Computer-aided Ear-training

A Contemporary Approach to Kodály's Music Educational Philosophy

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Susanna Király:

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Abstract

My doctoral thesis has involved two related tasks. The first was to analyse Zoltán Kodály’s philosophy of music education and, on this basis, to develop a computer-assisted instructional method (CAI) for teaching music theory and solfège (ear-training). The second task was to experiment with the effectiveness of this method and compare it with traditional approaches to teaching. Many students find music theory and ear training difficult. During the 1990s, in connection with my licentiate thesis "Solfège in the Computer Classroom" (2000), I initiated this research project and, developed a CAI method for teaching music theory and solfège. I wanted to see just how useful Kodály's approach could be in computer-aided teaching and learning.

Kodály's philosophy of music education includes the idea that every child has the right to learn his musical mother tongue. This learning should take place in a child-centred, natural and easy way. In the present study, I particularly focused on the opportunities for developing and testing the new, computer-aided teaching method, especially for ear-training, using Kodály’s concept. My purpose was to create a learning tool that could be used in music schools to facilitate the teaching of music theory and solfège.

The second objective of my study was to examine the effectiveness of this new tool. Did these newly-developed CAI materials and methods cause differences in students' learning outcomes in different environments? Three different groups tested the music theory and solfège instruction with CAI: the PIT group, in which there was a computer-aided tutorial, but only the teacher used a computer, not the students; the FIT group, in which each student had a computer, and each could interact with the curriculum independently; and a control group, TRAD, to whom music theory and solfège were taught using a traditional method, that is, without any computer-aided programme. The study was conducted in the West Regional Music Institute (LUMO) in Lohja, Finland, during the school year 2004–05. The study included a total of 125 music students, ages10 to 16.

This is an empirical and pedagogical developmental study. The testing phase also included quantitative analyses. The paramount objective was to develop and test a Kodály-based CAI solfège pedagogy. The results show that the Kodály approach can be successfully applied to the development of a computer-aided solfège programme: the Kodály-based computer-aided music theory and solfège material in fact produced the best results in most areas of learning, especially in the PIT group, in which a teacher worked with a computer-aided tutorial. The results also show that the Kodály system is applicable to new learning environments and teaching practices. It suggests that the computer-aided tutorial works well to support music theory and ear-training in individual lessons and indicates that pupils are eager to learn by using the computer. In music education CAI is an area with great potential for development. It offers multiple learning options and can enhance students’ motivation to study music theory and ear-training; some of the learning outcomes were even

better than with the traditional ways of learning. The results also show, however, that the teacher–pupil interaction is essential in a computer-aided learning programme.

… … … … … … … … … … … … … …

Keywords: basic education in the arts, CAI, digital network equipment, ear-training, Kodály, music education, music education technology, music theory, solfège

HELSINGIN YLIOPISTON SUOMEN KIELEN, SUOMALAIS-UGRILAISTEN JA
POHJOISMAISTEN KIELTEN JA KIRJALLISUUKSIEN LAITOS
UNKARIN KIELI JA KULTTUURI

… … … … … … … … … … … … … …
Susanna Király:

Tietokoneavusteinen säveltapailu
Uusi lähestymistapa Kodályn musiikkikasvatusfilosofiaan

… … … … … … … … … … … … … …
Tiivistelmä

Väitöstutkimukseni sisältää kaksi toisiinsa liittyvää osaa. Ensimmäisenä tutkimustehtävänä on ollut perehtyä Kodályn ajatuksiin ja periaatteisiin musiikkikasvatuksesta sekä kehittää tietokoneavusteinen ohjelma Kodály-filosofian periaatteisiin pohjautuvan säveltapailun opettamista varten. Toisena tutkimustehtävänä on ollut kokeilla tietokoneavusteisen opetusmenetelmän toimivuutta ja verrata sitä perinteiseen opetusmenetelmään. Monet oppilaat kokevat musiikin teorian ja säveltapailun oppimisen vaikeiksi. 1990-luvulla tekemässäni lisensiaatin tutkimuksessa ”Solfège in the computer classroom”(2000) aloitin perehtymisen tutkimusaiheeseeni ja tietokoneavusteisen opetusmenetelmän kehittämiseen.

Väitöstutkimukseni ensimmäisenä tutkimusongelmana oli selvittää kuinka Kodályn periaatteita voidaan käyttää tietokoneavusteisen säveltapailun opetusohjelman kehittämisessä ja toisaalta millainen on Kodályin periaatteiden käyttökelpoisuus tietokoneavusteisessa oppimisessa. Kodályn musiikkikasvatusfilosofian keskeisiin periaatteisiin kuului ajatus siitä, että jokaisella lapsella tulisi olla oikeus ja mahdollisuus musiikin kielen oppimiseen ja

tämän oppimisen tulisi tapahtua lapselle luonnollisella ja helpolla tavalla. Tutkimuksessani olen syventynyt Kodály-konseptin mahdollisuuksiin erityisesti säveltapailun tietokoneavusteisen opetusmenetelmäni kehittämisessä ja sen toimivuuden testaamisessa. Nyt kehitetyn opetusohjelman tarkoituksena on ollut luoda uusi Kodály-pohjainen, säveltapailun oppimista helpottava väline musiikkioppilaitosten käyttöön.

Väitöstutkimuksen toisena tavoitteena on ollut tutkia nyt kehitetyn tietokoneavusteisen Kodály-ajatuksiin pohjautuvan opetusmenetelmän toimivuutta musiikin teorian ja säveltapailun perustason oppimisprosessissa. Tutkimusongelmana oli selvittää, onko nyt kehitetyllä tietokoneavusteisella opetusmateriaalilla ja menetelmällä eroavuuksia oppilaiden säveltapailun oppimistuloksiin erilaisissa oppimisympäristöissä. Säveltapailun opiskelua tapahtui kolmessa erilaisessa ryhmässä. Ensinnäkin PIT-ryhmässä, jossa tietokoneavusteinen opetusohjelma oli opettajan kautta ja ohjaamana luokan oppilaiden käytössä, kun taas TIT-ryhmässä jokaisella oppilaalla oli oma tietokone ja he käyttivät säveltapailun opetusohjelmaa itsenäisesti. Vertailussa oli mukana myös TRAD-ryhmä, jossa säveltapailua opetettiin perinteisellä menetelmällä ilman tietokoneavusteista ohjelmaa. Tutkimus on tehty Länsi-Uudenmaan musiikkiopistossa (Lumo) vuosina 2004–2005. Tutkimuksessa oli mukana yhteensä 125, 10–16–vuotiasta, musiikkiopiston oppilasta. Tutkimus on luonteeltaan kehittävä ja empiirinen, opetusmenetelmän testausvaiheessa myös kvantitatiivisia analyyseja sisältävä. Keskeisimpänä tutkimustavoitteena on ollut Kodályin musiikkikasvatuksen periaatteisiin pohjautuvan säveltapailun pedagogiikan kehittäminen uutta tietokoneteknologiaa hyödyntäen sekä tämän tietokoneavusteisen pedagogiikan toiminnan testaaminen.

Tutkimustulokset osoittavat, että Kodályin periaatteita voidaan soveltaa tietokoneavusteisen säveltapailuohjelman kehittämisessä. Tutkimustulosten mukaan nyt kehitetty Kodály-pohjainen tietokoneavusteinen säveltapailun opetusohjelma antaa parhaimmat oppimistulokset PIT-ryhmässä, jossa opettaja ja tietokoneavusteinen opetusohjelma toimivat yhdessä säveltapailun oppimisen edistäjinä. Tutkimustulokset osoittavat, että Kodályn musiikkikasvatuksen periaatteet ovat sovellettavissa uusiin oppimisympäristöihin ja opetusmuotoihin. Tulosten mukaan tietokoneavusteinen opetusohjelma toimii hyvin opettajan tukena säveltapailun oppitunneilla ja oppilaat ovat innokkaita oppimaan tietokoneen avulla. Musiikin opetuksessa tietokoneavusteisten opetusmenetelmien kehittäminen on uusi ja kehittyvä alue. Se tarjoaa uusia oppimisen tapoja erilaisille oppijoille ja voi parantaa motivaatiota opiskella musiikin teoriaa ja säveltapailua. Osalla oppilaista oppimistulokset voivat olla jopa paremmat kuin perinteisellä tavalla opiskeltaessa. Tulokset osoittavat kuitenkin sen, että opettaja-oppilas – vuorovaikutussuhde on keskeinen myös tietokoneavusteista opetusohjelmaa käytettäessä.

… … … … … … … … … … … … …

Avainsanat: digitaaliset verkko-materiaalit, Kodály, musiikin teoria, musiikkikasvatus, musiikkikasvatusteknologia, säveltapailu, taiteen perusopetus

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ABBREVIATIONS AND ACRONYMS

CHAPTER 1

CAI	Computer-aided Instruction
LUMO	West Regional Music Institute in Lohja, Finland

CHAPTER 2

AV	Audio-visual
E-book	electronic (digital) book
IKS	International Kodály Society
EMF	Elementary Mental Functions
MI	Multiple Intelligences
MKO	the More Knowledgeable Other
PDA	Personal Digital Assistant
ZPD	Zone of Proximal Development

CHAPTER 3

FKC	Finnish Kodály Center	Suomen Kodály-keskus
FKS	Finnish Kodály Society	Suomen Kodály-seura
IKS	International Kodály Society	Nemzetközi Kodály Társaság

CHAPTER 4

ATMI	the Association for Technology in Music Instruction
EFTA	the European Free Trade Association
EU	European Union
Eurydice	Information on Education Systems and Policies in Europe
FME	the Finnish Ministry of Education
ICT	Information and Communication Technology
ISME	International Society for Music Education
IT	Information technology
MOVE	Music Education and Research Online
OPM	the Ministry of Education
PLATO	Programmed Logic for Automated Teaching Operations
PISA	the Programme for International Student Assessment
RIME	Research in Music Education
PLATO	Programmed Logic for Automated Teaching Operations
PISA	the Programme for International Student Assessment
RIME	Research in Music Education
TV	Television [telecommunication medium]
UNESCO	United Nations Educational, Scientific and Cultural Organization

CHAPTER 5

FIT	Full Information Technology	personal instruction, computer for everyone
PIT	Part Information Technology	group teaching, computer used by the teacher
TRAD	Traditional Teaching	without computer

CHAPTER 6

CD	Compact Disc
DOM	Functional syllable for the dominant
EACEA	The Education, Audiovisual and Culture Executive Agency
FNBE	Finnish National Board of Education
MIDI	Musical Instrument Digital Interface
SUB	Functional syllable for the subdominant
TON	Functional syllable for the tonic
VCR	Video Cassette Recorder

CHAPTER 7

UCLA	University of California, Los Angeles

Data Codes / Inserts Nos 15–17

V1_1	Pre-octaves	music theory task
V1_2	Post-octaves	music theory task
V2_1	Pre-barlines	music theory task
V2_2	Post-barlines	music theory task
V3_1	Pre-scales	music theory task
V3_2	Post-scales	music theory task
V4_1	Pre-intervals	music theory task
V4_2	Post-intervals	music theory task
V5_1	Pre-musical terms	music theory task
V5_2	Post-musical terms	music theory task
V6_1	Pre-melodic dictation	solfège task
V6_2	Post-melodic dictation	solfège task
V7_1	Pre-rhythmic dictation	solfège task
V7_2	Post-rhythmic dictation	solfège task
V8_1	Pre-chordic dictation	solfège task
V8_2	Post-chordic dictation	solfège task
V9_1	Pre-chords	music theory task
V9_2	Post-chords	music theory task
V10_1	Pre-interval dictation	solfège task
V10_2	Post-interval dictation	solfège task
V11_1	Pre-cadence dictation	solfège task
V11_2	Post-cadence dictation	solfège task

INTRODUCTION

In 1991 I began postgraduate studies at the Sibelius Academy in Helsinki, Finland. At the same time I was a music theory and solfège lecturer in Lohja, also in Finland.

My favourite memory of the Sibelius Academy is following Seija-Sisko Raitio's solfège instruction. At that time, teachers had begun to use music software. Aarre Joutsevirta suggested *Encore notation software* (2010), for which I am very grateful, because it is the only music software that is simple enough to use without any special technical training, and it is the only program that is suitable for small children from the very first lesson. (About *Encore notation software*, see, for example, Encore 2010=www.gvox.com)

In the autumn of 1992 Computer-Aided Instruction or CAI was begun in the *Länsi-Uudenmaan musiikkiopisto* (the West Regional Music Institute or LUMO in Lohja). At the time the principals of LUMO and the Anttila School had agreed that the computer classroom in the comprehensive school could be used for solfège instruction in the afternoons. Primary school teachers used the computer lab in the mornings, and the music schoolteachers used it in the afternoons. The principal of the music school, Jorma Mäenpää, invested in sound cards, synthesizers and *Encore notation software* (2010) for each computer. (Király 2000.)

In 1993 the Kuopio Department of the Sibelius Academy invited me to teach solfège with the aid of a computer.

Because I was unable to find any readymade computer-aided instructional materials for solfège, I began to develop such materials myself (Király 1994, 1995, 1996, 1997).

My licentiate study, *Solfège in the computer classroom* (2000), focused on learning outcomes in middle-grade and higher-level classes. A study was done on the students' attitudes, motivation and opinions about computer-based music theory and solfège learning. The results of the licentiate research suggested that notions of learning and teaching in the computer classroom have changed in quality. Learning has come to the fore more sharply than the process of teaching, and computers have become a useful aid to independent learning. (Király 2000.)

My licentiate research was connected with computer-aided teaching and learning experiences and focused on middle-grade and higher-level students' attitudes, motivation, opinions and learning outcomes with computer-based solfège instruction. I wanted to develop CAI materials in order to provide a more agreeable and effective method of learning than was available with traditional methods. I also wanted to find suitable didactic instruction for teaching music theory and solfège and combine it with the methods I had learned in my original music studies, which were done in Hungary. Learning in a computer classroom requires efficient computers, and kindergarten is the ideal place and age to begin CAI. (Király 2000.)

The results of my licentiate research demonstrated that solfège instruction needed rejuvenation, especially in its aims. The teacher's role has become more challenging. I have learned from experience that computer-aided teaching cannot be done effectively by teachers who are untrained in computer-teaching technology. A music teacher who uses a computer for music teaching requires special technological education, digital materials, a well-equipped virtual

environment and a special IT assistant who is always ready to help. (Király 2000.)

Solfa.Net project

The purpose of the Solfa.Net project (2002–2006) was to understand the pedagogical models for E-learning and the virtual learning space and to investigate how the models might be implemented in a practical environment.

The research programmes of the Solfa.Net project were Solfa.Net Teacher Education, Solfa.Net Learning Space and Solfa.Net Materials.

The research programme of the EU project concentrated on preparing music teachers for Web education and developing Web learning spaces and materials. Lasse Aumala and Pirkko Juntunen prepared Web material for instrumental instruction on the Finnish *kantele* (a type of zither) and violin. My role was to develop Web material for music theory and solfège instruction and for tutoring other teachers (Király 2004a-h, 2005a-h).

Together with Minna Viitala and Teuvo Ryynänen, teachers of music theory and solfège at the *Kyrkslätt musikinstitut* (Music Institute in Kirkkonummi, Finland) and at the *Borgånejdens musikinstitut* (the Music Institute in Porvoo, Finland), I developed a pedagogical approach to the technological problems in music education.

In my dissertation I continue exploring the theme of my licentiate work by focusing on the basic level of CAI and the new possibilities it offers for music pedagogy. The aim of this research is mainly to develop Kodály-based Web material and to determine how such material can be used in music education. Music theory and solfège are taught using three different methods on three basic learning levels. The

groups are compared in order to determine pupils’ learning outcomes and how the CAI materials function.

CHAPTER 2

THEORETICAL BACKGROUND

2.1. The origin of music

Speech is basic to the development of human culture and differentiates us from all other species. The major transition from hominid to human development (2.5 million years ago) took place when the human species began to make and use tools. To do this it was necessary to formulate and follow a plan and to think in advance. The basis of intelligent behaviour requires a sense of the past and the future, as well as a concept of time.

Musicologists and anthropologists of music around the world believe that music was adapted from cultural behaviour and religious ceremonies, and this explains its origin. Acoustic and musical signs were significant and understood among the human species as important factors in communication and for behaviour. It is more than likely that we were a creative, singing, dancing, clapping, music-making species long before we became verbal and talking Homo sapiens. Ancient Greek philosophers believed that music originated from language. However, Maria B. Spychiger's hypothesis (2001: 36) suggests that the ability to organise sound was evolutionary and was established much earlier than speech.

Donald Hodges (1989) put music in primary place among the functions of music in human development. Hodges (1989) introduced music in the 'third function', as an individual mode of knowledge. He suggested that important

concepts in human behaviour are represented and conveyed through music, and mentions expressions of truth, beauty, justice, love, care, faithfulness, triumph, grief, gladness, lightness, growing, diminishing as specific concepts in human experience. According to Spychiger (2001: 37), recognition of nonverbal knowledge is important because the belief persists that human thinking and intelligent behaviour are based on language.

Howard Gardner's theory of Multiple Intelligences (MI) (1983, 1999, 2005) reflects a concept of music as a 'mode of knowledge'. According to this theory, all human beings possess a minimum of eight forms of intelligence: linguistic, logical-mathematical, musical, spatial, bodily-kinaesthetic, naturalist, interpersonal and intrapersonal. These multiple intelligences identify us as human beings. Gardner's multiple intelligences are based on individual sign systems, such as verbal (language), numerical (mathematics), sonic (music), visual-spatial (objects and pictures) and kinaesthetic (gesture, mime, movement). Multiple intelligences correspond to modes of knowledge, and this comprehension, which is Hodge's third function of music, can be linked to Gardner's definition of musical intelligence. (Spychiger 2001: 38.)

According to Gardner (2000: 32), schools have the benefit of one or two forms of human intelligence involving language and logic as well as additional effective techniques through which we become acquainted with the world. Teachers need to modify their instructional techniques in order to give equal learning opportunities to all students, not just to those talented in linquistics or mathematics.

The following quotation comes from an article about Gardner's theory of multiple intelligences presented on the 25th anniversary of its publication (Gardner 2008):

> The most important steps taken by Gardner (1983) involved arriving at a working definition of ‘an intelligence’ and devising a set of criteria of what counts as ‘an intelligence’. Gardner described ‘an intelligence’ as: ‘a biological and psychological potential to solve problems and / or create products that are valued in one or more cultural contexts’. Armed with this definition and these criteria, Gardner identified seven relatively autonomous capacities that he called the multiple intelligences: linguistic, logical-mathematical, musical, spatial, kinaesthetic, interpersonal and intrapersonal. In more recent writings, Gardner added an eighth (naturalist) intelligence and has continued to speculate about a possible ninth (existential) intelligence. The two most important scientific implications of the theory are complementary. On the one hand, all human beings possess the eight or nine types of intelligence that make us human; on the other hand, no two human beings – not even identical twins – exhibit precisely the same profile of intelligence. (Gardner 2008: 1.)

2.2. Language learning

When Charles Darwin published *Origin of Species* in 1859, he had considerable interest in the origin and evolution of language. He consistently observed his son’s progress and language-learning process. (Darwin 1859.) In 1877 Darwin published his *Biographical Sketch of an Infant*, which reflected his evolutionary theory. Child development is a contemplation on the evolution of the species. For a long time language was considered the essential factor in the evolution of children. (Darwin 1877.)

Of the numerous books on theories of language learning, two appear to be closest to my study. They are the cognitive constructivism of Jean Piaget and the social constructivism of Lev Semyonovich Vygotsky. The main focus of *Piaget’s cognitive constructivism theory* is on the cognitive development of children (1963 [1936], 1971, 1993).

In *Vygotsky’s social constructivism theory* (1993 [1936], 1987) the primary concern is the affiliation between thought and language. Vygotsky was interested in the ways different languages could affect the way a person thinks. Vygotsky’s

theory views language first as social communication, which gradually promotes both language and cognition. He proposed that what Piaget observed as the egocentric speech of children was in fact personal speech. This is the child's way of exploiting words to think about something or other, which is a step from common speech to thinking in words. Therefore, Vygotsky's concept of language as common communication promotes the gradual development of both language and psychology. (David 2004: 12–13.)

2.2.1. Piaget's Theory

The child psychologist Jean Piaget (1896–1980) demonstrated the means through which the mind transforms new information. The basic inclination applied in thinking is towards *organising* – the compounding, arranging, decompounding and rearranging of information and concepts into a comprehensible system. Human beings are born with an inclination to organise their reasoning techniques into psychological constructions. Piaget identified these structures as *schemes*. In this theory schemes are the basic fabrication barriers to thinking. (Woolfolk 2007: 28.)

Children can understand only what they have experienced. A child believes that everyone sees the world in exactly the same way he does. According to Piaget, adaptation is the most important principle of human functioning. Adaptation is the continuous process of using the environment to learn and adjust to changes in the environment. It is a process of adjustment consisting of two complementary processes, *assimilation* and *accommodation*. (Piaget 1952: 357–419; Singer & Revenson 1978: 12–13.)

In scientific thinking, for instance, accommodation to reality is purely experimental, but assimilation is deductive,

incorporating objects into logical or mathematical schemas (Piaget 1962: 161).

Assimilation is the process of taking in new information and fitting it into a preconceived notion about objects or the world. *Accommodation* means adjusting to new experiences or objects by revising the old plan to fit new information. This dual process, assimilation-accommodation, which leads to adaptation, enables the child to form what Piaget calls a schema. A *schema* is a simple mental image or pattern of action, a form of organising information that a person uses to interpret the things he sees, hears, smells and touches. Adaptation is a process of seeking *equilibrium* between the self and the environment: It is a balance between the processes of assimilation and accommodation. (Piaget 1952: 357–419; Singer & Revenson 1978: 15–16.)

According to Piaget (1971, 1993), coordinating, assimilating and accommodating can be viewed as a sophisticated balancing process of behaviour. In his concept, actual modification in thinking occurs through utilising *equilibration* – the ability of enquiring to make adjustments. Equilibrium exists when a distinct scheme is applied to an event or situation and the scheme is carried out. If the scheme does not produce gratifying results, then *disequilibrium* will be ensue, and a person becomes uncomfortable. This prompts us to continue further enquiry to find a solution by way of assimilation and accommodation, and thus our thinking makes adjustments and moves ahead. (Woolfolk 2007: 29.)

According to Piaget (1993 [1947]: 172), after the appearance of language, or more precisely, the symbolic function that makes its acquisition possible (at age 1½ to 2), there begins a period lasting almost four years and involving the development of symbolic and pre-conceptual thought. From 4 to about 7 or 8 years of age, a closely linked continuation of the previous stage is developed – intuitive