurement	Mean	S	Difference	95% Confidence Interval		t	p
				Lower Bound	Upper Bound		
Pre-Test	9.49	2.68	-4.66	-5.45	-3.85	-11.54	.000
Post-Tet	14.15	2.12					

In the study, a paired-samples *t-Test* was conducted to examine whether there was a significant difference between the pre-test and post-test responses of the study group regarding the 19 questions on dart manipulation processes. The results indicated that the post-test scores were significantly higher, demonstrating a meaningful improvement in students' understanding after using the mobile application.

Conclusion and Discussion

The study aimed to propose a new instructional approach for the Pattern Making Course. The findings from student feedback collected during the implementation phase of the ADDIE model regarding the mobile application revealed the following:

- Students agreed with the information provided in the application ($\bar{x}$ = 3.40–4.19).
- Students agreed with the design of the application ($\bar{x}$ = 3.40–4.19).
- For the usability of the application, students agreed with six items ($\bar{x}$ = 3.40–4.19) and strongly agreed with five items ($\bar{x}$ = 4.20–5.00).

These results indicate that students had a positive perception of the content, design, and usability of the mobile application.

Evaluation results from the implementation phase of the ADDIE model showed that the instructor found the most beneficial aspects of the mobile learning application to be the use of visuals to explain key concepts, followed by the reinforcement of topics through videos. Similarly, Shalhap and Daher (2023) state that mobile learning supports cognitive engagement, particularly through videos, by integrating different tools in a modular format. The course instructor also emphasized that flipped learning supported by mobile learning enhanced student motivation.

Student evaluations of the PaMa mobile learning application were found to be highly positive. Students expressed that having access to information on their mobile devices without time and space constraints provided significant convenience and freedom. Existing research indicates that instructors can foster cognitive curiosity and engagement by recognizing the function of specific mobile activities, such as gamification tools (Shalhap & Daher, 2023). Students reported a high level of satisfaction with the visual representations of skirt patterns in the application, as well as with its interactive features. They stated that the mobile learning application significantly increased their motivation to learn in the Pattern Making Course, facilitated their learning process, and made the class more enjoyable. Studies conducted in various fields also suggest that videos and educational content facilitate learning, are cognitively stimulating and engaging, reduce anxiety levels, and enhance both academic success and course satisfaction (Willemse, Jooste & Bozalek, 2019; Ailoon & Delialioğlu, 2019; Bolatlı & Kızıl, 2021). Some students mentioned that the application occupied too much storage space on their phones, while others suggested adding a variable speed function for the videos. Although this feature was tested during the design phase, it was found that increasing playback speed caused students to miss critical details. Additionally, considering individual differences in learning styles, it was determined that excluding this function would be more appropriate for the application.

A significant difference was found between the pre-test and post-test scores of the study group before and after the implementation of flipped learning supported by mobile learning, indicating an increase in student achievement. Based on this result, it can be concluded that the mobile learning application had a positive impact on students' academic success. Similar studies support these findings. Ercan and Sönmez (2021) reported positive outcomes from their mobile learning application for Chemistry courses, while Nuanmeesri (2019) found similar results in undergraduate theoretical course modules. Likewise, Syahidi et al. (2020) developed a mobile learning application for engineering courses in vocational colleges, Oyelere et al. (2018) for computer technology system analysis and design courses, and Klimova (2019) for English language instruction, all of which demonstrated the effectiveness of mobile learning in improving academic performance.

Some students expressed that they did not find it suitable for flipped learning supported by mobile learning to be used throughout the entire course. When working on problems in class and teaching each other, students must engage in a different type of cognitive processing, which may enhance their learning. However, some students may initially find the flipped approach unsettling and may not fully embrace the shift from traditional methods, despite its learning benefits (Missildine et al., 2013; Strayer, 2012). Additionally, it is suggested that students in undergraduate education do not find a single method and content delivery approach sufficient, as they have expectations for a more varied learning experienceş.

Recommendations

Mobile learning provides students with individualized and self-paced learning opportunities, thereby promoting equal access to education. To ensure that students can fully benefit from this learning model, it is essential to expand internet access and improve connectivity.

This study focused on development and implementation-oriented data collection regarding mobile learning. Future research should consider expanding studies related to the Pattern Making Course in the field of Fashion Design by incorporating web-based online instructional methods. Researchers are encouraged to explore online teaching models alongside mobile learning applications to broaden the scope of instructional design in this area. Due to budget constraints, certain features such as forums or chat functions, which were initially intended to be integrated into the application, could not be included. Future studies should aim to develop more extensive in-app functions, such as animations and chat features, using low-memory-consuming methods to enhance the learning experience.

Additionally, for future research, it is recommended to include a wider variety of model visuals and patterns to help students better understand the relationship between skirt visuals and pattern structures. Furthermore, reinforcement assignments for extracurricular student activities should be planned to further support learning and skill development.

Given the individual differences among students, the workload planning for tasks they need to complete independently outside of class could be challenging. Additionally, instructors using this teaching method must actively respond to students' questions outside of class. Considering the course load in undergraduate Fashion Design programs for both students and instructors, it is suggested that flipped learning supported by mobile learning should be applied selectively to the topics students struggle with the most rather than the entire curriculum.

The developed mobile application is specifically designed for the Introduction to Pattern Making course in undergraduate Fashion Design programs and is limited to skirt dart manipulation, the most challenging topic for students in this course. Future research should explore similar applications for other topics and processes in pattern making.

The study focused on developing a mobile application for the Pattern Making Course. It is recommended that a similar study be conducted with a sufficient number of students by forming experimental and control groups to measure the application's impact on course success.

Considering the significance of developing high-value brands in our country's textile and ready-to-wear industry and competing with global brands, training skilled individuals capable of effectively transferring knowledge is crucial. Utilizing technological advancements to address instructional challenges in teaching Pattern Making, a fundamental

course in undergraduate Fashion Design programs, is considered essential for improving the learning process. In this context, considering that the Introduction to Pattern Making course is given at high school, associate and undergraduate levels, it is recommended that the developed application be included in the course as a teaching tool that will support students' individual learning and provide them with the opportunity to access basic information independently of the classroom.

Acknowledgment

We would like to thank Arel University for allowing us to conduct the pilot test and Haliç University for granting the necessary permissions and support for the implementation of this research. Our gratitude also extends to the esteemed professors and students who participated in the study. This research was supported by the Scientific and Technological Research Council of Türkiye (TÜBİTAK) under Project No. 222K079. We sincerely thank TÜBİTAK for their valuable support.

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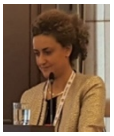

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Journal for the Interdisciplinary Art and Education, 6(2), 153-162, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

Genc Bilge Publishing Ltd.
(Young Wise) © 2025
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Research Article

Movement and voice plastics: suggestion for the combined use of movement and voice as a method to improve mental, emotional, physical capacities

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Article Info

Received: 17 October 2024
Accepted: 15 May 2025
Available online: 30 June 2025

Keywords
Imitation
Kinesthetic
Movement
Plastics
Voice

Abstract

The aim of this study is to propose the Movement and Voice Plastics Method, explain its applications and make its high-detailed taxonomy in order to create a new form through mechanisms of imitation of bodily movement and sound material in humans. It is also to propose a method that can be used in creative art education such as drama, dance, singing and to improve the quality of education and improvisation skills. In addition, another aim of the study is to examine and investigate the importance and contributions of studies related to plasticity in the neurobiological, emotional, sensory and affective development of an individual, which is of high importance in the lives of individuals. These components are also highly important in therapeutic settings. Nowadays, the use of materials of movement and sound/vocal is relatively common in art therapy practices. For this reason, the method and taxonomy specified in this study can also be used in art therapy applications. Therefore, this study also aims to be supportive method for art therapy practices.

To cite this article

Naiboğlu, B. (2025). Movement and voice plastics: suggestion for the combined use of movement and voice as a method to improve mental, emotional, physical capacities. *Journal for the Interdisciplinary Art and Education, 6*(2), 153-162. DOI: https://doi.org/10.5281/zenodo.15510448

Introduction

This study is based on proposing a method that includes the use of bodily movement in human beings with sound or the use of human voice in combination with movement. Imitation is as old as human history and plays a very important role in our lives. Human beings have imitated nature and human experiences, objects and matter from the very beginning. Imitation is a concept that also attracted the attention of the great philosopher Aristotle who lived in the 4th century *BC*. Aristotle mentions the concept of "mimesis" in his famous work called Poetics, which is regarded as the first theory of art in the world and was written on the art of poetry. *Mimesis* means imitating nature and human behavior, that is, mimicking nature and humans. Aristotle was influenced by Plato on this subject. “For some 20 years Aristotle was Plato’s student and colleague at the Academy in Athens, an institution for philosophical, scientific, and mathematical research and teaching founded by Plato in the 380s” (Britannica). “Plato and Aristotle argue that artist (Demiurge) and poet imitate nature, thus, a work of art is a relection of nature... According to Plato Demiurge creates the idea and by beholding the idea the Demiurge produces the object; his ability is exalted in the imitation of the Idea” (Baktır 2003). Of course, the act of imitation is not only an act of the artist, but people in their daily life practices repeat this action, which is very important for their development from the moment they are born."... both the desire to imitate and the fact that everyone likes imitations are characteristics that develop with people from their childhood” (Aristotle,

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2005: 1448b 5-15). Imitation exists through the combination of various elements in nature and life. In this study, movement and voice will be discussed, and the rest will not be within the scope of this study.

Problems of Study

The benefits of games for the development of psychomotor skills in their own freedom and spontaneity can be listed as follows: development creativity and improvisation, increase in neuroplasticity capacity, contribution to neurocognitive/neurocognitive processes, emotional development, and being more open to learning, especially for students. So what does this child gain when he makes this embodiment with this game?

Importance of Study

The unity of movement and voice is a phenomenon that we constantly encounter in daily life. We can claim that every moving item also has a sound. Even the movement in the blood circulation, which we cannot feel in our body, exists together with a sound that the human ear cannot hear in the presence of external sounds. "In humans and animals, when the area of the chest where the heart is located is listened to by the human ear, stethoscope or phonendoscope, some sounds are heard accompanying the heartbeats. ...There are two types of heartbeats heard by the ear. ...The first type of heartbeat is strong, deep and long... The second one is clear, high and short duration... Third and fourth heartbeat sounds are physiological sounds that cannot be heard by the human ear, but they can be recorded with special instruments (phonocardiography). These sounds, which have no practical value, are called third and fourth heart sounds. The third heart sound comes after the second sound and can sometimes be heard by ear in young people between 10 and 20 years of age. Since the frequency of the fourth heart sound is very low, it cannot be heard by the human ear, but it can be detected by special instruments" (Emre M. and Bahri,10 -11. Retrieved 2022). Even if it is not heard or felt, there are tens/hundreds of mechanisms that produce movement and sound at the micro-level in the human body.

For this reason, this study benefited from the games that children set up as they explore the world and their imitation of the sounds and movements they observe in life, which have been experienced by almost all people around the world regardless of their geographical location. Of the endless possible games that a child can set up, let's examine the games that have the elements of imitation only with bodily movement and sound. For example, when we think of a child who wants to be an airplane and imitates the airplane in his game, this child will run quickly by opening his arms to both sides, making the sound "woo..." or whatever sound his auditory reflection is. The child in the example both imitates and takes the form of bodily movement and voice. This child wants to behave like an airplane, and he turns into an airplane in his own reflection, limits and expression. As another example, let's consider a child pretending to be on a motorcycle. He can place his hands on the two invisible handlebars, and perhaps swaying left and right, producing "Rrrrrr" sound. Furthermore, there will be endless possibilities of sounds for individuals speaking different languages. This will be seen as their own original choice of reflection. Although these imitations show similarities when applied by different people, they will certainly produce unique results for each individual.

The Movement and Voice Plastics Method that is proposed in this study states that an individual can engage in a new behavior by using his unique maturity, development and limitations in various aspects, in short, his own natural capacity. This study claims to create and shape a new potential plastic field that the individual will reveal through imagination or direct simultaneous observation, and thus providing behavioral change. For this reason, it is also important to understand the medical meanings of the terms plastic, plasty and plasticity [2].

In this method, there is no need to practice or know any special advanced technique for dancing, movement, voice training or singing. This method will also provide support for art students and art professionals to foster advanced studies.

One of the standpoints of this method is "shaping", and the other one is "imitation". A child produces imitation games by using the reflections of nature or matter in his own mental design, world, and experiences.

[2] **Plastic** (medical); 1. Tending to build up tissues or to restore a lost part.; 2. Capable of being formed or molded; 3. Substance formed by chemical condensation or polymerization. **Plasty** (medical); Plastic repair of an organ or part of the body. **Plasticity** (medical); the capability of being formed or molded; the quality of being plastic.

Researchers in the field of dance movement therapy have studied the effects of movement mechanisms on humans. In a meta-analysis study by Koch et al. "Results suggest that dance and movement therapy and dance are effective for increasing quality of life and decreasing clinical symptoms such as depression and anxiety. Positive effects were also found on the increase of subjective well-being, positive mood, affect, and body image" (Koch, Kunz, Lykou, Cruz 2014).

"The seven main characteristics of movement are set out in Table 1." (Penfield)

Table 1. Characteristics of movement

Clarification
Direct access to unconscious
Kinaesthetic memory
Simultaneity
Transmutation
Cathersis
Integration

On the other hand, in the applications of music therapy and voice-vokal therapy, which are two separate genres, there is an active use of human voice and voice-making mechanisms. For example, singing in music therapy practices. "The World Federation of Music Therapy (WFMT) defines music therapy in the following way: *Music therapy is the use of music and/or musical elements (sound, rhythm, melody and harmony) by a qualified music therapist, with a client or group, in a process designed to facilitate and promote communication, relationships, learning, mobilization, expression, organization, and other relevant therapeutic objectives, in order to meet physical, emotional, mental, social and cognitive needs. Music therapy aims to develop potentials and/or restore functions of the individual so that he or she can achieve better intra- and interpersonal integration and consequently a better quality of life through prevention, rehabilitation or treatment. (1997: 1)"* (Darnley-Smith and Patey, 2003). Therefore, the method proposed in this study has the potential to provide these benefits if applied with a qualified therapist.

School-age children and young people, individuals studying in different fields of art, and even university students studying in many different fields of science can have fun in a workshop where this method is applied, and who knows, they can even empathize with atomic particles by trying to behave like machines and cells in their field of work.

- Can the benefits be increased if these activities are deliberately maintained with a method and technique for a certain period of time?
- Can a taxonomic concept and system named *Movement and Voice Plastics* be developed as a sequential method?
- Can this system be used for almost all age groups in education, arts, and health (therapeutically), art therapy?

In this study, the application of this method and its taxonomy will be explained. With this feature, this study is unique in terms of not being studied before. As a research method, a literature review was used.

Dynamics of this method study

There are two basic elements in structuring this method. One of them is plastic and the other is imitation.

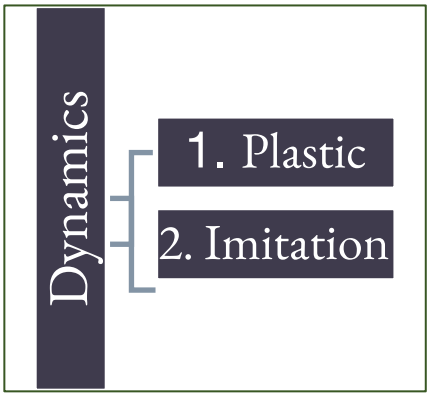

Figure 1. Dyn
amics of this method study

Plastic

Plastic body studies, dance, and movement are taught in actor training and all fields of performing arts. Plastic body and similar posture studies are given to those who are trained in performing arts, such as dancers, opera singers, and actors, in conservatories and academies that provide art education.

> "Çukurova University State Conservatory, Information Package/Course Catalog, Opera and Singing Department (introductory page) Profile of the Programme: Recognition of audio material and ***the plastic body*** in order to sing Opera works; accurate, efficient, and healthy use of audio-breath coordination; the use of breath-control techniques." (Accessed March 27, 2022).

In the literature, there are studies involving plastic works related to the body and movement. Comprehensive literature reviews have shown that, unfortunately, a plastic study in the field of voice has not been performed yet. Even if it has been performed, it has not been conducted in a formal framework, and the voice plastics concept has not been encountered in the literature. The most well-known and important work in the field of body and movement is undoubtedly the Stanislavsky method, which includes emotional and plastic studies based on imaginations in stage action. "At the beginning of the twentieth century, the Russian theater director Konstantin Sergeievich Stanislavsky developed the first complete system of education for the acting in Russia. The exercises in the Stanislavsky system continue to be taught today and are known internationally as acting fundamentals. While performing, it naturally occurs for the actor to become aware of his emotions, inner spirit, and physical agility. Stanislavsky spent twenty years developing plastica associated with psycho-physical exercises aimed at developing the soul and body aspect of plastica" (Hapgood 1924, 57). This system, which aims to develop the boundaries and technique of the individual by feeding on nature, his own life, and experience, is one of the basic applications in performing arts education today.

The term plastic and its works were also used by 20th-century performance artist, educator, and art theorist Joseph Beuys. He introduced the concept of Social Plastic, which is also commonly referred to as Social Sculpture. He aimed to give an aesthetic shape to the entire structure and social life. "Beuys developed the 'Plastische Theory', allowing the concept of plastic to spread widely, and for him even thought would count as plastic. In the early 1970s, Beuys began to call the most advanced example of this plastic principle the combination of a work of art beyond its fetishistic display value and social organization marked by artistic procedures and potentials." (Wedemeyer 2017:178).

Imitation

Although it has not been expressed as voice plastics before, various theories have been put forward on imitating the sounds of nature, experiences, and objects/matter, one of which is the Onomatopoeia. Professor Dr. Mustafa Özkan says the following about this theory in his lecture notes at Istanbul University: "According to this theory, which emerged at the beginning of the XXth century, the main factor in the formation of human language is sound imitation. Human beings have created language by imitating the natural events around them, the sounds of animals and all things that make noise. For example, the cries of animals, their roars, thunder, the crackling of branches, water gurgling, the buzzing of bees, etc. Words are formed by imitating sounds like: pop, crack, bark, meow, mumble, squeak, buzz, and baa. Many of the other elements in the lexicon of the language have likewise emerged from the imitation of certain sounds: clattering, groaning, snoring, grunting, rumbling, tinkling, etc." (Özkan M. Istanbul University Faculty of Open and Distance Education Lecture Notes).

According to Aristotle, who introduced the concept of "mimesis", that is, imitation, in his much older work, Poetics; "...Some arts imitate through sound; according to this, in all the arts mentioned, imitation, in general, is carried out either through rhythm, word or harmony. These three are used either separately or together. For example, panpipe (syrinx) instruments, such as flute and kitara, use only harmony and rhythm. The art of dance uses rhythm alone without harmony because dancers imitate character traits, passions, and movements through rhythmic body movements." (Aristotle, 4th century BC). From this citation, it is possible to understand that the sounds emanating from instruments in vocal art are imitations of various components of life. In the same way, when we envisage that the human voice comes

from an instrument in the human body, it is possible to benefit from its existence, whether it is for the purpose of making art or not.

The mechanism of voice formation in humans, which is a complex structure, is the result of many multi-directional simultaneous processes and operations. "The formation of voice and speech is a complex function in which central neural regulatory mechanisms, pulmonary and laryngeal functions, resonance and articulation functions occur together in humans." (Geker et al. 2000). In daily life, people use their voices in a limited way without any special effort. The larynx structure shaped through language learning and the musculature that supports/provides the vocalization mechanisms show limited development when not exposed to improvisation, discovery and use with different, special forms or techniques. "The sounds of language are studied by a discipline called phonology. Humans have the ability to make a variety of sounds. However, no language uses all of these sounds. People learn the sounds of the language of the environment in which they were born and use them perfectly. For this reason, the sounds of languages learned later cannot be voiced like native speakers of that language." (Aydin S. 2011, 228).

Language is the most important voice-producing and communication tool of humans. "Language development, which is an element that surrounds people's life to a large extent, is possible by having a high level and complex vocalization" (Denizoğlu, 2020). However, even in the use of language, which is one of the most common actions in human life, speaking a language allows only a part of the sound-making capacity of a person to be used. Thus, it is possible to say that over time, people cannot benefit from the secondary gains that vocalization can provide. These gains can be expressed as follows: neurobiological effects, being open to learning, providing sensory integration, emotional development, well-being, etc. However, scientific studies of plastic studies that have been researched in voice therapy and that also affect neurocognition capacity are still limited today. "...the role of cognitive mechanisms critical to voice therapy has yet to be explored." (Feinstein et al. 2021). It is clear that there is a need to investigate these mechanisms that mutually affect each other.

It should not be forgotten that the functions of the sense of hearing are active. "Auditory stimulus .... are acoustic waves or sound waves. ...a mechanical vibration creates a current generating potential in some of the inner ear hair cells. ...The current goes along these fibers to the brain." (Morgan, 1981). "Sound is a mechanical wave. It needs a vibrating source and a 'environment' in which it can move forward. Moreover, a hearing ear is necessary for sound to exist. Therefore, hearing is an indispensable condition (sine qua non) for the existence of sound. It does not exist without the source, the environment, and any of the perceiving ear." (Denizoğlu, 2020).

Of course, the presence of sound alone is not enough. In an environment where all these elements exist, if we do not focus on 'listening' and an 'awareness' dimension of these sounds in the environment where we live, wouldn't we be succumbing to the unconscious recording system of a mechanism that performs purely sensory functions? Directing our attention to what is going on around us will necessarily go beyond the blurry sounds and images stored in our minds. At this point, the studies to imitate the external and environmental sounds and movements to be made with the *Movement And Voice Plastics Method* will provide the sounds and movements of the environment, nature, experiences, matter, and materials; that is, it will open the way of observation and empathy regarding the general behavior of all these external and environmental elements and will not only improve communication skills with the external environment but also provide neurobiological gains.

Method

Movement and Voice Plastics Method and Its Application

The application of the *Movement and Voice Plastics Method* proposed in this study has three stages. However, there are infinite number of ways and sequences of operation that can vary and be modified depending on the creativity of the practitioners. Studies can also be carried out for different phased processes.

The three stages proposed in this study are, respectively, as follows:

- Introduction: Warm-up
- Body: Plastic Work
- Conclusion: Completion

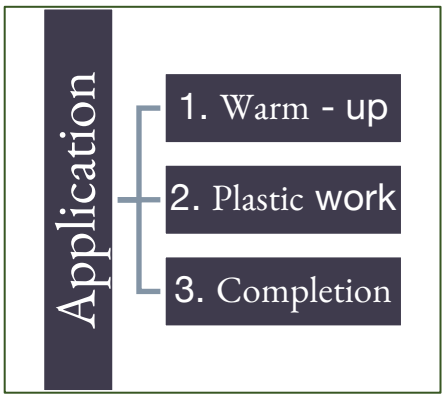

Figure 2. The application of the Movement and Voice Plastics Method

Warm-up Stage:

The first of these phases is the Warm-up stage. Based on my totally 4-years psychiatric clinic experience acquired through Art Psychotherapy supervision and education in Istanbul University, Istanbul Faculty of Medicine, during the Warm-up Stage the group or individual is pulled into state of "here and now". This Warm-up phase along with the pulling into the state of "here and now" can also be seen in therapeutic art practices. For this reason, the trainer or therapist running the workshop should use easy vocal warm-ups together with a physical warm-up that can consist of endless possibilities, including easy, daily movements and sounds that do not require a special technique.

As an example, the instruction of "Let's open our arms to both sides and support this movement with a voice" can be used. This will be a sound made by anyone in the group. Let's take the -u- sound as an example. While the group members open their arms to both sides, they will simultaneously experience the sound of this movement by making the "neeaoow" sound given as an example above. During this warm-up phase, movements and sounds will be mirrored by all members. The mirroring method will not only provide the opportunity to imitate the person or persons producing this movement and voice by taking the initiative in the group, but also will result in the simultaneous observation process of all group members seeing each other through its repetition. Thus, after a few different movements and vocal warm-ups, you can be ready for the main exercise.

The participation of the person who manages the group, educator or therapist, as a participant in these warm-up activities will often contribute to positive results and especially to group cohesion. The way to use special techniques and methods is possible depending on the level of the group. When this work is presented to the experience of art students in a conservatory, the group will automatically be at a higher level as they will reveal the work within their own bodily limits.

Plastic Work

This is the main work, and it should be given at least two or three times as much time as the warm-up. In this stage, a main title is chosen from the *Taxonomy of Movement and Voice Plastics*, which have been worked on for over ten years. For example, let's look at the title *1.1.Nature Plastics* under the *1. Concrete terms* category. Under this title, there is a category of *1.1.1. Natural Events*. This will form the general framework of the main study. Let's consider *1.1.1.1. Non-catastrophic Natural Events* among natural events. After the interaction of the group with a question in the form of "What are the non-catastrophic natural events?", let's go through a process of discovery under this category to form the plastic by giving *1.1.1.1.3. Rain* as an instruction. "How does it rain?, how are the movements of the droplets during the precipitation or how are the reactions and movements of the people when they touch raindrops? and what are the sounds that can be heard in the rain?" Out of all these multiple possibilities, a few plastics about "rain" will be made and mirrored by the group. Thus, mirror neurons will also be activated.

"Since its discovery, these neurons have been associated with many complex functions such as recognition, interpretation, imitation of actions, empathy, learning, and memory. This suggests that the mirror neuron system forms a kind of link between cognition and action." (Hari et al. 2021). "...mirror neurons in humans are activated even when observing meaningless movements. Observing meaningful actions causes activation of the frontal and temporal areas of the mirror neuron system (MNS), while observing meaningless actions causes only the frontal areas to be activated."

(Mehta, Bgandari 2016). "It has been suggested that the human mirror neuron system's sensitivity to meaningless actions may play a significant role in determining people's ability to imitate others' actions." (Hari et al. 2021).

"Many previous and new studies in the literature suggest that mirror neurons play a role in social functions such as learning, communication, empathy, imitation, and in understanding the physical components of other individuals' movements, the goal, intention, and emotional processes behind them. All of these functions are categorized under a general title called "action comprehension", and it is reported that they play a role in this main function in most of the studies." (Galese et al. 1996).

There is a convergence between cognitive models of imitation, works on imitation and empathy derived from social psychology studies, and recent empirical findings from the neurosciences. ...Social psychology studies have shown that imitation is common, automatic, and facilitates empathy. Neuroscience research has demonstrated physiological projection mechanisms at the single-cell and nervous system levels that support cognitive and social psychology forms." (Iacoboni, 2008). It is clear that the gains linked to the increase in brain activation with the activation of mirror neurons in plastic studies are also a subject of research.

For this reason, in order to ensure that the plastic application with the theme of "rain" given above covers a specific process, transforming it into a meaningful whole and ensuring the continuation of the activation of human complex mechanisms, plastic studies continue by adding other titles with similar themes from the *Movement and Voice Plastics Taxonomy* list below. Crossovers and various combinations can also be performed in the taxonomy list, e.g. 'the plastics of a daisy in the rain'. In the ongoing study, the movement and voice flow depends on the creation of a sequence or chain by adding these plastic motifs to each other. This sequence is arranged consecutively, and a structure similar to choreography or music is obtained from this sequence. Completely different options will arise from each individual in the group, and the use of movement and voice will change for each figure. As a result, both different plastic samples created with the same directive and plastic motifs created with different options will be connected to each other, and they will be able to create a combination. The study can be continued to obtain a new combination or sentence under a completely new title depending on the target length, the number of people, and the time allotted to the workshop.

Completion Stage

At this stage, the definitions of plastic studies are carried out. "How do we define this simultaneous observation or mental design/imagination/dream that we are making as a plastic study of kinesthetic-vocal imitation that is expressed to be embodied in the body and human voice?" This is the first phase.

The second phase is to share how it feels and emotions in the study. A common feeling can also be selected from a few alternatives put forward in a crowded group. This sharing corresponds to the answer to this question: "How did we feel doing this study?". What we aim to do here is to explore emotions while concluding the work and thus provide closure by creating awareness.

Conclusion

As a result, scientific studies on the simultaneous use of movement and voice as a supportive, developing, and curative method for various age groups are extremely rare. An implementation proposal of Movement and Voice Plastics that can be used in the field of art, education, and health (therapeutically) as a method was presented in this study. When this method is applied, it will be the beginning of a mental, emotional and physical change. It will enable the transition from any state of perception to the state of observing. The study of embodying the world, nature, human, object, emotion, music, painting or every observable and felt element of life in their bodies as motion and sound, which people perceive with an approach that they aim to imitate by observing on anything, is a subject open to research.

The act of imitation is one of the natural characteristics of humans. As a result of complex human nature, which allows the perception of human beings' experiences and elements of nature through the senses, it has been possible to collect the possible studies of these phenomenological, kinesthetic, and vocal plastic discoveries under various headings, which allow them to be embodied through movement and sound by observing and experiencing. From this point of view, the Taxonomy of Movement and Voice Plastics was obtained.

Table 2. Taxonomy of movement and voice plastics

1. Concrete Terms In this category, actions and events that are not intangible, perceptible, and observable through the senses are listed. **1.1. Nature Plastics** 1.1.1. Natural Events 1.1.1.1. Non-catastrophic Natural Events 1.1.1.1.1. Tide 1.1.1.1.2. Wind 1.1.1.1.2.1. Breeze 1.1.1.1.2.2. Strong Wind 1.1.1.1.3 Rain 1.1.1.1.3.1. Downpour 1.1.1.1.3.2. Drizzle 1.1.1.1.3.3. Light Rain 1.1.1.1.4 Aurora 1.1.1.1.5. Snowfall 1.1.1.1.5.1. Blizzard 1.1.1.1.5.2. Large Snowflakes	1.1.1.2 Catastrophic Natural Events 1.1.1.2.1. Disasters 1.1.1.2.1.1. Earthquake 1.1.1.2.1.2. Flood 1.1.1.2.1.3. Tsunami 1.1.1.2.1.4. Storm, Hurricane 1.1.1.2.1.5. Landslide 1.1.1.2.1.6. Avalanche 1.1.1.2.1.7. Lava 1.1.1.3. Seasonal Events 1.1.1.3.1 Fall 1.1.1.3.1.1. Falling Leaves 1.1.1.3.2. Winter 1.1.1.3.2.1. Frost 1.1.1.3.3. Spring 1.1.1.3.3.1. Blooming 1.1.1.3.4. Spring 1.1.1.4. Nature and Wildlife Patterns	1.1.1.4.1. Hunting 1.1.1.4.2. Sheltering 1.1.1.4.3. Fighting 1.1.1.4.4. Escaping 1.1.2. Plant Plastics 1.1.2.1. Trees: Includes all tree species. 1.1.2.1.1 Things Growing on Trees 1.1.2.1.1.1. Fruits 1.1.2.1.1.2. Seeds 1.1.2.1.1.3. Nuts 1.1.2.2. Bushes 1.1.2.2.1. Ground Cover Plants 1.1.2.2.1.1. Vegetables 1.1.2.2.2. Thorny Bushes 1.1.2.3. Herbs 1.1.2.4. Flowers 1.1.2.4.1. Flowering Trees	1.1.2.4.2. Blossom Flowers on Ground 1.1.2.4.3. Tropical Flowers 1.1.3. Animal Plastics 1.1.3.1. Wild Animals 1.1.3.2. Pets 1.1.3.3. Herd Animals 1.1.3.4. Land Animals 1.1.3.4.1. Primates 1.1.3.4.2. Reptiles 1.1.3.4.3. Flying Animals 1.1.3.4.4. Insects 1.1.3.5. Water Animals 1.1.3.5.1. Swimming Animals 1.1.3.5.1.1. Fish 1.1.3.5.1.2. Crustaceans 1.1.3.6.2. Non-swimming Aquatic Creatures 1.1.3.6.2.1 Sponges 1.1.3.6.2.2. Seaweed
1.2. Plastics of Historical and Social Periods This practice is a projection of collective human experiences and common lifestyles. 1.2.1. Past 1.2.1.1. Ages 1.2.1.1.1. Prehistoric Ages (Prehistory) 1.2.1.1.1.1. Stone Age 1.2.1.1.1.1.1. Old Stone Age (Paleolithic) 1.2.1.1.1.1.2. Middle Stone Age (Mesolithic) 1.2.1.1.1.1.3. New Stone Age (Neolithic) 1.2.1.1.2. Metal Age 1.2.1.1.2.1. Copper Age (Chalcolithic)	1.2.1.1.2.2. Bronze Age 1.2.1.1.2.3. Iron Age 1.2.1.1.2. Ages of History (History) 1.2.1.1.2.1. Ancient History 1.2.1.1.2.2. Middle Ages 1.2.1.1.2.3. Modern Age 1.2.1.1.2.4. Contemporary Age 1.2.2. Current Period 1.2.2.1. Ethnic Plastics 1.2.2.2. Global Plastics 1.2.3. Future Period: Some elements in this category could be examined under the title of "abstract" in terms of containing imaginary products. However, the realization and usability of these imaginary elements will be concretized at a later date. Therefore, these terms are in the “concrete” category.	1.2.3.1. Innovative Designs Plastics: It is an advanced imagination study fueled by imagination. We can benefit from projects that are not yet widely used but are planned to be conducted or spread. If the preferred material is a tool that people can touch and use, a plastic study of the behavior of a person using it can be performed. 1.2.3.2. Digital Age 1.2.3.3. Space Age 1.2.3.4. Robotic Age 1.2.3.4. Futuristic Thinking Plastics 1.2.4. Sociological Periods: It covers plastic studies related to production forms, production tools, and labor power.	1.2.4.2. Agrarian Society 1.2.4.2.1. Feudal Society 1.2.4.2.1.1. Serfs (Peasant) Class 1.2.4.2.1.2. Clergy 1.2.4.2.1.3. Nobility 1.2.4.3. Industrial Society 1.2.4.3.1. Working Class 1.2.4.3.2. Bourgeoisie (Bosses) 1.2.4.3.3. Aristocracy 1.2.4.4. Information Society 1.2.4.4.1. Blue-Collar 1.2.4.4.2. Gray-Collar 1.2.4.4.3. White-Collar 1.2.4.4.4. Pink-Collar 1.2.4.4.5. Gold-Collar
1.3. Everyday Life Plastics 1.3.1. Home Lives 1.3.1.1. In the Kitchen 1.3.1.2. In the bedroom 1.3.1.3. In the living room 1.3.1.4. In the Bathroom 1.3.1.5. On the balcony-terrace 1.3.2. School Life 1.3.2.1. Kindergarten 1.3.2.2. Primary School 1.3.2.3. Secondary School 1.3.2.4. High School 1.3.2.5. University 1.3.3. Work life 1.3.3.1. In the Office 1.3.3.2. In the Field 1.3.3.3. Occupations Plastics: Covers all occupational groups. 1.3.4. Unexpected Events 1.3.4.1. Accidents 1.3.4.1.1. Simple Accidents 1.3.4.1.1.1. Home Accidents 1.3.4.1.1.2. Work Accidents 1.3.4.1.1.3. School Accidents	1.3.4.1.2. Severe Accidents 1.3.4.1.2.1. Traffic Accidents 1.3.4.2. Chance Events 1.3.4.2.1. Good Luck 1.3.4.2.2. Bad Luck 1.3.5. Motor Activities 1.3.5.1. Basic Activities: A few of the basic activities are listed below. 1.3.5.1.1. Walking 1.3.5.1.1.1. Slow Walking 1.3.5.1.1.2. Fast Walking 1.3.5.1.2. Leaping 1.3.5.1.3. Hopping 1.3.5.1.4. Running 1.3.5.1.5. Jumping 1.3.5.1.6. Hitting 1.3.6. Equipment Plastics 1.3.6.1. Household Tools 1.3.6.2. School Equipment 1.3.6.3. Workplace Tools 1.3.6.3.1. Professions and Their Tools 1.2.6.4. Technological Tools 1.3.7. Cities Plastics 1.3.7.1. Metropolitan Cities	1.3.7.2. Midsize Cities 1.3.7.3. Small Cities 1.3.7.4. Rural-Pastoral Plastics 1.3.7.5. Suburban Life 1.3.7.6. Villages 1.3.8 Relationships and Roles Plastics in Social Life: This title refers to the imitation of the movements and sounds of attitudes arising from human social relations in the social environment and in various places. 1.3.8.1. Family: It refers to the imitations of movements and sounds that are observed or possible to be observed in social patterns and relationships in the family. 1.3.8.1.1. Child 1.3.8.1.1.1. Older Sister 1.3.8.1.1.2. Older Brother 1.3.8.1.1.3. Middle Borns 1.3.8.1.1.4. Last Borns 1.3.8.1.1.5. Only Child 1.3.8.1.2 Mother 1.3.8.1.3. Father	1.3.8.1.4. Grandmother 1.3.8.1.5. Grandfather 1.3.8.1.6. Cousins 1.3.8.1.7. Uncle 1.3.8.1.8. Aunt 1.3.8.2. Friends 1.3.8.2.1. Male 1.3.8.2.2. Female 1.3.8.3. Unfamiliar People 1.3.8.3.1. People We Met by Coincidence 1.3.8.3.2. People We Try to Connect with 1.3.8.3.3. People Trying to Connect with us 1.3.8.3.4. People We Contacted by Mistake

1.4. Developmental-Universal Plastics 1.4.1. Infancy 1.4.1.1. Newborn	1.4.2. Childhood 1.4.3. Puberty 1.4.3.1. Early Puberty	1.4.3.2. Middle Stage of Puberty 1.4.3.3. Late Puberty 1.4.4. Adulthood	1.4.5. Old Age 1.4.4.1. Young Adulthood 1.4.4.2. Middle Adulthood 1.4.4.3. Late Adulthood
1.5. Sensory Plastics In these plastic works, visible changes that the body perceives during the perception processes through the sense organs will be imitated. For example, the stages of squinting or opening the eyes, leaning the body forward or backward while looking, and creating a posture suitable for this action mean imitating while listening to the sounds coming from the body during this action, albeit at very low frequencies. The creature is accompanied by the sound of its breath even in the quietest possible action. Moreover, we hear many times the sound of the movement of the eyes in their sockets. 1.5.1. Vision 1.5.1.1. Things Hard to See 1.5.1.1.1. In Terms of Dimensions	1.5.1.1.1.1. Small Objects 1.5.1.1.1.1.1. Letters and Characters 1.5.1.1.1.2. Big Objects 1.5.1.1.1.2.1. Extremely Big Objects 1.5.1.1.2. In terms of Near-Far Objects 1.5.1.1.2.1. Seeing Nearby Objects 1.5.1.1.2.1.1 Seeing Nearby Objects 1.5.1.1.2.1. Seeing Far Objects Plastics 1.5.1.1.2.1.1. Seeing Extremely Far Objects 1.5.1.1.3. Blurred Vision 1.5.1.2. Those Seeing Clearly 1.5.1.2.1. Plastics of Seeing Clearly: while the eyes look at what can be seen clearly, it refers to taking the form and shape that posture and the body. 1.5.1.3. Vision in Motion	1.5.1.3.1. Vision in Slow Motion 1.5.1.3.1.1. In Linear Plane 1.5.1.3.1.2. In the Circular Plane 1.5.1.3.1.3. In Free Plane 1.5.1.3.1.4. While Turning Around 1.5.1.3.2. Vision While Moving at Medium Speed: Motion planes also apply here. 1.5.1.3.3. Vision While Moving at High Speed: Motion planes also apply here. 1.5.2 Hearing 1.5.2.1. Hearing in Terms of Frequencies 1.5.2.1.1. Hearing Low Frequency Sounds Plastics 1.5.2.1.2. Hearing High Frequency Sounds Plastics 1.5.2.2. In Terms of Distance 1.5.2.2.1. Distant sounds 1.5.2.2.2. Nearby Sounds 1.5.2.3. Sounds Easy to Hear	1.5.2.4. Sounds Difficult to Hear 1.5.3. Smell 1.5.3.1. Good Smells 1.5.3.2. Bad Smells 1.5.4. Taste 1.5.4.1. Tasting Sweet Plastics 1.5.4.1.1. Little Sweet 1.5.4.1.2. Extremely Sweet 1.5.4.2. Tasting Salty Plastics 1.5.4.2.1. Little Salty 1.5.4.2.2. Extremely Salty 1.5.4.3. Tasting Sour Plastics 1.5.4.3.1. Little Sour 1.5.4.3.2. Extremely Sour 1.5.5. Touch 1.5.5.1. Plastics of Touching Hard Objects 1.5.5.2. Plastics of Touching Soft Objects 1.5.5.3. Touching the Slippery Objects 1.5.5.4. Touching Liquids
2. Abstract Terms Express the concepts that cannot be seen with the eyes and cannot be perceived by the sense organs. **2.1. Emotions Plastics:** When all living things feel these emotions, their external reflections on their bodies can be imitated. On the other hand, it is possible to take shape by abstracting any emotion. Movement and sound in the reflections of the emotion of the individual will be used. 2.1.1. Positive Emotions 2.1.1.1. Hopes 2.1.1.2. Wishes 2.1.1.3. Pleasures 2.1.2. Negative Emotions 2.1.2.1. Fears 2.1.2.2. Frustrations 2.1.2.3. Difficulties 2.1.2.3.1. Economic Difficulties 2.1.2.3.2. Academic Difficulties 2.1.2.3.3. Social Difficulties 2.1.2.3.4. Physical Labor 2.1.2.3.5. Emotional Labor 2.1.2.4. Losses and Mourning 2.1.2.4.1 Deprivation **2.2. Free Plastics** 2.2.1. Improvisation 2.2.1.1a. Movement Improvisation 2.2.1.1a.1. Improvisation According to the Size of the Movement	2.2.1.1a.1.1. Small Movements-Fine Psychomotor Skills 2.2.1.1a.1.2. Basic Movements-Basic Psychomotor Skills 2.2.1.1a.2. Movements According to Body Part and Plane 2.2.1.1a.2.1. Upper Extremity 2.2.1.1a.2.1.1. Improvisation for Head Region 2.2.1.1a.2.1.2. Improvisation for Shoulders and Arms 2.2.1.1a.2.1.3. Hands 2.2.1.1a.2.2. Lower Extremity 2.2.1.1a.2.2.1. Legs 2.2.1.1a.2.2.2. Improvisation Using Feet 2.2.1.1a.2.3. Whole Body 2.2.1.1a.2.3.1. Lateral Improvisation 2.2.1.1a.2.3.2. Sagittal Improvisation In this section, there will be categories arranged as staccato and legato, crescendo and decrescendo, short and long duration, which are listed under the heading "Sound Improvisation" below. There will also be common items for the improvisation section in the movement. These features can also be used in the movement. 2.2.1.1b. Vocal Improvisation 2.2.1.1b.1. In terms of the field of Register-Sound 2.2.1.1b.1.1. Improvisation with Low Voices 2.2.1.1b.1.2. Improvisation with Medium Voice	2.2.1.1b.1.3. Improvisation with High Voices 2.2.1.1b.1.4. Mixed-All Voice Fields 2.2.1.1b.2. In terms of Articulation 2.2.1.1b.2.1. Staccato (Short and sharp) 2.2.1.1b.2.2. Legato (Connected) 2.2.1.1b.2.3. Mixed 2.2.1.1b.3. In terms of Dynamics-Loudness 2.2.1.1b.3.1. Piano (Light-Low): Expresses a low-intensity sound. 2.2.1.1b.3.2. Forte (Strong-High): Expresses the high-intensity sound. 2.2.1.1b.3.3. Progressively Changing 2.2.1.1b.3.3.1. Crescendo Improvisation: Refers to gradually increasing the volume. 2.2.1.1b.3.3.2 Decrescendo Improvisation: Refers to gradually decreasing the volume. 2.2.1.1b.3.4. Mixed: It may contain some or all properties of dynamics. 2.2.1.1b.4. Improvisation in terms of Duration 2.2.1.1b.4.1. Improvisation with Short Duration Sounds 2.2.1.1b.4.2 Improvisation with Long Duration Sounds	2.2.1.1b.4.3. Mixed: Improvisation resulting from the use of long and short duration sounds together. **2.3. Plastics of Associations** 2.3.1. Free Association 2.3.1. Associations with Instructions: It includes plastic studies on the association formed by a given instruction or word. 2.3.1.1. Associations of Colors 2.3.1.2. Associations of Concrete Elements 2.3.1.3. Associations of Abstract Elements **3. Special Plastics** 3.1. Face Plastics 3.1.1. Mimics: A few of the mimics have been selected and listed. 3.1.1.1. Joy 3.1.1.2. Sorrow 3.1.1.3. Astonishment 3.1.1.4. Fear 3.1.1.5. Anger 3.1.1.6. Compassion 3.1.2. Improvisation 3.1.2.1. Improvisation with Eyes 3.1.2.2. Improvisation with Mouth 3.1.2.3. Improvisation Using the Whole Face

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Journal for the Interdisciplinary Art and Education, 6(2), 163-173, June 2025
e-ISSN: 2717-8870
dergipark.org.tr/jiae

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Research Article

An analysis of Ayaz Gambarli's piano work titled Six Children's Pieces

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Article Info

Received: 26 April 2025
Accepted: 25 June 2025
Available online: 30 June 2025

Keywords
Ayaz Gambarli
Piano music
Six Children's Pieces
Cycle
Musical language
World of images

Abstract

The article presents an analysis of the "Six Children's Pieces" by Ayaz Gambarli, a representative of modern Azerbaijani composition. It discusses the programmatic approach used by the composer in this cycle. It is noted that the cycle is dedicated to the composer's son, Oktay. The compact form of each piece and the creation of a rich childlike imagination with small details generate great interest. The article provides information on the intriguing concept of the cycle. It also offers a detailed explanation of how the pieces, written within a tonal framework, are both contrasting and possess a cohesive overall structure. The article also mentions the names of the cycles written by Azerbaijani composers on children's themes and provides extensive information on the special role of fortepiano music in the composers' creations. The article highlights how the composer skillfully adapted the musical material to fit the characteristics of fortepiano texture and the performing capabilities of children, presenting it in an original manner. Further studies on A. Gambarli's Six Children's Pieces could explore its pedagogical applications, music education adaptability across age groups, and cultural comparisons, particularly in Azerbaijani music. Additionally, in-depth analysis of the polyphonic structures and modulation techniques could enhance understanding of contemporary children's music.

To cite this article

Babayeva, M. (2025). An analysis of Ayaz Gambarli's piano work titled Six Children's Pieces. *Journal for the Interdisciplinary Art and Education, 6*(2), 163-173. DOI: https://doi.org/10.5281/zenodo.15752815

Introduction

Piano music, which has always remained at the forefront of artistic focus, constitutes one of the principal domains in the creative pursuits of Azerbaijani composers. It is well established that the formation of piano art in Azerbaijan dates back to the late 19th century, coinciding with the establishment of the first piano classes. Within a relatively short period, the piano achieved significant progress and became an integral part of Azerbaijani musical culture (Babayeva, 2021). In general, piano music in the works of Azerbaijani composers is associated with innovative perspectives, while also bearing the influence of European musical traditions—a factor that must be particularly emphasized. The wide adoption of the piano as an instrument has also greatly stimulated the development of several musical directions. Most notably, it has fostered the emergence of original compositions and the evolution of performance art.

The present article is devoted to the analysis of Ayaz Qəmbərli's *Six Children's Pieces*, a representative example of Azerbaijani piano music written for children. As an important aspect of national musical culture, piano music composed for children holds a special place in the creative work of composers and reflects the developmental features of this genre. Since the earliest stage of Azerbaijani piano art, when it emerged as an independent field of composition, this genre has taken shape and gained significance.

Alongside the works of prominent 20th-century composers such as Asaf Zeynally, Gara Garayev, and Fikret Amirov, compositions by many contemporary Azerbaijani composers intended for children have found broad application in

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pedagogical practice. In summary, Azerbaijani composers have enriched the repertoire with numerous examples of children's piano music. This field has undergone significant development and has become one of the essential branches of national music culture. Azerbaijani composers have endeavored to create works that align with children's psychology, are rooted in a national musical language, and are characterized by clear musical imagery.

As Professor T. Seyidov, Doctor of Art Studies, notes: "By the 1950s, Azerbaijani piano literature had been enriched with numerous compositions that differed not only in content and execution methods but also in their approach to the subject. Some composers (e.g., G. Garayev, Z. Bagirov) sought to portray characteristic images in music written for children, while others (F. Amirov, A. Abbasov) adapted 'adult' genres to suit children's abilities" (Seyidov, 1992, p. 38). The composers, who constantly enriched the domains of modal-harmonic language, timbre, and rhythm, reflected a broad palette of genres in their works. The use of contrasting juxtapositions, vivid and distinct thematic development, concise melodic and rhythmic structures, and compact textures all contribute to the accessibility and clarity of musical information.

It is well understood that composers who address themes related to children must first possess a deep familiarity with their modes of thinking and imagination. Writing music for children is by no means an easy task, as children must first be able to comprehend and enjoy these works. Historically, many composers have written piano pieces for children they loved, making this connection well-known. It can be unequivocally stated that piano cycles and albums written in this context serve as genuine gifts for young beginners taking their first delicate steps in the world of music.

Programmatic titles in children's piano cycles have always generated considerable interest. These titles facilitate easier comprehension and performance of the pieces, guiding children through the world of sound. In fact, short and concise compositions help develop children's musical thinking and acquaint them with a rich world of imagery. It should be emphasized that children's piano cycles in a composer's oeuvre often have broad thematic content, encompassing topics such as games, natural phenomena, fairy tales, legends, psychological states, portraits, and more. One of the most notable aspects of such cycles is their contrastive nature. The principle of contrast is highly characteristic of the cycle genre, and many composers include pieces of varying moods and subjects, uniting them under a single narrative line. The alternation of contrasting character pieces within children's cycles enhances their appeal and variety. Most importantly, the emotional and imagistic musical world presented in these cycles must be accessible and comprehensible to children.

The systematic study of Azerbaijani children's piano music requires the examination of a wide range of sources with diverse orientations. This article reviews several significant monographs, scholarly studies, and academic articles dedicated to piano music. Professor Tarlan Seyidov, Doctor of Art Studies, has devoted a substantial portion of his academic work to researching Azerbaijani piano culture. In his 2016 work, he presents the early years of piano music in Azerbaijan enriched with compelling historical facts:

> *"Among the European-origin musical instruments, the piano captured the attention of Azerbaijani intellectuals and music enthusiasts in the late 19th and early 20th centuries, although within a relatively limited circle. Despite amateur performance practices and a restricted repertoire, home piano playing gradually expanded, drawing closer to certain standards of concert performance" (Seyidov, 2016, p. 3).*

Historical insights into the formation and development of Azerbaijani piano music can also be found in *The History of Azerbaijani Music* by E. Abbasova and S. Gasimova (Abbasova, 1992). Contributions to children's piano music are also explored in various other studies. For instance, V. Sharifova discusses Asaf Zeynally's *Children's Suite* (Sharifova, 1986), L. Karagicheva analyzes Gara Garayev's *Six Children's Pieces* (Karagicheva, 1960), and A. Taghizade examines J. Hajiyev's *Musical Pictures* in his book (Taghizade, 1979). Composer Vasif Adigezalov's collection of children's pieces is studied in I. Efendiyeva's monograph (Efendiyeva, 1999).

A review of these studies reveals that the theme of childhood has consistently occupied a prominent place in Azerbaijani piano music. This thematic focus reflects both artistic concern and pedagogical significance within the broader context of national musical culture.

Aim of the Study

The primary purpose of the present study is to examine and analyze certain features of the musical language in the newly published collection *Six Children's Pieces* by Ayaz Gambarli. In accordance with this aim, the study sets forth the following specific objectives:

- To investigate the historical development of Azerbaijani piano music in a systematic manner
- To analyze the general influence of European musical traditions on Azerbaijani national piano music
- To study piano cycles composed for children by Western and Russian composers
- To examine works on children's themes in the oeuvre of Azerbaijani composers
- To analyze the piano music of contemporary composer Ayaz Gambarli within the framework of tradition and innovation
- To conduct a comparative analysis of the composer's piano works in order to identify his individual compositional style.

Method

The study employs established methods of musicological research relevant to the subject. These include systematic analysis of the composer's output and application of comparative, structural, and theoretical approaches to the study of musical language. The article draws on scholarly works dedicated to children's piano cycles, including Aygun Abbasova's *Children's Piano Cycles in the Works of Azerbaijani Composers (1930s–1980s)* (2017), Tarlan Seyidov's *20th-Century Azerbaijani Piano Culture* (2016), E. Abbasova's *History of Azerbaijani Music*, V. Sharifova's *Azerbaijani Composers* (1986), L. Karagicheva's *Gara Garayev* (1960), and Z. Adigozalzade's *12 Miniatures by Fikrat Amirov* (1979), among others.

Findings

The Beginning of Piano Education in Azerbaijan

One of the most significant developments in this regard was the establishment of the Azerbaijan State Conservatory in 1921, initiated by Uzeyir Hajibeyli. The composition department was one of the first to be founded, and its graduates would later become prominent figures in Azerbaijani composition. These composers gave special attention to piano music, composing notable works in various genres for the instrument. Children's pieces and albums occupy a distinctive place in the creative output of Azerbaijani composers.

The Role of the Piano in World Music

The piano is a unique musical instrument with vast expressive possibilities. It can encompass a wide range of emotions and emulate the full tonal spectrum of an orchestra. Since its invention, the piano has remained a central instrument in music history. Given the extensive repertoire and the strong creative interest composers have had in it—many of whom were pianists themselves—it is often called the "king of instruments." A prime example is Ludwig van Beethoven, a leading figure of the Viennese classical school. While known for his contributions to symphonic music, he was also a virtuoso pianist who composed prolifically for the piano, even before writing his first symphony at the age of 30. Many of his musical innovations first appeared in his piano sonatas, underscoring the instrument's significance as a "creative laboratory" for composers.

Children's Piano Cycles in the Romantic Era

As noted, the piano has long served as a creative "laboratory" for composers, and this remains true today. In the 19th century, the emergence of various piano genres—particularly cycles and albums for children—became a defining feature of the instrument's literature. The birth of music specifically composed for children was one of the era's notable achievements. Among the pioneers of this genre was Robert Schumann, a leading figure of the Romantic period, whose *Album for the Young* played a key role in Western European music history and laid the groundwork for a lasting tradition. This tradition was later carried on by composers such as Georges Bizet, Edvard Grieg, Claude Debussy, Maurice Ravel, Pyotr Tchaikovsky, and many others.

Children's Piano Cycles in 20th-Century Composition

Numerous composers of the Soviet era also produced piano cycles for children. During the 1930s and 1940s, notable works include Sergei Prokofiev's *Music for Children*, Op. 65 (1935); Nikolai Myaskovsky's *Pieces for Children*, Op. 43 (1938); Dmitri Kabalevsky's *30 Children's Pieces for Piano*, Op. 27 (1937–1938); and Georgy Sviridov's *Children's Album* (1948). From the 1950s to the 1980s, prominent contributions were made by Dmitri Shostakovich (*The March of the Dolls*, 1952), Sofia Gubaidulina (*Musical Toys*, 1968), Sergey Slonimsky (*Album for Children and Youth*, 1970–1974), and Rodion Shchedrin (*Album for the Young*, 1983), among others.

Children's Piano Pieces by Azerbaijani Composers

The global interest in children's music is also reflected in the works of Azerbaijani composers, with the earliest example appearing in the 1930s in the oeuvre of A. Zeynalli. As is well known, Zeynalli holds a significant place in the history of Azerbaijani music culture as the first professionally trained composer. Despite his short life, he pioneered many firsts in Azerbaijani music and turned his attention to children's themes with his composition *Children's Suite*. This suite, consisting of six pieces, presents various character types and reflects different aspects of a child's world through a rich palette of imagery: *March of the Dolls*, *The Child and Ice*, *Play*, *Dance*, *Sheep*, and *Dispute*. "The lives of children are revealed in a playful manner through musical and domestic scenes. Each piece displays distinctive rhythmic features of a particular genre (march, folk song, or ashig performance)" (Abbasova, 2017, p. 59).

Composing for children and contributing to the pedagogical repertoire has become one of the primary objectives of Azerbaijani composers. This tradition, initiated by A. Zeynalli, continued throughout both the first and second halves of the 20th century. Among those who wrote music on children's themes are Z. Baghirov (*Puppet Show*), H. Neimatov (*Six Children's Pieces*), A. Abbasov (*Little Pieces*), G. Garayev (*Six Children's Pieces*; *Six Moderately Difficult Pieces*), F. Amirov (*Children's Pictures*; *Twelve Miniatures*), E. Nazirova (*Eight Children's Pieces*), O. Zulfuqarov (*Variations*), T. Bakhikhanov (*Five Children's Pieces*), F. Guliyeva (*Gunel's Children's Sketches*), A. Melikov (*Children's Pieces*), A. Alizade (*Children's Suite*), R. Shafag (*For Children*, *Musical Patterns*), and E. Rustamov (*Six Pieces*), among others. Thus, Azerbaijani composers have written programmatic works for children, both small-scale and large-scale.

Although we do not frequently encounter children's works in the output of 21st-century Azerbaijani composers, one remarkable exception is *Six Children's Pieces* by Ayaz Gambarly, a highly talented contemporary composer whose music has been featured in international competitions and festivals. A. Gambarly is known as a worthy successor of the renowned composer Arif Melikov. His achievements in the field of music and his representation of Azerbaijan abroad have earned him the "Youth Award" and the Presidential Prize on multiple occasions for his stage work. Gambarly is an ever-searching artist, steadily advancing toward his goals. As a young and talented representative of the contemporary era, he reflects innovations and changes brought by globalization in his works. His harmonic and melodic language is exceptionally rich. Whether in orchestral compositions, chamber-instrumental works, or solo piano pieces, Gambarly draws upon classical traditions while remaining within a modern framework. Each of his compositions reveals a strong creative spirit, effectively conveying the subject to the listener. The sound palette and timbres are employed with particular taste. "The most significant feature of the composer's technique is the synthesis of modernity and tradition. Though working within a traditional framework, Gambarly distinguishes himself through the originality of his musical, melodic, and harmonic language. He imitates no one; his style is entirely his own" (Huseynova, 2023, p. 790).

The young composer experiments with a variety of genres and forms, creating highly engaging pieces. Notably, the piano is among his favorite instruments. Since his student years, he has written several notable piano works, such as *Six Sketches* (2003), *Resonance* (2015), *September Clouds* (2015), *Vertical Distortions* (for prepared piano, 2015), *Mirage* (2018), *Melancholy* (2019), and *Rain in Riga* (2020).

Gambarly's music is profound and meaningful, never leaving the listener indifferent. He preserves the high traditions of the Azerbaijani school of composition while also demonstrating a modern sense of clarity, simplicity, and logical structure rooted in philosophical thought. In this regard, *Six Children's Pieces*, a recently composed and significant contribution to the piano repertoire, occupies a special place in Gambarly's body of work. The composer dedicated the collection to his son, Oktay Gambarly. The six pieces portray a range of emotional imagery: *Delicate Steps*, *Journey by*

Train, *Rainbow*, *In the Botanical Garden*, *Little Song*, and *Snowflakes*. Each programmatic title is vividly reflected in the music, as the composer takes full advantage of musical means to achieve imagery. Although Gambarly typically avoids overt illustration in his work, the artistic and imaginative elements in these pieces are clear and compelling.

By naming the collection *Six Children's Pieces*, the composer created a musically rich and engaging cycle for children. However, the technical demands suggest that these pieces are more suitable for students in the upper grades rather than younger beginners. Although the textures are simple and clear, the harmonic and melodic richness plays an important role in shaping the performer's artistic sensitivity.

The cycle is presented within a tonal framework, with noticeable contrasts in tempo, tonality, and imagery between the pieces. According to the composer's individual approach, pieces 1, 4, and 6 are more extended, while pieces 2 and 5 are more concise; pieces 3 and 6, written with sixteenth-note textures, contribute to a sense of unity throughout the set. Consequently, *Six Children's Pieces* demands a high level of skill and expressive capacity from the performer. It is worth noting that the composer himself premiered the work.

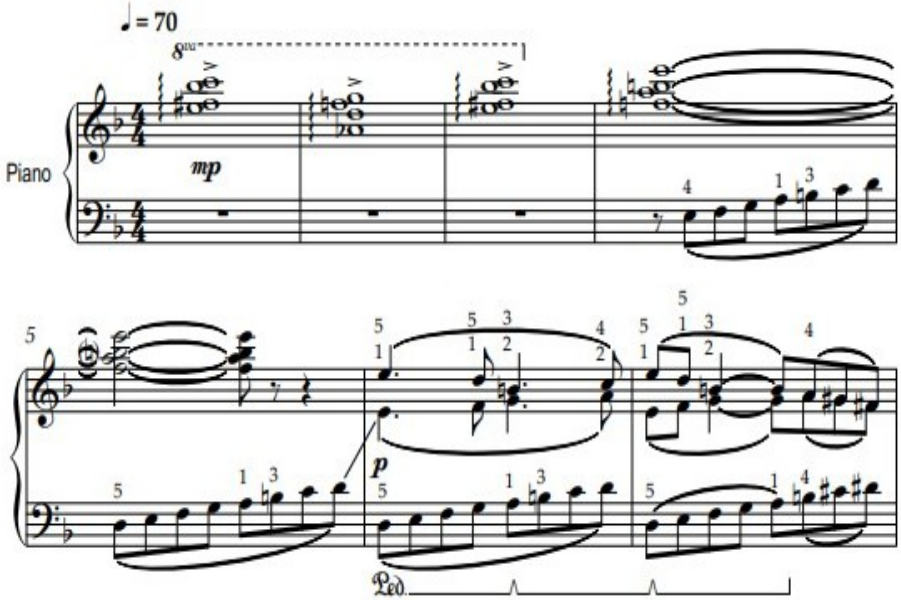
The cycle seems to depict a child's life through the richness of imagination and fantasy. Each piece captures attention through its evocative title. The series begins with *Delicate Steps* and ends with *Snowflakes*. It appears that the composer sought to portray, through his musical language, the places his young son has seen, the images he has encountered, and his reactions to natural phenomena.

Gambarly's cycle-based compositions reflect a new and original phenomenon, arising from a unique set of ideas and creative thinking. Vivid imagery, colorful nuances, and logical development all contribute to expressing the composer's ideas. As such, the analyzed cycle encompasses themes of domestic life and nature. "...The composer skillfully and delicately adapts the musical material to the characteristics of piano textures and children's performance abilities while maintaining originality. The principle of contrast that regulates the structure of the cycle introduces children to various genres of national traditional music, thereby making them easier to perform and experience directly on the piano" (Timurova, 2021, pp. 57–58).

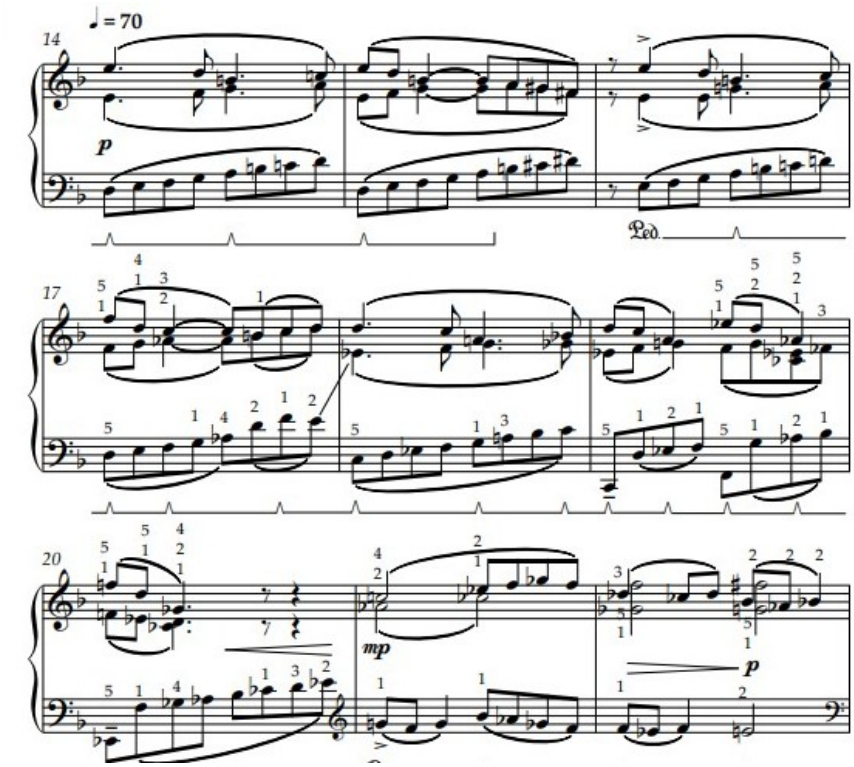
Six Children's Pieces is an engaging cycle built on the contrast between different characters. It reflects the characteristics of various genres (lullaby, lyrical piece, dance, and song). The opening piece, *Delicate Steps* (in D minor), is written in a simple ternary form. Its calm and composed nature musically portrays a baby's first steps. The title is especially thought-provoking—it seems to depict a child taking his first steps, trying to experience the world. In fact, from the moment a human being is born, they begin learning. This process typically starts in early childhood.

Through music, the composer attempts to depict the child's first steps in a calm and lyrical atmosphere. The D minor scale sequence is likened to steps, and with the effect of pauses, the child's fall and recovery are musically illustrated. The piece opens with three measures at *mezzo piano* dynamic, in the piano's upper register, using the pitch sequence E, F♯, B, and C. The dissonant harmonic combinations within the tonal framework are quite intriguing.

In this first musical number, the D minor scale ascends, symbolizing the child's small steps. Although the key signature includes B♭, the composer alters the sixth degree (B♮) to form a Dorian mode (Example 1). Additionally, Gambarly ventures beyond the tonal framework by using pitches such as G♯, F♯, A♯, E♭, D♭, and F♭ throughout the piece (Example 2). The melodic line is dynamic, energetic, and built on a sequential development principle.

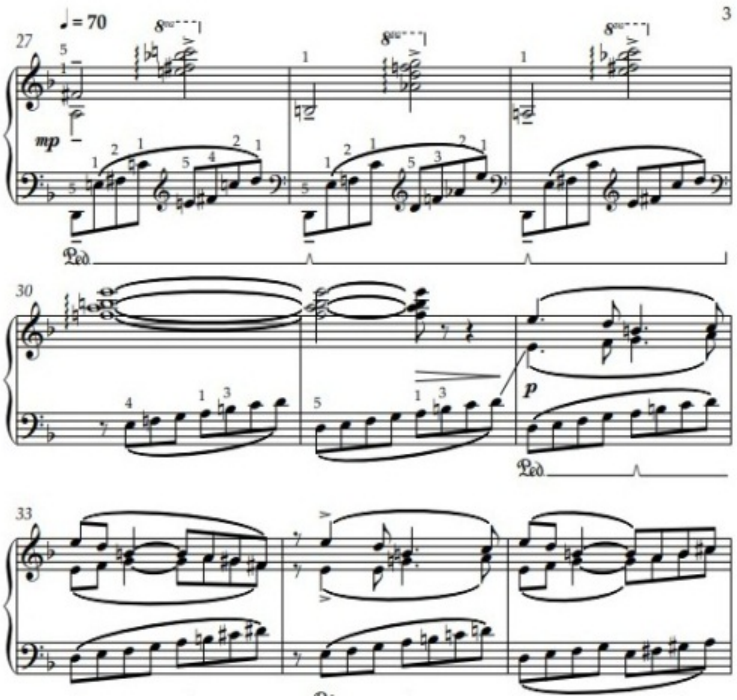


Example 1. Fragile Steps-I



Example 2. Fragile Steps-II

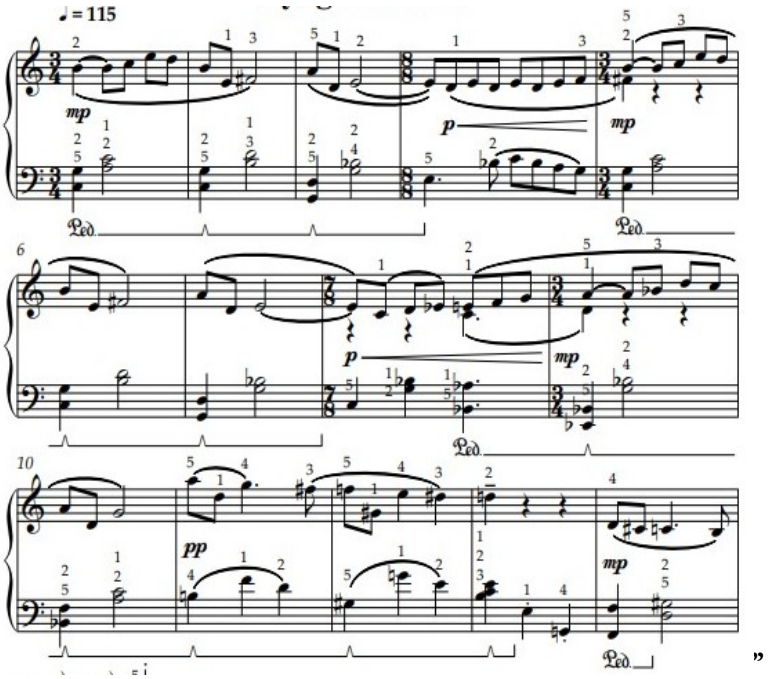
In the middle section of the piece, the composer attempts to portray the steps with more confidence and boldness. The notes previously introduced on the piano are now fully articulated, played in an arpeggio style, which further enhances the dynamics.



Example 3. Fragile Steps-III

The sincerity in the music and the play of poetic colors catch the attention. Towards the end of the piece, the tempo gradually slows down, leading to the tonic. The composer wraps up the work by repeating the initial sound, bringing the piece to a close.

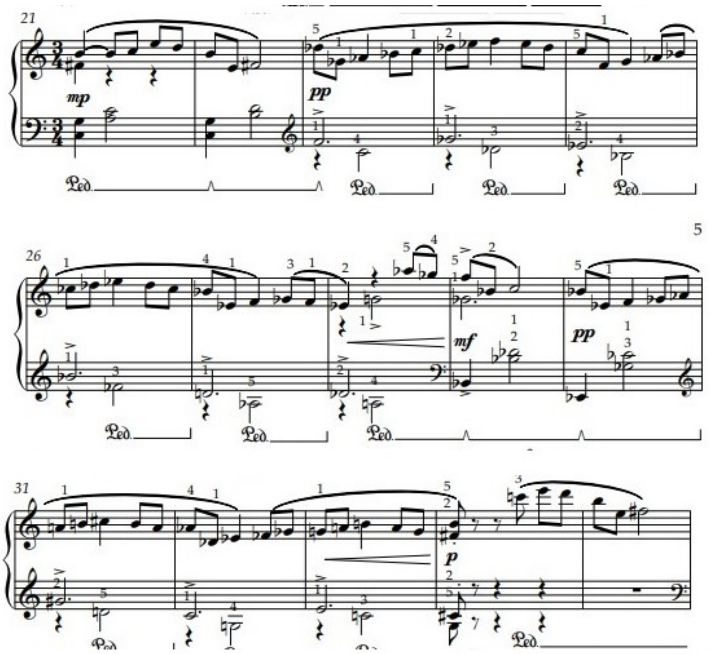
The second piece in the series is titled "Travel by Train" (C major). This delicate, lyrical piece evokes the gentle movement of a colorful train for children. After the calm, composed sound of the first piece, dance-like intonations (waltz rhythm; 3/4) are now felt. The piece is written in C major and follows a simple three-part form. One of the notable features is the piece's changing metro-rhythmic characteristics (3/4, 9/8, 7/8, 5/8). The composer employs polyrhythm to reflect the irregularity in the movement of the train. The fluctuating meter of the piece brings a striking contrast to the music of the series.



Example 4. Train Travel-I

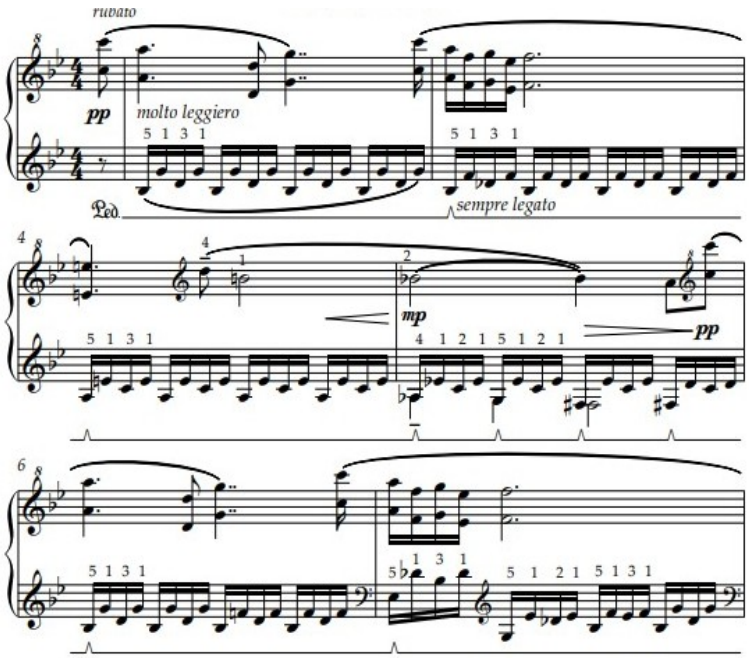
In the middle section of the piece, the composer uses pure fourths with half notes in the bass and tenor voices, followed by the consecutive use of augmented and diminished fourths in a sequential manner (Example 5). It is also

worth noting that although the composer presents the piece in the C major scale, he uses the notes "fis," "es," "gis," and "cis," and the piece concludes with the higher note "e" and the lower notes "dis," "fis," and "cis." This further confirms A. Qəmbərli's free, individual approach within the framework of tradition. Interestingly, in both analyzed pieces, the dynamic marking f is never encountered. Both pieces leave a pleasant impression with their gentle, calm sound.



Example 5. Train Travel-II

The third piece in the series is titled "Rainbow" (G minor) and is written in a simple two-part form. It is an interesting example in the series and represents a nature scene. In this piece, the composer presents one of nature's most beautiful and colorful events, utilizing all the possibilities of the piano to convey it to the listener. Throughout the composition, the accompaniment is presented with sixteenth notes. These sixteenth notes give the music a sense of movement.



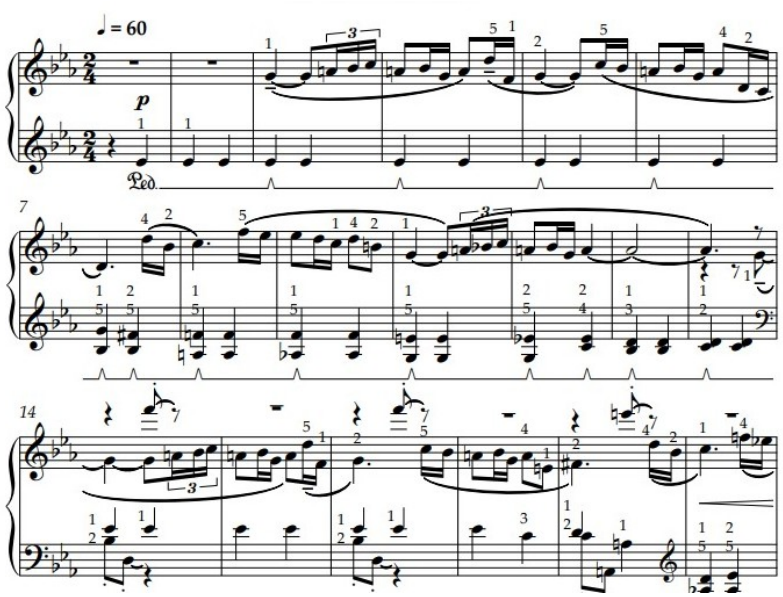
Example 6. Rainbow

In this piece, the composer uses the whole-tone scale, incorporating an enchanting, magical realm into the music. As mentioned, the programmatic title of the pieces is quite interesting. The compositions in the series, dedicated by the composer to his child, seem to reflect the most memorable landscapes in his mind. The rainbow, which appears after the

rain, eagerly awaited by everyone and magnificently displaying a palette of colors, is presented in a unique way in A. Qəmbərli's creative pen.

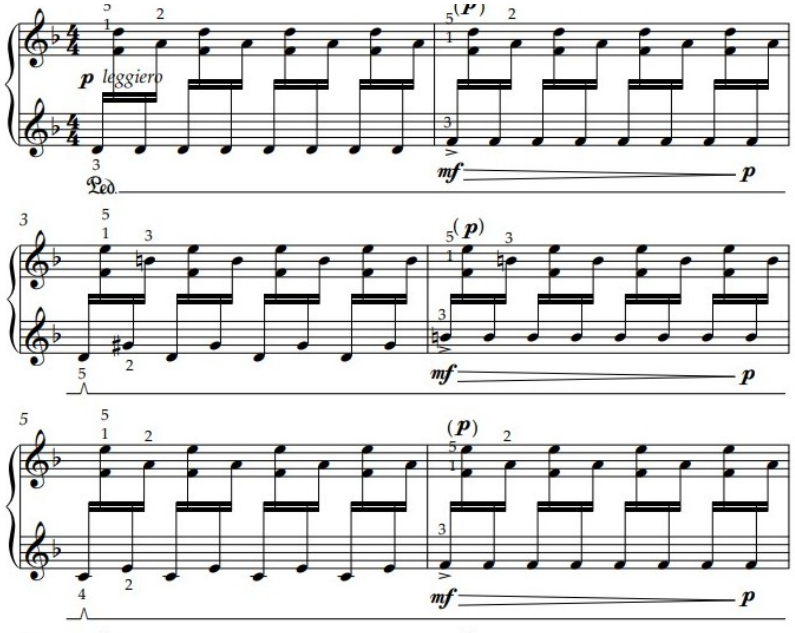
Interestingly, the transition from the third piece of the series to the fourth is seamless. The next piece, "In the Botanical Garden" (E minor), is performed directly. This piece, which contrasts with the one heard before, is characterized by a calm tempo and a composed nature. Here, it seems to depict a child's walk in a new place, exploring nature, touching the yellowed leaves, and gazing at the great trees.

The fifth piece in the series, "Little Song" (E-flat major), is written in a repetitive period form. The piece, written in a lyrical mood, is very readable.



Example 7. Little Song

The final piece of the series, "Snowflakes" (D minor), is particularly remarkable for its expressiveness. Interestingly, the first and last pieces of the series are written in D minor, thus framing the entire set. The astonishing delicacy and refinement of the shades throughout the music captivates the listener. Thinking of the frantic and restless flight of the dancing snowflakes, the composer has managed to bring this to life in the music. Using his skill in descriptive writing, A. Qəmbərli enriches the emotional color of the piece with great mastery.



Example 8. Snowflakes

The captivating beauty of nature has been reflected in the musical works of many composers. The changing of the seasons has always been a theme that draws the attention of creative individuals working in various fields of art. Musicians, as well as poets, have tried to create a parallel between weather changes and the subjective feelings of human life. In this context, it is worth recalling P. Tchaikovsky's musical world. The great Russian composer's First Symphony in G minor, titled *Winter Dreams*, holds a special place in his creative output. The first two movements of this four-movement symphony are programmatic: the first movement is called "Dreams on the Winter Road," and the second movement is called "Foggy, Dull Land." It is known that the composer was inspired by his impressions from a summer trip to Lake Ladoga, Valaam Island, and the Imatra Waterfalls in 1860 while composing the second movement of this symphony. The image of the winter road in the composer's first symphonic work resembles a delicate, refined watercolor. Thus, by depicting various seasons of nature in their works, composers succeed in expressing the feelings of the human soul. In Tchaikovsky's music, we would like to note how the theme of winter is interpreted with different shades, especially in the coldest season.

Conclusion

In his final piece, A. Gamberli attempts to represent the image of the flying snowflakes, eagerly observed from the window, through the means of musical expression. In short, throughout the entire process of composing each piece in this cycle, the composer introduces the listener to carefully thought-out, well-measured, and meticulously crafted writing. The composer's sole aim was to communicate his feelings, emotions, and his relationship with the places he visited with his young son, while bringing the caprices and impressions of nature to life in music, thus creating an engaging cycle for children.

In A. Gamberli's *Six Children's Pieces*, alongside simple forms, we also encounter polyphonic writing. Moreover, there are unexpected modulations and contrapuntal voice leading with polytonal sound combinations. The cycle combines pieces of various characters and genres, showcasing the originality of the new suite's principles.

Contemporary children's piano music represents a unique interpretation and reflection of the global processes within the world of academic music, with its best elements adapted to the child's perception. This cycle, intended for young performers at various stages of their education, is intriguing due to the diversity of expressive means and the composer's individual creative style.

A.Gamberli's *Six Children's Pieces* series occupies an important place when examined within the context of children's music in Azerbaijan. One of the key reasons for its significance is its ability to best express the emotional world of children and nature through musical narrative. In terms of musical techniques, A.Qəmbərli has added new dimensions to his works through elements such as modulation, polyphony, and polytonality. It is highly valuable in music education. Each of Gamberli's works has a unique character. In this regard, its originality, diversity, and pedagogical usability are notable. The richness of the musical language in his works and the variety in expressive forms can deepen the relationship children form with music.

Recommendations

Pedagogical Applications: A.Gamberli's *Six Children's Pieces* series can be examined in depth for research on children's music education. Both qualitative and quantitative research methods can be employed in these studies.

Music Education Applications: Research can be conducted on how the pieces can be utilized in education, especially focusing on adaptation processes for students of different age groups.

Cultural Contextual Examination: The cultural themes in A.Qəmbərli's works, especially those related to Azerbaijani music and children's music, can be enriched through cultural comparative studies.

Studies on Musical Structures: In-depth analyses of the polyphonic structures and modulation techniques in the works can contribute to a broader understanding of contemporary children's music.

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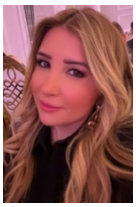

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Journal for the Interdisciplinary Art and Education

ISSN 2717-8870

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