

# Visualization of Music and its Application in the Process of Education

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**Abstract:** The visualization of music and its connection with modern technology and media is one of the teaching methods directed towards today's students' interests and demands that shows potential. The main goal of this study is to determine the possibilities of the application of visualization methods during the process of the development of students' musical ability, skills, and experience during music lessons concerned with all types of music education.

Analysis of a review of the Czech and international professional literature provides us with a comprehensive summary of current trends in pedagogy, together with the latest research results in the field of the effective application of visual methods during the process of education. An introductory study provides us with a historical overview of visual arts and their connection with musical and artistic masterpieces. The next part of the text consists of an analysis of the visualization of music from the points of view of musical pedagogy and psychology. The study also examines some basic principles of the implementation of visual elements in music lessons.

During the process of our analysis of the literature, we discovered that the integration of visualization into the process of music education has a positive effect on the development of students' musical ability and skills. The implementation of some visual elements in music education seems to have a positive effect on the students' development. In compliance with the results of the study, we find that the implementation of the visualization of music in the pedagogical process is very suitable for teaching practice.

**Key words:** visualization of music, music pedagogy, psychology of music, education

## Introduction

It is common knowledge that up to 80% of all the information that people receive is detected visually (Novotný & Hruška, 1998). Thanks to information technology, we are seeing the phenomenon of the

continuous and deeply penetrative development of visual culture in all school subjects to an extent that is unprecedented in the history of humankind. The intense impact of visual culture already becomes an integral part of people's lives during their education at school, but it is not

confined merely to academia. Communicating information without proper visual support is certainly suitable in certain cases, and, as far as musical education in particular is concerned, appropriate in many respects. However, in terms of the development of new and innovative teaching methods with an ever-increasing limit of effectiveness, visual support-education is no longer fully sufficient. The requirements for the gradual development of creativity and an active approach to music education emphasize the mediation of any personal experience with music. Music teachers therefore face new challenges in how to convey this personal experience to students as effectively and as clearly as possible, and thus to encourage and in some cases to stimulate their creativity. Enriching teaching with an activating method of teaching music and the related visualization of information appears to be a good idea, but only if the key pedagogical principles are satisfied. These include, in particular, clarity, which lies at the heart of visualization, and appropriateness in terms of the age of the students and the level of their musical abilities and skills. The literature indicates that the method of information visualization, if used as part of the teaching approach, may develop critical thinking in students and stimulate their creativity (Shatri, 2017, p. 71). This task should be interwoven with all the modern didactic concepts, perhaps even more intensively as far

as music education is concerned. The conclusions of one of the latest music pedagogical studies show that the quality of music education can reflect the quality of the whole educational system, especially because music education can better assess the degree of the effect reached by focusing on the development of individuality and all the components of the personality of a child (Artemova et al., 2020, p. 1208-1214).

### **Visualization of Music in Historical Context**

Ancient philosophers, such as Aristotle and Pythagoras, were among the first to mention in their writings the clear connection between the tones of the musical scale and the colours of the rainbow. This idea later fascinated great Renaissance artists, including Leonardo da Vinci, who created elaborate coloured glasses designed for watching court musical performances. Da Vinci was succeeded by the famous painter Giuseppe Arcimboldo, who, in addition to his famous portraits composed of fruit, vegetables, and subtle symbols, designed hydraulic machines for various theatre stages (Moritz, 1997). According to the period records, he built a device depicting music with colours at the exact time when he was performing his tasks for the theatre. The tendencies towards the practical integration of visual and auditory perceptions can be

found further on, not only in the field of fine arts, where with the development of Impressionism and Expressionism various musical works became an inspiration for works of art, but also in the field of musical art, where numerous works saw the light of day thanks to the experiences and inspiration conveyed by artworks. A typical example of the strong ties between music and the fine arts can be seen in Modest Petrovich Mussorgsky's cycle "Pictures at an Exhibition", which was composed as a tribute to Viktor Hartmann's paintings. The painter Wassily Kandinsky had a great talent for combining his visual and auditory imagination. He created a cycle of paintings based on Mussorgsky's "Pictures at an Exhibition" and throughout his life pointed out the strong correspondence between music and images.

The first attempts to construct a musical instrument that could combine musical expression with a visual phenomenon date back to the first half of the 18th century. A French member of the order of the Jesuits, Louis Bertrand Castel, who built a musical instrument called the Ocular Harpsichord, may claim the honour of being the first in these efforts. The instrument contained 60 coloured glass panes and interconnected each tone with a different colour (Moritz, 1997). The invention of electricity opened up new possibilities of the projection of light effects, which resulted in the construction of a new musical instrument by the Brit-

ish painter Alexander W. Rimmington. He built a musical instrument similar to an organ that could project colours in harmony with music. For a modified version of Rimmington's instrument called the *clavier à lumières*, Alexander Scriabin composed the synaesthetic symphony "Prometheus: The Poem of Fire", which premiered in 1915 in New York (Moritz, 1997). The visualization of music has reached its greatest boom with the development of information technology and interactive media. Thanks to these technical conveniences, the interconnection of music and image has acquired unlimited possibilities and variants of combinations. In her work, Sládková (2012, p. 79) emphasizes the emergence of visualization programs and software as a major milestone, and from among the commonly available apps names the Windows Media Player, where we can find the following practical forms of visualization instruments: Belts, Fog over the Ocean, Fire Storm, Oscilloscope, Water Flower, and Dandelion.

## **Visualization of Music and its Application in Music Education**

By visualization we mean a graphic output relating to the form and content of a musical work. Visualization elements can have a static or dynamic form; by the static form we mean an interpretation

or description of an image, and by the dynamic form we mean a video presentation, either in interactive or non-interactive form (Váňová, 2008, p. 96). According to Váňová (2008, p. 96), in order for visualization to fulfil its purpose and become a full-fledged teaching method, it is necessary to observe the following principles:

- visualization must not distract the child from the very essence of music;
- visualization must result in a semantic and structural analysis of the musical work;
- visualization is the initial experience triggering the child's creative activity.

There are many ways in which this teaching method of activation may be enriched. Visualization can be used in most activities that are part of music education. Váňová has long been exploring the possibilities of applying visualization in listening activities. Her research relies on the musical-psychological basis of visualization, which classifies it amongst visual associations of musical perception and defines it as a pedagogical-psychological process enabling the synthesis of auditory and visual perceptions to activate the child's attention and participate in the shaping of their musical imagination (Sedlák & Váňová, 2016, p. 270). Váňová mentions pictorial documents related to the perceived composition,

film sequences with suggestive performances of the actors, and ultimately the visual expression of the content of the perceived musical composition as specific examples of visualization within listening activities (2016, p. 270).

The application of visualization techniques and their effectiveness as a teaching method have been the subject of many pedagogical-psychological studies. Though this enriching of the teaching approach intuitively seems to be successful at first glance, the degree of its effect ultimately depends on the readiness, will, and technical literacy of the teacher. Thomas Naps even mentions the teacher's willingness to devote time to processing information into a visual and comprehensible form as a key element of the successful introduction of visualization into the educational process (Naps et al., 2003a, p. 131-152). According to the study, the most demanding aspect of the approach is the time spent in searching for suitable examples of the subject and the time required to operate the visualization medium (Naps et al., 2003a, p. 132). Another possible obstacle often consists of the technical condition of the equipment at schools, including modern computer software. In another study of his, Naps mentions one of the possible solutions to the problem of time-consuming preparation for the use of the visualization technique. He suggests that the creation of high-quality visual materials be dealt with by

experts in the publishing of textbooks. If equipped with such enriched and up-to-date teaching materials, teachers could save some time in preparation for their classes. Visualization would therefore more easily become a regular part of teaching classes (Naps et al., 2003b, p. 124–136). As we have already mentioned, the development of visualization teaching methods depends not only on the technical skills and computer literacy of teachers, but also on their ability to access sources of information and ideas. Digital teaching materials are available from the methodological portal of the framework curriculum. Teachers can interactively share and draw from the prepared teaching presentations and worksheets on the website [www.jak-nahudebku.blogspot.com](http://www.jak-nahudebku.blogspot.com), and a large quantity of teaching materials is available from foreign language sources on the website [www.teacherspayteachers.com](http://www.teacherspayteachers.com) for a small fee.

## Visualization Coupled with Musical Activities

Visualization, as one of the teaching methods featuring activation, can be used in listening, vocal, and instrumental activities (Folkestad, 2005, p. 284). When rehearsing a new song within the scope of vocal and instrumental activities,

the method of visualization of musical scores can be used, using colour-coding of the individual notes of the song that interconnects the visual stimulus with the musical sign, the note. For students who do not yet have the ability to intone and distinguish the pitches of individual tones completely anchored, this technique has proved to be highly effective. Another useful option is to mark individual piano keys, strings, xylophone keys, or recorder holes with coloured symbols. Thanks to this “coloured musical notation” corresponding to the coloured symbols on the instrument, the experience of musical accompaniment can be conveyed even to students who have no musical education at all. Another accessible and effective visualization method is the use of musical films with the aim of linking auditory and visual perception of music,<sup>1</sup> or of musical works the composer of which sought to combine music and image, such as “Peter and the Wolf” by Prokofiev or “The Carnival of the Animals” by Camille Saint-Saëns. The didactic application of the above-mentioned compositions into music education is described in the publications by Ašenbrenerová (2006). Visualization, conceived as an interaction of listening activities and various forms of artistic expression, includes graphic processing of a specific theme, whether through col-

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<sup>1</sup> In 2000, the U.S. Walt Disney Film Studio released a DVD called *Fantasia 2000*, in which eight well-known pieces of artificial music are audio-visually processed.

lages or abstract or concrete artworks created by children. Extensive research on the subject of children painting while listening to classical music was carried out by Elkoshi (2019). Her research sample of 181 primary school pupils were asked to express their feelings graphically while listening to classical music of different periods and styles. The compositions were chosen in such a way that a different means of musical expression was more prominent in each of them, and they were either strictly instrumental or choral musical pieces. The analysis of the drawings showed that the students had been capable of distinguishing each means of musical expression through colours or symbols. Thanks to combining listening with graphic art activities, the students concentrated better on listening to the music and could more rapidly identify the means of musical expression even in compositions that had not been played during the experiment (Elkoshi, 2019, p. 590). Another use of visualization in music education consists of interactive presentations<sup>2</sup> containing hypertext and web links, audio and video demonstrations, accompanying texts, and visual material that can be aptly displayed on interactive whiteboards. The entertaining form of teaching and active participation of students in lessons create the necessary motivation

and demonstrably better results in terms of memorizing new information (Serafin et al., 2017, p. 1–4). Of the available forms of visualization in teaching, it is certainly worth mentioning the popularization music series, musical films, and animated films with underlying artificial music (Sládková, 2012). The literature review clearly shows that the subject of pedagogical-psychological studies most often focuses on the visualization method of the graphic representation of notation and creation of elementary graphic musical scores (Barrett, 1997, p. 2–14). Všetíčková introduces this method in the musical-creative project *Slyšet jinak* (Listen Differently). The experience from this project clearly proves that the use of graphic scores for the recording of musical ideas within the process of elementary composing is a suitable means for children's equal and active access to music in which no one is disadvantaged by their knowledge and skills (Všetíčková, 2013, p. 11). Všetíčková also suggests that the creation of the graphic score itself is the very highlight of the whole creative process. She recommends starting the lesson with introductory games, called starters, in order to bring up a creative atmosphere (2013, p. 12). Gromko (1994, pp. 136–147) claims that the specific form of graphic notation created and recorded by a child after having sung a simple tune

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<sup>2</sup> Interactive music presentations available at: <http://mustech.pbworks.com/w/page/21952707/FrontPage%20>.

indicates the degree of his or her musical skills and abilities. Other findings show that children capable of creating their own graphic notation were quicker at reproducing a tune rhythmically and also singing it by heart compared to a control group of students who were not given the opportunity to depict the song graphically (Gromko, 1994, p. 136-147). Rivka Elkoshi and her team conducted an extensive study presenting a comprehensive system of graphic notation called TMN (Toy-Musical-Notes). TMN facilitates the teaching of music theory and at the same time improves the ability of students to play according to the notation (Elkoshi & Carmon, 2012, p. 74).

## Conclusion

Visualization of music may be perceived from various perspectives. In the historical context, visualization was a matter of connecting auditory and visual perceptions, with inspiration drawn from fine art and music. It is documented that artists in every historical period tried to combine music and visual elements into one meaningful ensemble. These attempts culminated in the unlimited possibilities enabled by the technical inventions of the 20th century. If we look at the visualization of music from the point of view of musical psychology, we inevitably touch the areas of musical perceptions and imagination with auditory and visual associations. Visual associations are in-

separably linked to musical imagination, especially when listening to programme music. Váňová (Váňová & Sedlák, 2016, p. 271) attributes this growing trend of associations between hearing and sight to the development of multimedia and information technologies.

From the pedagogical point of view, music visualization is one of the effective teaching methods employing activation. It has been demonstrated that enriching the development of a child's musical abilities, skills, and emotional experiences with visualization techniques has a positive effect on the development of his or her musical personality, on his or her understanding of musical speech, and the development of his or her critical thinking. By incorporating into teaching the method of activating multiple senses at the same time, specifically by enabling sight to assist in the development of the musical sense of hearing, we appeal to one of the most important pedagogical principles – demonstration (Váňová & Sedlák, 2016, p. 270). A significant advantage of this teaching method is its diversity. There are many ways of applying the principles of visualization to teaching. This gives us a wide variety of opportunities to use it in most activities of music education. Using a computer and interactive presentations, visualizations of musical scores, animations, mime, dramatization, music films, and special visualization programs and applications may transform the teaching

of music and make it more effective, inspiring, and creative. Interesting experiences for both teachers and students are brought about by the linkage of controlled listening with graphic activities. One of the most frequent problems associated with the preparation and integration of visualization technique into classes is clearly its time-consuming nature. The technical and computer literacy of the teacher may be another limiting aspect, as may the insufficiency or unavailability of the technical equipment of music classrooms. However, once these limitations are overcome, the teaching method can bring indisputable benefits and qualities to music education classes. If, as teachers, we attempt to address the question of “how to motivate children

to music activities and how to maintain their focused attention, visualization plays a positive role, even in the growing percentage of children whose concentration and attention disorders are due to mild brain dysfunctions” (Váňová & Sedlák, 2016, p. 270).

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