TOPICAL ISSUES OF MUSICAL PEDAGOGY

Learning the Modal and Rhythmic Patterns of Non-European Music: The New Opportunities from Mobile Applications

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Abstract. The aim of this paper is to disclose new methodological possibilities for improving music ear for ethnic modal scales and rhythmical patterns by means of modern electronic devices in the field of music education. Musicological and methodological analysis of mobile applications for smartphones and tablets is the main core of such a demonstration. The traditional ethnic music from India, Iran, China and other non-European countries is used as rhythmical and melodic basis of these applications. Most part of the selected and analyzed applications may be successfully used in academic courses of ear training at the secondary and high levels of music education. The concrete methodological possibilities of ethnic music instrument-simulators as well as applications-thesauruses (modal and rhythmical) have been demonstrated for the purposes of ear training in pentatonic, mixed diatonic and symmetrical modal scales, microchromatic intonations and also for training in syncopation and irregularly accented rhythmic.

Keywords: ear training, music education, mobile applications

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Изучение модальных и ритмических паттернов неевропейской музыки: новые возможности мобильных приложений

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Аннотация. Целью данной работы является раскрытие новых методических возможностей развития музыкального слуха на материале этнических ладовых и ритмических моделей средствами современных электронных устройств в сфере музыкального образования. Основу музыковедческого и методического анализа составляют мобильные

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приложения для смартфонов и планшетов. В качестве ритмического и мелодического материала этих приложений используется традиционная этническая музыка Индии, Ирана, Китая и других неевропейских стран. Большая часть отобранных и проанализированных приложений может быть успешно использована в академических курсах тренировки слуха на среднем и высшем уровнях музыкального образования. Показаны конкретные методические возможности этнических музыкальных инструментов-имитаторов, а также приложений-тезаурусов (модальных и ритмических) для тренировки слуха в пентатонических, смешанных диатонических и симметричных ладовых гаммах, микрохроматических интонациях, а также для тренировки синкоп и неравномерно-акцентной ритмики.

Ключевые слова: тренировка слуха, музыкальное образование, мобильные приложения

Music of non-European cultures penetrates more and more intensively into the modern concert practice of Europe. This process is facilitated by lectures and performances on traditional instruments, as well as instrumental master classes. There are also the growing interest of modern composers in new timbres and methods of vocal and instrumental improvisation.

At the same time, in educational practice, there is still a difficulty for learning auditory to study the intonation and rhythmic models of such a traditional music. Concerning the standard Western and Eastern European courses devoted to ear training, a music language is mainly studied as concentrated on the classical-romantic rhythmic patterns and only partly on the music language of the 20th century. Moreover, the most sol-fa applications can be effective only at the initial stage of acquaintance with intervals, chords, etc. Nowadays the development of modern digital technologies can accelerate the solution of this problem.

This decade continues the rapid growth and improvement of mobile communications and multimedia communications. Many mobile applications for iOS and Android mobile platforms have been created for the development of musical ear. Smartphones and tablets, having acquired "humanized" touch screens that allow you to manage tasks by touching it, have become a mass, therefore, relatively inexpensive commodity. This allows us today to make full use of multimedia mobile applications for the purpose of music education. The first so far the most general studies on this topic have begun to appear (see [1; 2; 4; 5; 7; 8; 9]).

At the same time, interest in ethnic cultures is growing. On the one hand, the theme of "ethnic ear training" has been gaining popularity, new manuals are being created based on the national modal and rhythmic musical material (see for example "Macom Solfeggio" by Svetlana Matyakubova [15]). On the other hand, this interesting material is usually used by teachers only occasionally, to add a certain kind of exoticism to the academic course.

In this situation, the applications devoted to the rhythmic-intonation patterns in traditional music (India, Turkey, Iran, China, Korea, etc.) provide wider opportunities for studying a variety of modal scales (including pentatonic, mixed, symmetrical, non-octave

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and microtone) and rhythmic patterns (including irregular rhythm) in solfeggio classes at all levels of music education.

The focus of our consideration of the issue of "ethnics" in solfeggio classes will be not so much the national musical (rhythmic intonation and timbre) material itself and its study by means of mobile applications (which may be a topic for a separate work), but the methodological possibilities of such applications for training academic skills developed by in the academic course of ear training.

Let us briefly outline the main specifics of musical "ethno-applications". Most of them, by their function, were not conceived as auxiliary material for working in an ear training course. Applications of this kind are intended primarily for studying the traditional music of European (Greece, Turkey) and mainly non-European cultures (Iran, China, India, Korea, America and other countries and regions), including learning to play national instruments.

Despite their auxiliary nature, these applications actually constitute serious methodological competition for those mobile programs that are created specifically to help those who train their musical ear. As already said "Profile" ear training applications are focused mainly only on the basic level of mastering the material (auditory recognition and intonation of intervals, the main types of third chords, major and minor modes, etc.). In the context of the achievements of Russian ear training school, they are more suitable for home individual training of basic level students. "Ethnic" applications provide more opportunities for the ear training studying a variety of modal scales (including mixed, symmetrical, non-octave and microtonal) and rhythmic patterns. (Psychological and methodological aspects of the development of stylistic musical ear on the material of "ethno-applications" have been considered in the articles: [11; 12].) In accordance with this the main areas of our consideration will be applications that can be useful for mastering modal and rhythmic difficulties.[1]

There are three main types of training by means of such "ethnographic applications":

1) training on music instruments-simulators;
2) training on modal patterns;
3) training on rhythmic patterns.

The main ear training tasks that can be successfully solved thanks to applications of this kind include:

– improvement of recognition of new modal scales,
– auditory analysis of melodic and rhythmic patterns,
– development of operative musical memory,
– development of music-making skills and intonation,
– rhythmic improvisation in a certain modal context.

At the same time, the formation of basic auditory skills includes:

– the development of a sense of modal stability as the ability to keep the reference tone in memory;
– the feeling of a single metric pulse as the ability to count the smallest rhythmic fraction.

Now let's look at these questions in more detail.

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[1] The attention in the article is focused on applications running on the Android platform as the most popular and accessible to a wide range of users. See the author's articles about iOS applications: [11; 14].

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Auditory mastery of modes other than major and minor. For this purpose, two leading types of "ethno-applications" can be used:

1. Applications—musical instruments (the so-called simulator instruments) tuned according to the sounds of scales other than major and minor, including with an element of micro-chromatics;
2. Applications—modal thesauri as audiovisual simulators for mastering new modal models also other than major and minor.

In applications of the first type, instrumental timbres are as close as possible to the real sound of a folk instrument (at least, a string-plucked or percussion group). In applications of the second type, MIDI and synthesizer timbres are more common as a demonstration multimedia basis. The inclusion of both types of applications in an ear training lesson can give a balanced result, in which the training, audiovisual part will be supplemented by a kinesthetic component (direct touch of virtual strings or keys on the screen).

Let us start with an overview of applications—musical instruments and their possibilities for mastering modal scales. The most numerous group is applications for studying pentatonic scales. Let's give examples.

"Gugak". The interface of the application is the Korean plucked instrument of the same name. Its virtual strings are tuned in anhemitonic pentatonic scale, they can be fingered on the screen.
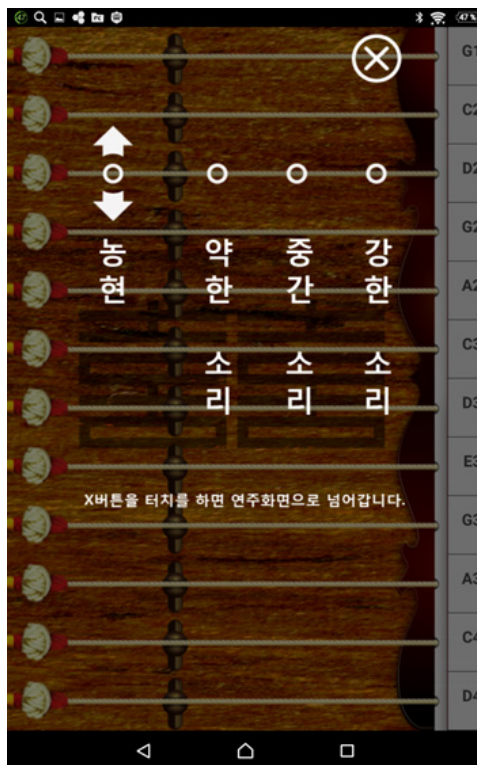

Figure 1. Screenshot of the open Gugak application window

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The sound quality of the instrument is very close to authentic. On such an instrument, one can play simple dictations, reproduce intervals and chords.

"Chinese Band". This application is developed with the participation of professors from the Taiwan University of Education in Taipei. It contains two sections which are useful for ear training purposes. The first of them is "Guzheng". It imitates the sound of the guzheng instrument (a Chinese variety of harp), and the second is a simulator of a set of Chinese drums (they will be discussed separately below).

The scale basis of the first section is the anhemitone pentatonic scale $c - d - e - g - a$ in the range of five octaves. The interface is made in the form of five rows of rectangular buttons (corresponding to five octaves of the scale). Each of them is accompanied by pitch symbols (appearing next to written colorful hieroglyphic and their phonetic equivalents). All five rows are also equipped with a "spare" leading tone (b in English notation), which allows both changing the pitch position of the pentatonic scale and, if necessary, creating diatonic intonation elements. The arrangement of sound pitches (located, as it were, in separate cells of the table) may seem visually unusual, since it is not associated with a piano keyboard. This feature allows students who are accustomed to look at the piano to practice more effectively on their own in determining intervals by ear: the keyboard "hint" does not work here.

Figure 2. Screenshot of the "Guzheng" section window of the Chinese Band application

This "guzheng" can be played with two hands. The application supports pressing multiple "strings" at the same time, which makes it possible to work with chords. This application also turns out to be convenient for exercises on melodization of rhythmic figures with short durations because the touch response to pressing is quite fast. An additional methodological advantage is recording of the played fragment and saving it. This is convenient for training in self-dictations (with their verification without the participation of a teacher).

In the classroom, if you have several tablets or smartphones with the application installed, you can arrange group orchestral improvisations, for example, in order to master a certain rhythmic pattern: someone can perform it on the "strings", and someone on the drums.

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This kind of music-making can be useful at a music school (to a certain extent, replacing and continuing the idea of an Orff orchestra).

Today modern digital devices, computer programs and mobile applications, including tuners that show the exact pitch in hertz (Hz), could be the technical basis for the successful development of the microchromatic ear training technique (see [3]). This, however, does not happen. Attempts to offer methods for the auditory development of microchromatics (quarter-tones and other types of melodic intervals based on tunings other than equal temperament) are rare in the course of ear training. A complex methodological approach to teaching microchromatic hearing is not available. The point here is not only in objective obstacles (such as, for example, limited study hours), but in psychological barriers. On the one hand, there is a technological unpreparedness of the majority of teachers to work with this digital content. On the other hand, such material has positioned in their minds as "dry", abstract, and hardly accessible to musicians. "Ethnic" applications with a microchromatic component in musical content can be useful on the way of accustoming the ear to the intonation of microtones, as well as their aesthetic acceptance. Let us look at a few examples.

"R-ORG" (Turkish-Arabic Keyboard). The application is made in the design of a keyboard synthesizer, but with a "Turkish-Arabic" keyboard in which only white keys sound (black keys serve only as a design). The keyboard reproduces the characteristic second semi-low degree, characteristic of the intonational structure of Turkish and Iranian music. In the synthesizer, you can choose one of 14 sounding timbres (for example, zurna, saz, oud and other traditional instruments of the region) and rhythmic accompaniment formula. At the same time, it will depend on the choice of instrument whether it is possible to play several sounds on the keyboard at the same time (for example, for zurna is possible only monophony and for oud is possible polyphony). The timbres of this synthesizer convey the sound of national instruments quite correctly, and the playing on mastering the intonation of microchromatics will acquire a "natural" ethnic flavor. However, the methodical disadvantages for the academic use of this application include the relative nature of the scale: the names of sounds drawn on the keys do not correspond to their real pitch. Almost all scales begin not from *do*, but from re or even from *la*.

Figure 3. Screenshot of the main window of the R-ORG (Turk-Arabic Keyboard) application

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"Santoor" is an Iranian application that imitates the instrument of the same name and has a corresponding interface, the register of the instrument covers three octaves. It allows to select one of the seven main mugham modal scales (Shur, Segah and others), and to display the pitch. It is methodically important that the quarter-tones are highlighted visually: they are marked with a special sign, the so-called crown, which means the sound is lowered by 50 cents (the example below shows the *a* semi-flat string involved).
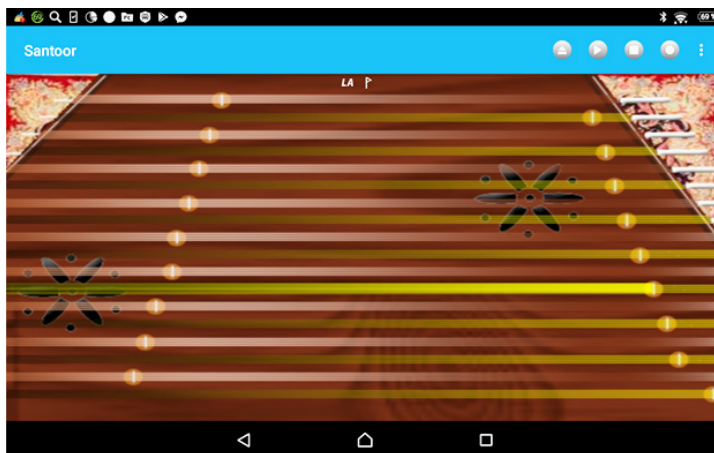

Figure 4. Screenshot of the main window of the Santoor (Santur) application

Among applications-modal thesauri one can select those in which information blocks with modal scale tables are combined with their sound reproduction (in a piano or wind MIDI timbre).

"Music Scales" is an application that provides great opportunities for extended acquaintance with various modal scales. The scales are grouped according to the initial letters of their name in Latin and numbered. In general it reflects an empirical approach ("naming to highlight") without scientific and theoretical justification. Here we will find examples of both typical "school" names (for example, No. 38 — "Twice Harmonic Minor", "Double Harmonic Minor Mode"), and ethnic ones (Japanese — No. 69 "In-sen" and No. 81 "Kokin-joshi", Jewish — No. 112 "Mi Sheberach", Hungarian — No. 67 "Hungarian Minor"), genre-stylistic (various variants of blues modes and modes called "bebop" — "Bebop" — Nos. 11–17), nominal ("Bartok Mode" — No. 10 of the "Bartok Scale", in fact, Lydian-Mixolydian) and even poetic ones (Nos. 41–43 are called "Enigmatic Mode", that is, "Mysterious Mode"). In addition to the pentatonic scale and various mixed and diatonic seven-degree modal scales, we can also find here variants of non-semitone tetratonic scale (No. 9 "Ama Lama Cooma Scale"), examples of Shostakovich's mode (No. 20 "Diminished").

All scales are written from *c*. By clicking on the play icon, one can simultaneously listen to the sound and follow the animation of the cursor moving around the staff. At the university, one can use this material for sight reading (without turning on the sound mode) and for composing one's own compositions based on these modes.

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The application has two interface options: in the form of a piano keyboard and in the form of a guitar fingerboard. The first interface is more convenient, more familiar for working on studying the material. The second one is more attractive for free improvisation in the selected modal scales due to its less audiovisual predictability. Unfortunately, the application does not allow playing intervals and chords in these scales, it is monophonic.

Numerous applications aimed at studying intonation models of the Indian raga are particularly interesting for working on new-mode and microtone intonation. Let us highlight a few of them.

"Swaras". Swara is an Indian concept denoting the sound-row basis of raga. In this application the main modal scales of the raga in the form of ascending and descending scales are presented exclusively in the sound version. All of them are given in equal temperament, in the MIDI timbre of the flute. Based on the scale selected from the available list, melodies are programmatically generated. The generation algorithm is based on the most typical intonational chants selected by the compilers of the application on the basis of existing compositions of a particular raga. These melodies are supported by a bourdon tone (in the timbre of the tanpura), which gives a modal support on an interval of a perfect fifth.

Among the interesting features of the application, we can note the following:

– the number of generated variants is not specified, but every time a new melodic version sounds after pressing the play button;
– one can choose the duration of the sound of the melody (from five to thirty seconds);
– the generated version of the melody can be repeated an unlimited number of times by pressing the "Replay" button.

Figure 5. Screenshot of the main window of the Swaras application

Based on the described features, the application is very convenient for training musical ear and musical memory. Thus, the absence of musical notation of modes makes it possible to conduct a musical dictation (oral or written) without the temptation of checking with the original source before the end of the task. It is useful also for self-dictations. The constantly drawn-out bourdon bass (in addition to the traditional stylistic attribute of the raga) helps to retain the modal support tone in memory when changing different modal scales.

In auditory learning of rhythmic patterns we can select two main types:
1. Applications—musical instruments (drums).
2. Applications—thesauri of rhythmic patterns.

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The basis of the first type is sets of various kinds of "ethnic" drums, with an indefinite or definite pitch. Sometimes they are joined by instruments from other groups. There are a large number of applications of this type (moreover, many of them are similar to each other in terms of functions and interface). For the purposes of rhythmic ear training we need to select those whose interface allows us to perform fine rhythmic figures. Let's name a few useful applications in this regard.

"Real Percussion". The electronic drum kit provided by the application includes instruments: congas, bongos, timbales, box, cowbell and tambourine. There are a sound recording (with the possibility of its "loopback") and animation during playback, showing which "drums" were hit. Thanks to these features, this application can serve as a useful tool when studying rhythmic patterns in elementary grades, in particular, for distinguishing rhythmic patterns and their repetition.

"Chinese band". In the rhythm part of this application discussed earlier, there are eleven different instruments that are convenient to play with two hands. This application allows to play simultaneously with the playback of a previously recorded model.

As the common typical properties of Rhythm Pattern Thesauri-applications we can select:

– playback of accented and non-accented beats at two different pitches, reflecting this difference in visualization;
– visual highlighting of the smallest pulsating beat with a graphical display of this reading;
– visual highlighting of written durations when they are played;
– the possibility to select the rhythm of the model and change the tempo of its playback.
– the possibility to record and play a rhythmic model (in many applications).

"Turkish Music Rhythmic Pattern" is very interesting application that can be adapted in many ways to work in a rhythmic ear training course. Let's consider it in more detail.

In addition to general information about the rhythmic patterns (usul) of traditional Turkish music, there are also buttons in the main menu that open the way to three sections of the program:

– "Minor Usûls"—the performance of rhythms containing from 2 to 15 beats in a pattern is configured in this section;
– "Major Usûls"—rhythms having from 16 to 88 beats in the pattern are programmed here;
– "Series Usûls"—in this section, one can set up rhythms that reach up to 124 beats in length in one combination.

For ear training lessons, due to the smaller number of parts in the pattern, the first section will probably be the basic one. Let's describe on its example the possibilities of the application.

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After clicking on the "Minor Usûls" tab, for the further operation of the program, you must select in sequence:

– by clicking on the note icon at the top of the screen—the playback timbre, in particular the type of percussion instrument. There are more than three dozen options, including darbuka, def, cowbell, clave;

– by clicking on the icon with the image of a tambourine—the number of beats in the pattern;

– by clicking on the icon with the image of drumsticks—the main or additional forms of the pattern (the latter, designated as "Velvele", usually represent one or two rhythmic variants of the original model, formed by splitting durations and other changes).

Having set all the settings and then clicking on the playback symbol (a triangle in a square), we will get a continuous looped sound of the rhythmic pattern (pattern) programmed by us, accompanied by an animated display of the one performed on a two-voice rhythmic score. This score is complemented by the image of a metronome, which silently shows the number of the current metrical beat in numbers, as well as the indication of the tempo of the quarters, which can be adjusted during the performance.

Figure 6. Screenshot of the main window of the "Minor Usûls"

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We can list the main methodological advantages of using the application in the ear training course:

- coordination training—when performing patterns with right and left hand strikes according to the lines of the score (including the simultaneous sound);
- visibility of the process of counting beats pulsation—this helps to accustom the ear to the internal calculation of rhythms for both long and short durations at the same time;
- synchronization in the perception of a rhythmic pattern with its musical notation;
- the convenience of working out rhythmic patterns at different tempos due to the simplicity of software adjustment of the playback speed.

Among the available forms of studying with the application in ear training classes, we list the following:

- oral and written rhythmic dictations, during which one can repeat the sounded rhythmic pattern by tapping it;
- melodic improvisation against the background of a constantly repeating rhythmic pattern;
- rhythmic sight reading. For this purpose, it is preferable to use the sections "Major Usûls" and "Series Usûls" in order to prevent memorizing a short rhythmic model by ear. At the same time, even duplicating a sounding two-voice score will not be an easy task due to both the sufficient complexity of rhythmic figures and the peculiarities of their distribution (probably traditional) among the voices.

Many modal and rhythmic applications described in this article have been tested in classes with students of the Moscow Conservatory of I–III years (musicologists and choir conductors). Thus, first-year theorists deciphered by ear and recorded with notes all the modal scales that sounded in the "Swaras" application. Their homework also included the choice of the most expressive modes and training in vocal improvisation based on them. The result of this assignment was a video recording of a collective vocal-instrumental improvisation[2], which combined several different mobile applications, live vocals and playing a real musical instrument (a singing Tibetan bowl). For the video recording, it was decided to use visual stylization as well: the participants, to their general pleasure, were dressed in traditional Indian attire.

As an example of the use of electronic simulators of ethnic musical instruments for mobile devices, we present the following materials from the lesson where students performed a rhythmic score from the Afro-Latin Rhythm Dictionary [6] using pre-downloaded applications that imitated the sound of the indicated in African and Latin American percussion notes. (See more about it in the author's articles [10; 13].)

Now we will mark out the main academic tasks that can be solved step by step using "ethnic" musical mobile applications.

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[2] The video is available at: http://www.splayn.com/cgi-bin/show.pl?option=RecordInfo&user_id=44&record_id=2105.

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Figure 7. Solfeggio lesson at the Moscow Conservatory in the class of Marina V. Karaseva (September 2015). Second-year students of the Faculty of Choral Conducting demonstrate on their mobile devices applications that imitate African and Latin American instruments.[3] Technique prepared for the performance of a rhythmic score from the Dictionary of Afro-Latin Rhythms

Among the main ear training tasks that are successfully solved thanks to this kind of applications are the study of new modal scales, auditory analysis and recording of melodic and rhythmic patterns, training of operational musical memory, development of music-making skills and intonation and rhythmic improvisation in a certain modal context. The formation of basic auditory skills in this case includes the development of a sense of modal balance as the ability to retain the reference tone in memory and the feeling of a single metric pulse as the ability to count the smallest rhythmic beat.

The general pedagogical and psychological tasks include: achieving greater freedom and expressiveness in performance; instilling a taste for collective co-creation in improvisation; finding areas in the field of digital technologies that are attractive to young people, and using them to increase the interest of modern pupils and students in music theory classes.

With all this, one of the most important socio-cultural tasks, the solution of which can be successfully facilitated by the use of "ethnic" mobile applications, should include the education of ethnic tolerance. Students get to know elements of another music cultures through their melodies and rhythms. Of course, students do not need to investigate deeply the theory of national modes or rhythmic structures. However, even a short intonation contact with them can help students to get interest both in the music of other national cultures and in ethnomusicology in general.

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3 The video is available at: http://www.splayn.com/cgi-bin/show.pl?option=RecordInfo&user_id=44&record_id=2711.

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The Android-based mobile applications we have described are mostly completely free or quite cheap in their paid versions. They are small in the megabyte size and can be installed on many different devices, including rather old, respectively, cheap models of smartphones and tablet computers.

Now dealing with the described mobile applications can be available at any level of musical education, starting at an early age. At a music college, one can study pentatonic scales and master the ratios of rhythmic durations. At the university it makes sense to expand student's auditory acquaintance with folk modes, master new various syncopated rhythms, concentrate on even more complex elements, such as symmetrical modes, microchromatics and irregular rhythm. The digital world is familiar to today's students from their early childhood—all we just need to fill it with the necessary and useful content.

Summarizing the main conclusions of the article we can say that the use of such applications in academic educational music-theoretical courses can contribute to the solution of important general pedagogical and psychological problems. Among them:

– achieving greater freedom and expressiveness in performance;
– stimulating students for collective co-creation in improvisation;
– forming the ability to find unusual perspectives and new aspects of the use from information objects that were not initially aimed at solving academic problems;
– finding areas in the field of digital technologies that are attractive to young people;
– using them to increase the interest in music-theoretical studies among contemporary students;
– increasing the feeling of ethnic tolerance through the adoption of intercultural sound images and models.

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