

Digital Environment in Music School Education

Ewa Parkita, Ph.D.¹ & Paweł A. Trzos, Ph.D.²

Abstract

This article refers to the use of digital resources and multimedia on early stages of innovative music education. The innovative aspect within the text is mainly discussed in context of audiation. Theory of universal music learning, according to Gordon, is mostly directed at teachers. The text presents the possibility of implementing E. E. Gordon's theory into professional training of early music education teachers at Kazimierz Wielki University in Bydgoszcz, Poland. The author recognises the importance of shaping research and musical instrument technical (including interdisciplinary) competences of future teachers as they help students use not only practical (pedagogical), but also empirical work of E.E. Gordon's theory. Additionally, the text presents the reports from research on the application of E.E. Gordon's Theory, carried out by students of early school and innovative music education at Kazimierz Wielki University in Bydgoszcz, Poland. *Music Fairytale "e-Audiation Songbook"* is the first interdisciplinary project, which is the result of cooperation between music pedagogy, computer science and mechatronics students. Despite the fact that the application has not been finished yet, it is going to be implemented, tested, assessed and evaluated (in terms of content and achievement). The initiation of such activities gives ground for long-lasting pedagogical research on academic instruction quality of future early school music education teachers, when it comes to organizing their knowledge and skills via use of E.E. Gordon's theory in Poland

Keywords: interdisciplinary character, innovation, audiation, early music education, digital environment, multimedia, teaching, GTML (Gordon's Theory of Music Learning)

Introduction

Dynamic development of the information and communication technologies is affecting numerous aspects of a human life, posing high expectations also on the education system. Therefore, theoretician and practitioners are required to perform in-depth and extensive research on the use of modern technologies in upbringing and education. The research should also concern teacher academic training process which has to meet the requirements of interdisciplinary education. The interdisciplinary aspect of early school music education teacher's work involves not only human sciences knowledge, but also culture studies (knowing tradition: cultural, historical and aesthetic), psychotherapy and methodology of education. What is more, innovative teaching, very often means using digital technology. Multimedia, as the name suggests, make it possible to combine various means of communication: visual (photos, graphs, pictures) and aural (recorded music, acoustic effects, lectures, dialogues), as well as movies (film sequences, cartoons). This combination opens enormous possibilities of applying computers also in music education. The most characteristic advantage of this technology is the assumption that the user is not a passive receiver of the presented content, but adjusts the way of viewing and searching data, and chooses the direction of activities.

¹ The Institute of Music Education, Jan Kochanowski University in Kielce (Poland)

² The Faculty of Pedagogy and Psychology, KazimierzWielki University in Bydgoszcz (Poland)

Education via multimedia means that the learners gain knowledge and skills in the audio-visual and symbolic language (Strykowski, 1997, pp. 5-6). This collaboration and dialogue with the computer influences different types of activity in children (sensory, intellectual, verbal, motoric, emotional), enriching their cognitive skills, as well as the ability of targeted, creative thinking and acting.

Computer technologies in music education

Supporting early music education with computer technology has huge possibilities and promises to develop performing, creative, and perceptive skills in children. Another important advantage of a computer is the possibility to store and process vast music resources in different file types: audio (music pieces in best interpretations), video, animation, musical films, images, photographs, and software, which can be used at any time during music classes. Internet connection is an indispensable feature, broadening the range of possibilities.

Well-designed music education software is of great didactic value when introducing learners to the world of musical terminology, notation (associating sound with a particular position on the five-line staff, name, pitch and duration), music history, ear training and aural skills, sense of rhythm, music-related memory, singing (learning correct sound production and breath control by listening to the reference version and child's own performance), and playing musical instruments. Music software can also be applied in creative development of children, allowing them to compose their own motives, melodies, and full pieces, as well as to add accompaniment to a song, modify scores registered by notation editor software, and play the resulting music. Such software may have a beneficial influence, enhancing the development of learners' imagination and interest in music. The following features can be of use:

- Designing teachers' working environment (information materials, score files, recordings of a selection of pieces and their accompaniment, multimedia presentations, designing action plans),
- Active search and storage of data (selection, archiving), use during school activities (use of multimedia charts, interactive blackboards, Internet resources, including hypertext techniques and multibooks),
- Use of electronic techniques and diagnostic tools to evaluate musical development of learners,
- Organization of attractive peripherals and educational software for sound processing (computer, audio interface, studio microphones, keypads: MIDI control "keyboard type", Digital Audio Workstation and others) (Zielak, 2012, pp. 65-74),
- Supporting e-learning solutions (platforms and databases of developed didactic and diagnostic solutions),
- Use of sound and video recorders (vocal, motor and instrumental student activity) for achievement evaluation,
- Promoting mini-innovations in education.

Didactic materials carefully designed by the teacher can also stimulate the learners, directly or indirectly, to take on creative activities. This can be achieved by the use of sound samples, such as different acoustic tones and effects, melodies or harmonic background, which learners can use to create interesting forms. Stimulating musical creativity in learners is a very difficult task. Information technologies can be helpful, but they have to be used appropriately. Creativity of the music teacher is also of great importance (Newton L., Newton D., 2010, pp. 111-124; Russell G., Finger, Russell N., 2000, pp. 149-165; Wojtas, 2005, pp. 99-102; Parkita, 2013, pp. 44-46; Pearson, Somekh, 2006, pp. 519-539).

Child e – music playing in play pedagogy

Moreover, on early stages of education, learning through play is crucial. Also in this respect, good practices have been established of using multimedia in educational games for music learning. The designed software combines elements of education, aesthetics, and entertainment that stimulate the development of social skills (Mann, 1994, p. 5). These solutions correspond to the respective requirements, which include the following:

- The interface needs to be simple, natural and friendly for the child;
- Reactions to any user activity should be understandable and immediate;
- The software should be operated by pointing and selecting options with the mouse rather than entering text using the keyboard;
- Valuable didactic material should be combined with good entertainment;
- Logical and creative thinking should be taught;
- Sense of aesthetics should be developed;
- Gradation of task difficulty should correspond to the observable progress of the learner;
- Rewarding the child for correct problem solving with a short melody or interesting sound effect;
- Introducing diversity of activities to avoid boredom and discouragement for further work;
- Possibility to stop and complete the work in any place (Juszczuk, 2002, p. 344).

Numerous musical games and multimedia software for music education are commercially available (Parkita, 1998, pp. 212-221; 2004, pp. 196-199; 2005a, pp. 137-142; 2013, pp. 46-47; 2014, pp. 60-62; Milner, Mann, Bawa, 1998, p. 181; Mellor, 2008, pp. 451-472; Kołodziejcki, 2012a, pp. 100-103).

The application titled *Klikuczyśpiewać* is an interesting collection of multimedia music games prepared by Maria E. Twarowska. It is designed for children at the age of 6-10, and some games can be used for even younger children. The scope of music issues is very wide and in some cases offers more than the school general curriculum.



Figure 1: Main interface of *Klikuczyśpiewać* software.

Main character of the game is a little boy whose name is Klik. He offers to have fun together with children. The boy is extremely patient, motivates children and helps them make decisions. Klik takes children for an interesting journey around the world of music. Popular songs for children such as: *Wyszły w pole kurkiczy* [Three chickens went into the field], *Kaczkapstra* [A gaudy duck], *Siedzi sobie zając* [A hare is sitting], *Czerwone jabłuszko* [A red apple], *Miałababuleńka* [Granny had...], *Ojciec Virgiliusz* [Father Virgil], *Maryna* [Maryna is a female name], *Krakowiaczek jeden* [A boy from Cracow], *Bajkajskierki* [A tale of little sparks] play an encouraging role.

Numerous games are based on music material of each song and they include:

- **Listening puzzles** - sensibilising to sounds and being connected with recognizing sounds from the environment, birds chirping, animal calls, uniform rhythms from major and minor scales and triads, melody character, tempo, articulation, dynamics; listening puzzles also include tales and music stories illustrated with examples from music literature;
- **Melodic tasks** - being connected with drawing the direction of melodic line, aural melody analysis, showing graphics of diatonic succession jumps, bar sequencing, reacting to final phrases of music tasks, recognizing scale, intervals and triads;
- **Rhythmic tasks** - being connected with note and rest basic values (used in rhythmic puzzles and bar filling), introducing to such terms as: pulse, rhythm, bar, metre;
- **Tasks connected with musical instruments** - containing presentations of tone possibilities of different instruments and listening tasks "who plays this?"; in this task group there is also playing song melodies on virtual keyboard and experimenting with the choice of timbre to a melody character, accompaniment and song content. The application also enables one to connect an instrument with MIDI input;
- **Coloring books** - they aim at remembering musical symbols (and knowledge connected with them) through finding them and marking with the right color.

At the beginning of the game the child selects one of the offered instruments, which helps the application identify users and remember their progress. The tasks in the application are divided into two categories. The first, these are graded tasks, in which a child gets notes becoming red when the activity is solved in a correct way. Every single correct solution is saved to the so-called certificate which can be printed out. The second category is based on experimenting and it is not graded. When problems occur, the child is given help by Klik or goes to *chest full of music tips*. Cognitive content is ordered alphabetically or when a certain keyword, placed below the bulb sign, is selected (sequenced in the order as they appear in particular games). The tips stored in the chest concern: sound names and their placement on keyboard, metre, note and rest rhythmic values, characteristic rhythmic groups, interval jumps scale succession, major and minor triads, Polish national dances, instruments (Parkita, 2005b, p. 16-18). The reviewed software could be used in teaching contents from music curriculum at the first stage of child education.

Digital resources in innovative music instruction (a Polish lab example for audiation development)

When analysing the advantages of digital support for early music education, it is usually assumed that the technology should not only facilitate achieving knowledge about music, but also developing selected, actual musical skills, believed to be significant. The aim is targeted at intense stimulation of the main cognitive processes in music (such as memory, attention, perception, focus, good reflexes, and visual-motor integration). One of the key areas of cognitive development in a child is developing rational (i.e. objective) musical thinking skills, which is thinking in the language of music (and its attributes). Developing musical language based on the correct, i.e. rational motivation, is definitely one of the most important and greatest challenges of the modern music education.

Results of the Polish research show that success depends on the significant development of musical thinking, understood as audiation, as defined by Edwin Gordon (*Zwolińska*, 2013, pp. 143-155; *Bonna*, 2013, pp. 66-86, *Kołodziejcki*, 2013, pp. 410-429). Content of the curricula, which are dedicated to audiation and make use of computer technology, make it possible to introduce new elements that correspond to the current level of musical development in the learner. Attractive form of communication is also a significant factor that shapes the appropriate interaction between the learners' musical development (learning potential) and their attitude towards music.

Introducing learners to the world of attributes of music and shaping their ability to assess music consciously is challenging but feasible on early stages of music education. Such activity must not be treated lightly or belittled as a pleasant form of general contact with music. Providing teachers and learners with diversified and appropriately designed experience in the practical music learning is crucial. Such activity, which emphasises delivering appropriate sequence of musical stimuli throughout education, is the domain of research carried out by Edwin E. Gordon.

Academic model based on the assumptions of the music learning theory of E.E. Gordon is an innovative model in Poland. It includes the specific role of talent in music learning as a multidimensional construct. In such adaptation of Gordon's concept of giftedness, implications of other known psychological and educational concepts are of high importance. These include: J. Renzulli's model, F. Mönks's model, The Munich Model of Giftedness by K. Heller et al., and model of giftedness by R. Milgram (Renzulli, 1986, pp. 51-92; Heller, Perleth, 2008, pp. 173-190; Mönks, 2008, pp. 79-85). Gordon's concept of developing the ability to learn music has been the subject of research at KazimierzWielki University in Bydgoszcz for years.

The aim of this research is systematic application and developing conditions in Poland for implementing E.E. Gordon's theory. The educational model developed in Bydgoszcz is mainly based on the concept of audiation. This means that audiation is the starting point of setting innovative goals for music education (Gordon, 2005, pp. 63-66, 82; Nuzzaci, 2013, pp. 263-276; Apostoli & Nuzzaci, 2010, pp. 67-75). Indeed, audiation requires from the learner a more complex mental activity than perception. Above all, permanent competence is required on two levels: differentiating and drawing conclusions. This is because audiation is only possible, when we are able to recall and understand, what we have already perceived, sensed and, eventually, differentiated (Gordon, 1980; 1999, pp. 127-130). This is crucial for achieving educational goals in this domain.

Practical and developmental activities are aimed at combining interdisciplinary academic knowledge (including theory and research) with practical knowledge in the curriculum of future early music education teachers. Academic studies of future education staff in this field need to embrace the following key components: theory of teaching, research and dissemination (including expertise). Moreover, the key competences of a teacher of music need to be implemented, such as theory of teaching, research (including innovations) and dissemination of incubated solutions in education (*Kołodziejcki*, 2012b, pp. 357-371). These assumptions are the aims of the interaction model, which constitute the statutory research field at The Department of Music Pedagogy of KazimierzWielki University in Bydgoszcz (Poland). This model provides that educational activity of the staff and students needs to follow the idea of an innovative "laboratory of audiation development" and be a strong response to the need of the currently expected mission of a "real-life university" (Trzos, 2015, pp. 128-136).

"e-Audiation Songbook" – core of the project

Combining academic teaching according to Edwin E. Gordon's theory of education with teaching computer skills is beneficial for developing competences of the future early music education teachers. Developing interdisciplinary competences in students of The Department of Music Pedagogy of Kazimierz Wielki University in Bydgoszcz (Poland) is the aim of the work towards designing and generating interdisciplinary and innovative solutions in music teaching theory. The solution is scientific and didactic in character, but above all interdisciplinary.

Electronic songbook solution, entitled "e-Audiation", is a module of the electronic application *Music Fairytale* for working with early school children. This solution (and the entire application) has been designed by the laboratory team of students from three faculties: early school education, computer science and mechatronics, in an EU-funded competition project "*Wykwalifikowani, aktywni, komunikatywni – absolwenci UKW*" (*Qualified, Active, Communicative – UKW Graduates*) (no. UDA-POWR.03.01.00-00-K024/15) via the National Centre of Research and Development. The purpose of this solution is to use digital technologies in specialist practice of developing actual audiation during early music education. The theoretical concept of this solution was implemented by the interdisciplinary team of lecturers from the Institute of Pedagogy and Institute of Computer Science and Mechatronics at Kazimierz Wielki University in Bydgoszcz (Poland), and an external expert representing an education-research enterprise specialised in commercialisation of solutions based on the E.E. Gordon's theory in Poland. The collaboration focused on the following tasks:

- Developing the conceptual assumptions of an electronic songbook,
- Selection (including content-based organisation) of the content package for active development of the basic music skills in children on early stages of education,
- Possibility to design quantitative educational research, which would form the basis of the proof-of-concept of the criteria and prognoses of implementing the interdisciplinary solution into the practice of actual audiation development.

— The selection of the musical contents (repertoire) for the songbook was based on the five criteria of the *Gordon's Theory of Music Learning - GTML* (Gordon, 1980, 1999, 2005):

- Praxeology (consistency with the methodology of action on early stages of education, requirements of the standard curriculum and theoretical assumptions of E.E. Gordon),
- Tonal content (including a variety of scales: major, Dorian, Phrygian, Aeolian, harmonic Aeolian),
- Rhythmic content (including a variety of meters: simple/compound, duple/triple),
- Performance (including different presentation of the same content: vocal monophony/polyphony, instrumental: harmonic/melodic) and
- Typological criteria (content based on types of actual audiation: listening, reading/writing, performing/creative skills and improvisation) (Parkita, Trzos, 2016, pp. 39-47).

The solution is still being developed, but part of the material has already been prepared and sent to practicing experts for evaluation. The main element is the assumed high level of digital innovation and aesthetics of the solution (graphic design, quality of the file, navigation) – Photo 1.

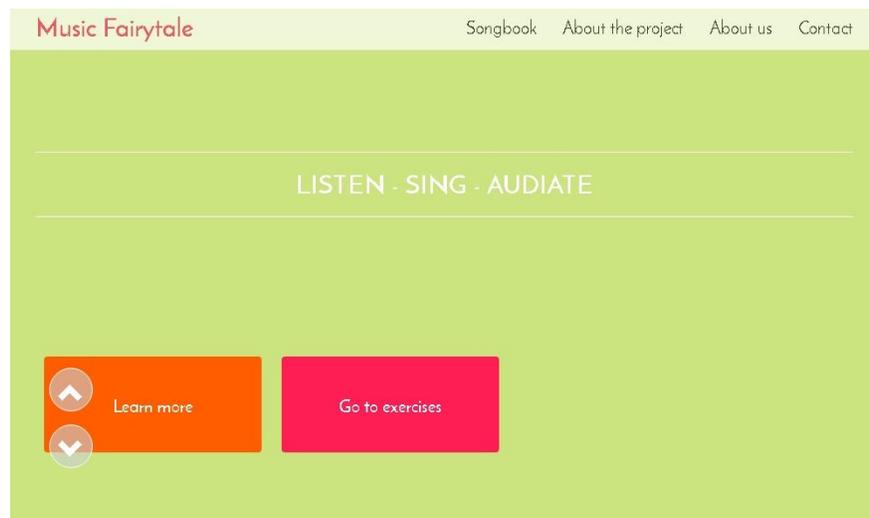


Photo 1: Homepage of the *Music Fairytale* project*

*The application (including the "e-Audiation Songbook") is in Polish

The methodological material (tonal and rhythmic content) to be included into the Gordonian "*multibook*", needs to be useful in education and dissemination. Moreover, the exercises have to be interactive, in order to appeal to children. Such a musical *multibook* is a form of presenting and processing the collected tonal and rhythmic content in form of tasks that develop actual audiation. The key criteria of organising the teacher's activities based on the collected material refer to the basic theoretical background (GTML). The reference is mainly to the key types, stages and levels of audiation, according to which the suggested types of tasks (exercises) have been selected in order to develop musicality in children (Parkita, Trzos, 2016, pp. 42-45).

The *Music Fairytale*, "e-Audiation Songbook" application is under development. However, it has already been established that the generated didactic solutions will be sent for development to professional editorial centres. The aim is to turn all into professional products: the students' solutions in graphics, quality of musical files that meets the requirements of content conversion, and speed of data access. The solution itself is fully customisable in terms of pace and difficulty level of the exercises (including error correction). One of the significant assets of this *multibook* is combining the included contents with the continuously updated Internet platform, containing educational packages for each level of learning. Otherwise, separating the contents of the *multibooks* from the teaching curricula might hamper the process of music teaching. Therefore, it would be beneficial to combine the *Music Fairytale* "e-Audiation Songbook" application with the only currently available, alternative curriculum based solely on the theory of music teaching by E.E. Gordon (Zwolińska, Gawrylkiewicz, 2007). This way, the criteria proposed in the application solution will be fully adjusted to the Polish context.

Information technology in early school music education - an attempt of diagnosis

The students involved in "e-Audiation Songbook" project use valuable formal and theoretical GTML (Parkita, Trzos, 2016, pp. 43-46) database in their studies. High applicability and cohesion are indicated as the major criteria of usability assessment when it comes to cognitive status of Gordon's theory.

Those criteria are the subject of studies on the innovative aspect of audiation theory in Bydgoszcz school model (solutions usability in case of challenges of modern child education). The approach of students (N=100) from the Faculty of Music Education of KazimierzWielki University (Poland) to the GTML applicability scale assessment has also been put under research. The work aims at designing and generating interdisciplinary solutions in music teaching theory. The abridged version of E.A. Zwolińska's research findings (2011, pp. 77-85) is given in Chart 1.

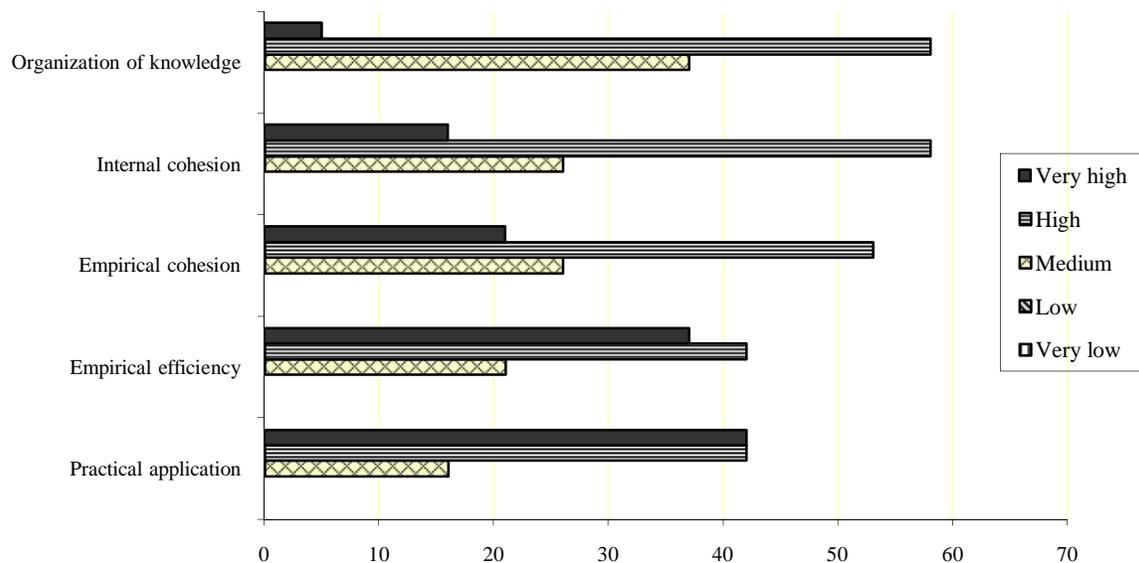


Chart 1: Frequency of using GTML by students

Source: Zwolińska (2011, pp. 77-85)

From Kazimierz Wielki Music Pedagogy graduates' opinions, one can classify Gordon's theory as: 1. highly useful in practice, 2. empirically and theoretically coherent. The concepts, content and solutions may be supported via different applications showing practical GTML's aspect. Neomedia are among those applications (together with digital technology software). However, it turns out that teachers need both theoretical and practical approach to audiation development. They need competencies which are necessary for modern knowledge organization in case of music instruction, and they must also "be aware of theory" (Zwolińska, 2011, s. 85). It means that teachers have to know how to use the theory in practice when it comes to learned aspects (Table 1), especially in case of modern multimedia technologies. That is why, as D. Makarewicz and E. Parkita's research shows, there is still a lot to be done (Chart 2).

Research carried on 210 music teachers shows that they use software for writing music to a small extent (Makarewicz & Parkita, 2014). Everyone declares that computer skills are vital in music teacher's work. However, there are barriers which do not allow for using information technology in instructing the subject. Teachers themselves notice that age and lack of time are the main reasons for a bad situation, though schools are equipped with computer labs where classes could be conducted. Some teachers, usually those with long teaching experience, evade using new technologies, simply because they do not know them.

Still, it turns out that there are teachers who value and understand the need for using information technology on music lessons and they implement it effectively. Among subjects of the study, 40% declare using music processing software. However, the majority (60%) do not apply such software at all.

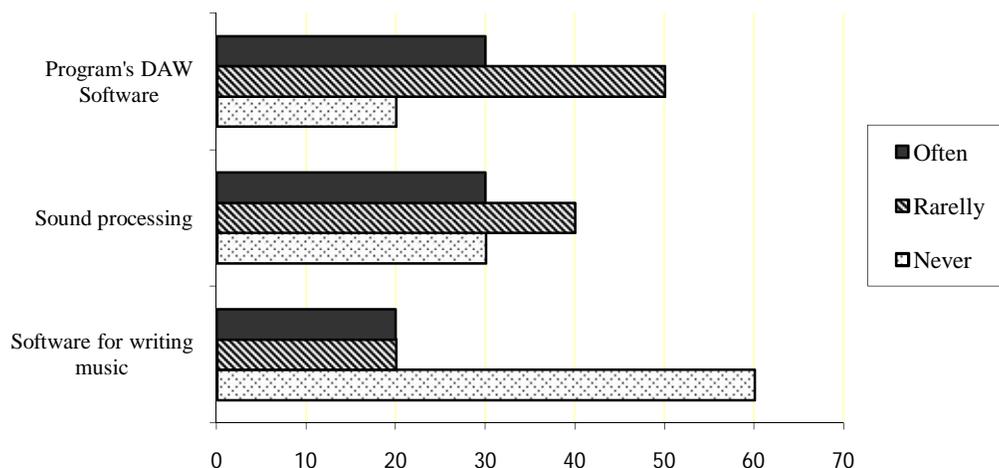


Chart 2: Frequency of using software for writing and editing music by the subjects

Source: author's own research (Makarewicz & Parkita, 2015).

From the above chart one can see that software for music writing is not popular with the interviewed. Those applications give numerous possibilities, but are quite demanding when it comes to knowledge how to operate and use them. Even apps that seem to be simple could be difficult and pose problems, often impossible to be solved by a user. Therefore, one stops using the software and turns to writing music faster in paper handwritten version. The most frequent problem is not writing a notation, its duration and pitch, but inserting dynamic denomination, repetition and other designation.

The second reason for low popularity of music writing software could be availability of ready-made materials in bookshops and on the Internet. One can easily find chart of almost every popular piece of music. Teachers very often search for ready materials because creating music from the scrap usually takes long time and needs devotion. 30% of the subjects use sound editing software, which is quite simple and available application is enabling one to carry such operations as: cutting, copying, change of tempo or tonality. 40% use those apps rarely. The rest of teachers do not use such software in their work. DAW (*Digital Audio Workstation*) software, used for processing and creating music, has become more popular among teachers recently.

Those apps join the world of Audio and MIDI together, giving unlimited possibilities for recording own compositions, creating arrangements of popular music at home without access to the professional recording studio. The ability to use such apps via music teachers can enhance their work. 30% of the interviewed teachers say that they often use such software, the rest of them use it seldom or do not use it completely. MIDI files players or karaoke players are applied in entertainment during different school or out-of-school events. The majority of the respondents (65%) use the software in their work, 30% from this group use it frequently. The remaining respondents totally do not implement the software. Less than half of the respondents (40%) can record incidental music to computer with the use of keyboard with automatic accompaniment in wav or mp3 formats. The remaining respondents (60%) do not have such skills. The same numbers of teachers have problems with the Internet audio or MIDI files editing and describing tools used for such editing.

When it comes to the source of arrangements, it turns out that 20% of subjects perform arrangements on their own, 35% of them buy ready-made products, and the remaining (45%) search for available materials (Parkita 2014, pp. 65-67).

Conclusion

The introduced innovation can stimulate changes in the model of the present day school, including music education. Analysing current trends in the development of educational technologies, we can expect the future school to be ICT based, and therefore up-to-date; focused on developing both knowledge and practical skills by targeted implementation of information and communication technologies into the functional, educational space. Software has become indispensable in everyday life (Jennings, 2005, pp. 225-238), however, the developers of the *Music Fairytale* "e-Audiowanie Songbook" application are convinced that even though digital technology can enhance the learning process, it will never replace personal interactions between teacher and learner, which continue to be the focus of attention in the educational space (Al-Zaidiyeen, Mei, Fook, 2010, pp. 211–218; Hennessy, London, 2013, pp. 15-24; Cutrim-Schmid, Whyte, 2012, pp. 65-86; Parkita, 2014, pp. 67-68; Wojtas, 2004, pp. 99-102; Nuzzaci, 2013, pp. 270-275).

Supporting interdisciplinary aspect in using digital resources for music education is still a challenge for universal education. In spite of the fact that advanced computer aided strategies in teacher's activity will never replace human interactions, they are developing and are innovative both in case of theory and practice of music education. Additionally, Ministry of National Education published materials and government latest directives for public consultations on the newest *Core Curriculum* for teaching music in primary schools seem to value the importance of IT solutions.

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Ewa Parkita Ph.D. – a musician, pedagogue, scientist and university instructor from The Institute of Music Education, Department of Pedagogy and Art - Jan Kochanowski University in Kielce (Poland). She is conducting research on the problems of artistic music perception via children and teenagers. Additionally, she is keen on amending the process of teaching music also through the use of modern information technology. Parkita is a topic editor of the magazine titled: "Pedagogy Studies. Social, educational and artistic problems". E-mail: ewa.parkita@ujk.edu.pl

Paweł A. Trzos Ph.D. – adjunct (assistant professor) from Music Pedagogy Faculty, Kazimierz Wielki University in Bydgoszcz (Poland). He is dealing with the problems of research on early school music education. His special interest is studying audiation. He is a member of Polish Pedagogy Society and Team of National Education Ministry Experts for reviewing music education reference books. Dr. Trzos is also a scientific secretary of Art Comity works in Department of Human Sciences in Bydgoszcz Scientific Society. E-mail: ptrzos@ukw.edu.pl