

# Features Essential in a Music Tutoring System for Learning South Indian Classical Music

Arnita Saini<sup>1</sup>, S. Nikhil Siva<sup>2</sup>, Pradeep Yammiyavar<sup>3</sup>

<sup>1</sup>Department of Design, Indian Institute of Technology, Guwahati, Assam, India

**Abstract**— This paper reports the work done in identification of the essential features for the design of a Music Tutoring System for learning the South Indian Classical Music and the conceptualization of its Graphical User Interface. For this, surveys were conducted in two phases to understand the teaching styles and problems faced in the initial stages of learning of Western and Indian Classical Music. Further, an analysis of two of the existing Western Music Tutoring Systems was carried out based on the available literature and a generic framework of music tutoring was determined for which, the Kolb’s model of Experiential Learning was used. This was then compared with the results of the survey. In this comparison, the cultural differences and the differences in the music styles of Western and South Indian Classical Music were considered and used to outline a set of contextualized characteristics that a tutor of South Indian Carnatic Music should incorporate into its framework. Based on these features and characteristics, implications for graphical user interface and interaction design of such a tutor is subsequently suggested.

**Keywords**—Computer Assisted Musical Tutoring, South Indian Classical (Carnatic) Music, Customizing Learning environments, Cultural adaptation, Kolb’s Model of Learning, Graphical User Interface, User-centred Design.

## I. INTRODUCTION

In recent times, there has been a shift in learning from its traditional methods of one-to-one correspondence with a teacher and is exploring and adapting in various domains that use various electronic media. Such electronic media assume the role of a teacher for instruction purposes and impart education. In the context of this paper, this role is played by a ‘tutor’, an environment of computer assisted music instruction. This paper will discuss some previous projects in the field of computer based Western Music tutoring and through the comparison and study of which in the context of Indian Classical music tutoring, a framework emerges for designing of a counterpart tutor in the Indian context.

The Carnatic or the South Indian Classical Music is a part of the Indian Classical Music system.

Traditionally in Carnatic Music, knowledge has been passed on through generations by the Gurukula (Guru-teacher, kula-extended family) system, wherein the teacher, Guru imparts the knowledge to the student, Shishya orally [11]. Even in today’s times this knowledge is believed to be transferred best in the student-teacher context. A quick survey revealed that a number of such computer assisted musical tutors are available for learning Western Music, however, very few such tutors are available for learning South Indian Classical Music in computer assisted environments. Also that, availability of Carnatic Music teachers is mainly in the southern part of India. This need for tutoring of South Indian Classical Music has been an inspiration for development of a framework for Carnatic music tutoring. It is important however to understand the contextual and individual aspects of students while designing such music tutoring system as suggested by Higgins(1992) [13].

## II. BACKGROUND

Few of the existing computer assisted tutors of South Indian Classical Music have been discussed. Sishya [4] is a tutor intended at teaching Carnatic Music Vocals for beginners. Although it has basic features like hand gestures, adjustable tempo (the speed at which a composition is to be played) and shruthi (pitch), it lacks important features such as feedback, error correction, etc. Fig. 1 shows a screen capture of Sishya.

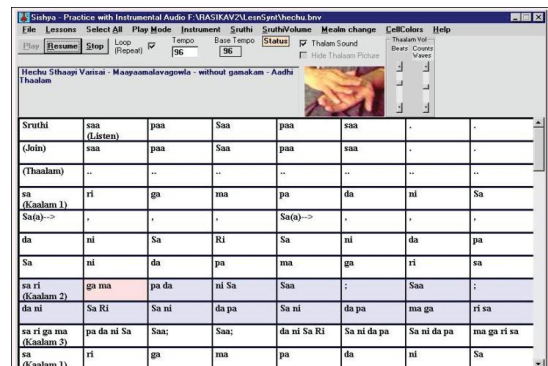
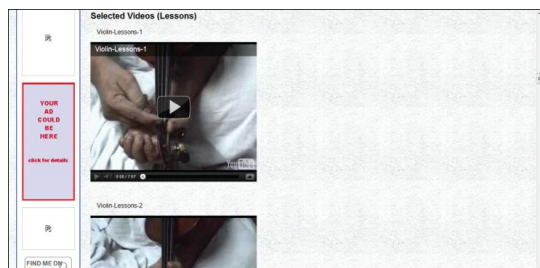
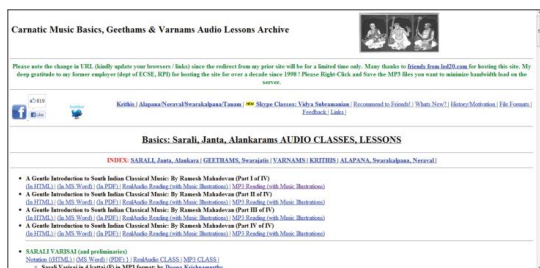


Fig. 1: Screen shot of Sishya [4]

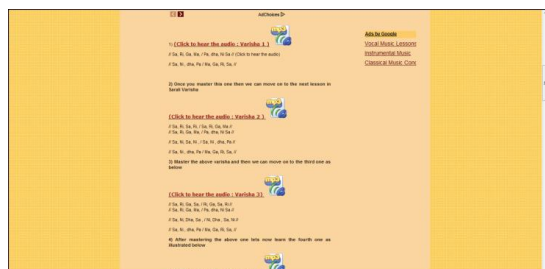
There are a few online tutors [2, 3, 7] (as shown in the screenshots below in Fig. 2, 3 and 4) with a collection of audio and video files for self-training by the students.



**Fig. 2: Screen shot of Violin Tutor [7]**



**Fig. 3: Screen shot of Carnatic Music Audio Lessons [3]**



**Fig. 4: Screen shot of Learn Carnatic Music Online [2]**

In contrast to this, a lot of research has been carried out in regards to computer based instruction of western music and many tutors exist for the same. Two of the prominent works done in this field include the Piano Tutor Project [5, 6] and Intelligent Music Tutor System, IMUTUS project [1, 12] and these have been analysed for understanding the framework for music teaching which will be discussed later in the paper.

### III. DATA COLLECTION AND ANALYSIS

Data was collected from subjects in the age group 16 – 22 years utilizing questionnaires, in two phases and music teachers were also interviewed. The sampling frame along with questionnaire and interview details are explained as follows:

#### A. Phase I: Questionnaire

Sample size: 20 (both male and female).

Average age: 20 years.

Average experience in music learning: 6 years (excluding the time of self-practice/learning).

Questionnaire details: A set of 12 closed/open ended questions were formulated with the following topics in considerations:

- (a) demographic information;
- (b) difficulties encountered in the initial stages of music learning;
- (c) methods adopted to overcome these difficulties;
- (d) amount of self motivated practice/learning;
- (e) basic course structure and in what steps the lessons were given;
- (f) use of online tutors for learning/reference and its disadvantages encountered
- (g) features desired in an online tutor.



**Fig. 5: Subject filling Questionnaire – Phase I**

#### B. Phase I: Questionnaire

Sample size: 6 music teachers.

Background: Hindustani – 2, Carnatic – 3, Western – 1.

Goal: Better understanding of the learning process involved in the different styles of music.

*Interview details:* Each interview session consisted of the teacher, an interviewer and a note-taker. A set of 10 open-ended questions were asked. Each interview lasted for an average of about one hour.

The questions were framed into majorly four domains of learning the basics of music, ear training (training the ear to identify the pitch differences, scale, etc.), testing of music skills and revision of lessons learnt.



**Fig. 6: Teacher Interview**

**C. Phase II: Questionnaires**

Sample size: 12 (both male and female).

Average age: 19 years.

Average experience in Carnatic music learning: 7 years.

Sample characteristics: Significant experience in learning of South Indian Classical Music.

Questionnaire details: The questionnaire was a set of three closed-ended questions:

- (a) Preferred mode of lesson instruction.
  - (b) Preferred mode of feedback presentation.
  - (c) Preferred type of Feedback (real-time/on-demand).
- four open-ended questions:

- (a) Problem areas in initial stages of learning.
- (b) Strategies adopted by teacher for better memorizing.
- (c) Features in the feedback of performance analysis.
- (d) Importance of Bhava (emotion) in learning.

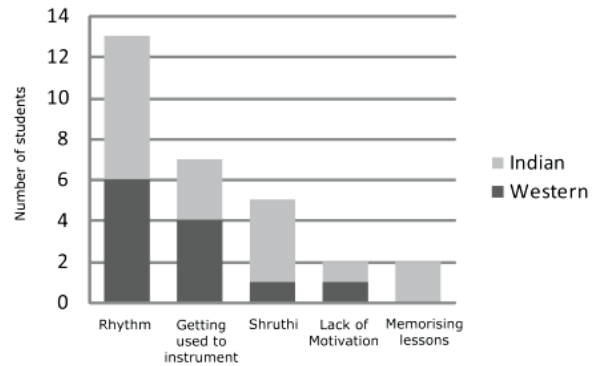


**Fig. 7: Subject filling Questionnaire – Phase II**

**IV. RESULTS**

**A. Phase I: Data Interpretation and Analysis**

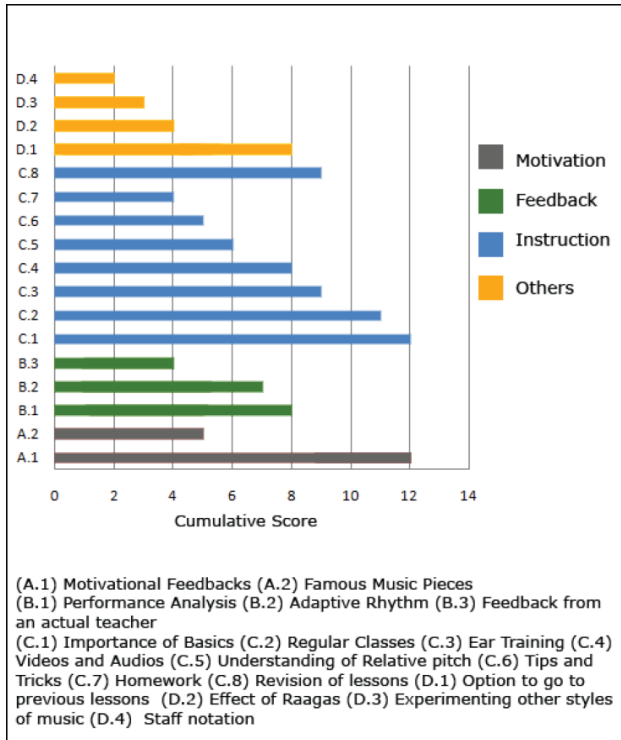
Data was analysed for two primary foci of analysis, the problems faced in the initial stages of music learning and the aspects of music learning that a tutor should incorporate. Fig. 8 shows the major problems faced.



**Fig. 8: Comparison of Major Problems in Music Learning**

The results show that problems like getting used to the rhythm and the instrument as well as lack of motivation were equally prominent in Western and Indian Classical Music, however, problems like understanding the *shruthi* (pitch) and memorizing lessons were predominant in Carnatic Music.

Next, the experience of experts in Carnatic Music was incorporated into data analysis to isolate the important aspects of a tutor in context of tutoring of Carnatic Music. Hence, an expert evaluation was carried out with 3 experts with more than 8 years of Carnatic Music learning experience. They were asked to rate the various features of a tutor that the survey yielded on a scale of 0 to 4, 0 being for the lowest order of importance and 4 being for the features of most importance. Fig. 9 shows the results of the expert evaluation conducted.



**Fig. 9: Results of Expert Evaluation**

### B. Results of Teacher Interviews

Collating answers of the subjective open-ended questions, following inferences have been deduced by the authors:

- (i) The major problems faced by students are in getting used to rhythm, instruments, and mostly in the accuracy of notes and pitch.
- (ii) In order to make sure that the student perfects his/her lessons, teachers use the strategy of repetition of lessons.
- (iii) All teachers identified ear training as vital and believed that it is gained through experience. They suggested listening to lots of songs as a means of improving the musical ear.
- (iv) Generally, a student is able to learn his/her lessons faster if the understanding of rhythm and pitch is ingrained in his/her mind properly from the start.
- (v) Revision is generally done only when the student feels the need for it.

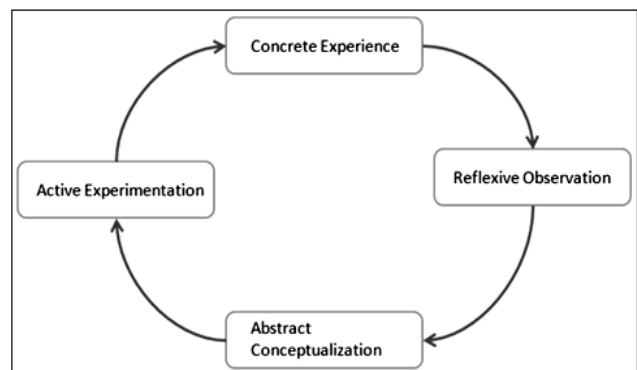
(vi) Some of the teachers employ standard tests conducted by universities to test the student’s learning before proceeding to the later stages of learning while some prefer their own judgment. Also, one of the teachers stated “Patience and motivation is very important while learning music.

### C. Phase II: Analysis

The data collected in the second phase of questionnaire as well as the music tutors available for Western Music tutoring were both analysed using Kolb’s Model of Experiential Learning (explained below). This was done with a view to map the effectiveness of Western tutors to the Indian context in regards to the various stages encountered in music learning.

*Kolb’s Model of Experiential Learning:* Kolb in his model of Experiential Learning [8], emphasizes that experience plays an important role in learning and conceives learning to be a four stage cycle, as shown in Fig. 10. According to this model, for learning to be effective, learners need four kinds of abilities:

- 1) Concrete Experience, the ability to involve themselves fully and openly and without bias in new experiences.
- 2) Reflective Observation, the ability to observe and reflect on these experiences from many perspectives.
- 3) Abstract Conceptualization, the ability to create concepts that integrate their observation into logical sound theories.
- 4) Active Experimentation, the ability to use these theories to make decisions and solve problems [8].



**Fig. 10: Kolb’s Model of Experiential Learning**



*D. Phase II: Data Interpretation and Analysis*

Application of Kolb’s Model on the data collected by the survey, the following findings were obtained.

*Abstract Conceptualization:* In the initial stages of Carnatic Music learning, the student is presented with lessons, thinking upon which he bases his concepts about those lessons. This is the abstract conceptualization stage of learning. In this stage the survey shows that more students preferred the video of the teacher as a better alternative for the delivery of the lesson over the other alternatives.

*Active Experimentation:* After receiving his/her lessons, the student proceeds to experimentation (doing/practice) stage of learning. The main problems faced by students in this phase are adapting to the correct rhythm, singing/playing in the right pitch, correct techniques of playing instruments, correct posture, recalling lessons he/she has learnt, etc.

*Concrete Experience:* After/during the practice, the student seeks for feedback from the tutor about his/her playing. Here, the students preferred real-time feedback on their mistakes/errors (58%) slightly more than a feedback on their own demand (42%). Also, they wanted features such as identification of mistakes in *Gamakas* (melodic ornamentation), pitch, tempo, raga, conveyed emotion, also comparison with actual music piece, etc.

*Reflective Observation:* After the feedback is given it is vital that the student observes and reflects upon these mistakes for efficient learning to take place. For this stage, the students prefer errors to be described in the form of dialogues like a teacher, over textual or graphic description of the errors.

Also, students opined that *Bhava* or emotion becomes important in later stages of learning and not very important while learning the basics of Carnatic Music. The students also believe that creation of a devotional atmosphere would give a deeper understanding of the music.

**V. ANALYSIS OF WESTERN TUTORS**

*A. Phase I: Data Interpretation and Analysis*

Two Western Music tutors, IMUTUS, Intelligent Music Tutoring System [1, 12] and the Piano Tutor Project [5, 6] were analysed for their instructional frameworks and features using the Kolb’s Model based on the available published literature. Table 1 shows a compiled observation of the study of both these tutors.

**TABLE I**  
 COMPARISON OF WESTERN MUSIC TUTORS USING KOLB’S MODEL OF EXPERIENTIAL LEARNING

	<b>Kolb’s stages of learning</b>	<b>IMUTUS Music tutor [1,12]</b>	<b>Piano tutor [5,6]</b>
A	Abstract Conceptualization		
1	Presentation of lessons	Graphic module (visualizations, annotations, tips)	Computer graphics display (text, visual, sheet music)
2	Method of instruction	Exercises based questions for ear training, music reading	Guidance from music teacher, music sheet lessons presented
B	Active Experimentation		
	Self-practice	Metronome, page turn facility	Music displayed, accompany student
C	Concrete Experience		
	Feedback	Real-time score position, 3 errors shown at once, error position, correct techniques, grade every performance on scale of 3, positive feedback	Verbal feedback, with graphic/video, highlight error notes, run-time tempo suggestions, follow student performance, dialogue feedback
	Performance Analysis	Done by virtual teacher	Seems like a real teacher
	Learning Decisions	Give scope for exploratory learning	Prerequisite based lesson enabling
D	Reflective observation		
	Self-judgement	Self-judged error remedy strategy	Self-analysed error improvement in practice mode
	Error correction	Repeat exercise or similar one, new exercises	Check target error and other correctable errors

**VI. DISCUSSIONS**

In order to outline the features of a tutor for tutoring Carnatic Music, by comparison with the framework of western music tutors and to incorporate the results of the surveys conducted, it becomes necessary that differences between the two styles of music and the cultural differences are kept in mind while doing so.



**International Journal of Recent Development in Engineering and Technology**  
Website: [www.ijrdet.com](http://www.ijrdet.com) (ISSN 2347 - 6435 (Online)) Volume 4, Issue 11, November 2015)

Here, we propose the suggested characteristics that should be incorporated in framework design of a Carnatic Music tutor.

*A. Involvement of Teachers*

According to the phase II survey done, it is observed that the students prefer learning from a teacher even in an online environment rather than mere textual, graphics or animated delivery of knowledge. This involvement of a teacher in the learning process could be in the form of verbal explanations, feedbacks in the form of dialogues by a teacher, videos of teachers pointing out the errors or showing the corrections, etc. This is further supported by the following two concepts.

- 1) *Guru-Shishya*: The knowledge of Carnatic music has been conveyed through generations from the teacher to the student orally. Also, the syllabic notations (notation for the notes in a musical piece) commonly used in Carnatic music do not incorporate the melodic detailing[11]. Hence the role of the Guru becomes vital in the transfer of this melodic aspect of music orally and helps to inculcate a sense of understanding of Bhava or emotion pertaining to a particular song or lesson: In the initial stages of Carnatic Music learning, the student is presented with lessons, thinking upon which he bases his concepts about those lessons.
- 2) *High Power Distance*: Cultural analysis of Indian population by the Hofstede Dimensions of National Culture, show that India has a high power distance index (80) [9]. This high power distance index has in the context of teaching and learning, suggests that students in such a country treat their teachers with due respect, gain personal wisdom from them, and are thus dependent on them for knowledge and learning [9].

*B. Ear Training*

In Carnatic Music, it is possible to have more than 12 melodic entities with minute variations from each other, in an octave [10]. Such subtle variations in pitch need a well trained ear to identify the intrinsic differences. Also, from the survey it has been found that students generally find difficulties in maintaining the *shruthi* or the pitch, the correct understanding of *swarasthanas*, the position of the notes and *gamakas*, the melodic ornamentation. Hence it is suggested that the tutor must have the following:

- 1) *Lesson-focussed ear training*: Ear training lessons should be included in the lessons although not as a separate module, but it should work in tandem with the lessons for better understanding. Exercises such as finding the basic pitch differences, relative positioning of notes, etc. should be incorporated in these ear training lessons.
- 2) *Library of songs*: The tutor must also have a library of songs, musical pieces, related to the particular raga, the scale or the particular lesson. As an outcome of the teacher survey, it is known that listening to a lot of songs helps students develop their musical ear. In modern times repeated listening to recordings of live concerts, commercial studio productions and broadcast enable most musicians to analyze and memorize complex improvised musical passages [11].
- 3) *Self-judgement*: To train the musical ear of the student, he/she must be trained in self judgment of his/her own performance. This could be done by incorporating a system of receiving feedback on the demand of the student and also pointing out only the major errors real-time as the student performs.

*C. Teaching Strategy*

In Carnatic Slow pacing of the lessons is absolutely essential in understanding the intrinsic details of the lessons and ragas. Countless repetition and recall is also essential in understanding of the essence of the lessons. Breaking down of the lessons into smaller modules can be adopted to improve the understanding as well as memorizing of the lessons.

VII. IMPLICATIONS

*A. Phase I: Data Interpretation and Analysis*

Based on the above discussion, an attempt is made to conceptualize an instructional framework and a graphical user interface for such a tutor. The following are the features proposed for a Carnatic music tutor.

- (i) For better understanding of the pitch differences and the raga in a particular lesson, ear training before instruction of the lesson has been incorporated.
- (ii) Each lesson is divided into modules to facilitate better understanding and easier memorizing of the lessons.
- (iii) To employ the concept of teacher involvement, the lessons are instructed to students through videos of a teacher explaining the lesson.

(iv) Along with the video, syllabic notations and the key-points of that lesson are shown in the summary.

(v) While practicing, real-time feedback points out the major errors as dialogues of a teacher, example, “you are going too fast, slow down”.

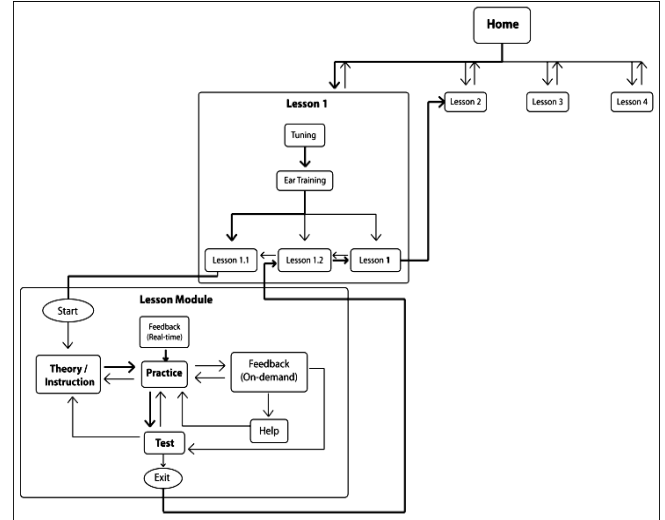
(vi) Detailed analysis of practice is given on the student’s demand in order to improve his/her self-judgment skill.

(vii) The help feature includes error corrections suggested in the form of dialogues by a teacher, example, “go back to practice and count the *taal* along with the lesson without playing”.

(viii) A library of songs pertaining to the lessons, to give a better understanding of the raga and also the bhava of the song. Additionally, the library contains a collection of concert videos of famous musicians.

(ix) Keeping in mind the cultural and historical richness of South Indian Classical Music, a section of interesting facts is included for motivation and a sense of appreciation for the Classical style of Music.

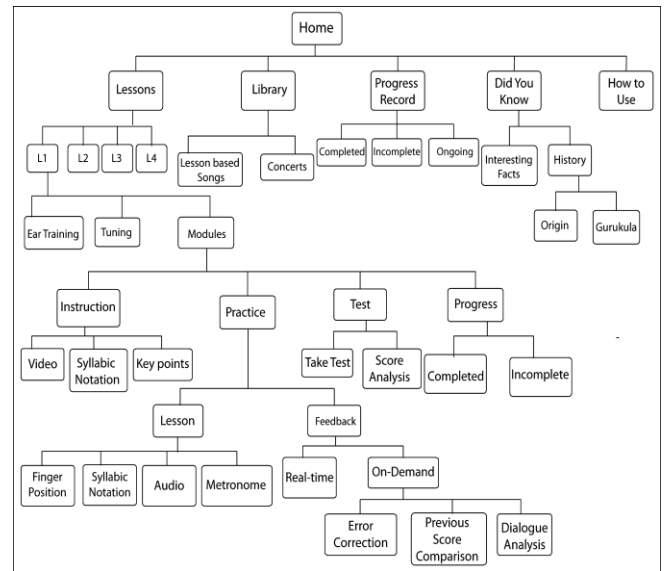
(x) To make sure that a student completes all his lessons sequentially, the tutor records and shows the student’s progress and the lessons are given to student only if the progress record of the previous lesson shows complete.



**Fig. 11: Navigation Diagram of Lesson Instruction**

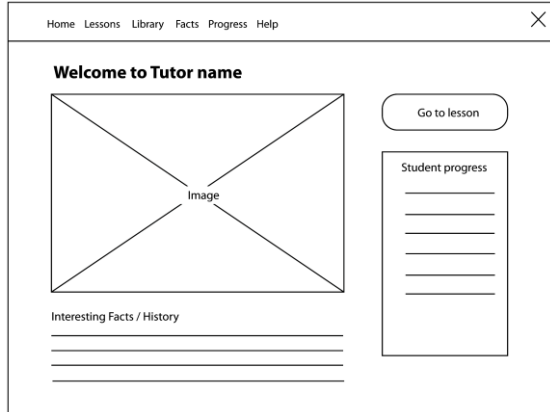
Fig. 11 shows the Navigation diagram of the user while he/she is learning a particular lesson, example, lesson module 1.1 of lesson 1. The student starts by receiving the instructions, then he/she practices his/her lessons while receiving real-time feedback. He/ She may or may not choose to receive additional feedback and error corrections and proceed to take the test. He/ She then proceeds to the next lesson on successful completion of the test.

Fig. 12 shows the proposed information architecture of the tutor shown as a tree hierarchy. Figures 13, 14 and 15 show the wireframes of the screens of the tutor when the student is at the home screen, receiving instructions and practising the lesson respectively.

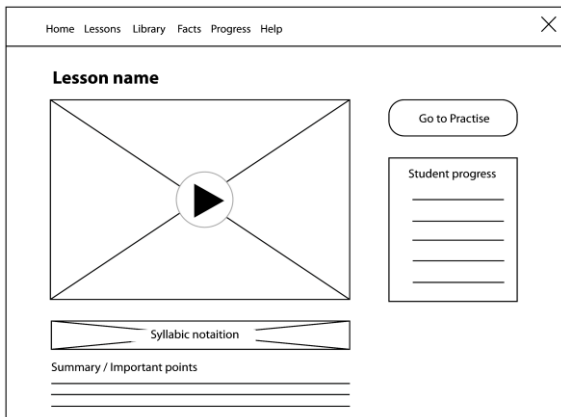


**Fig. 12: Information Architecture**

In the home screen interesting facts, history, tips and suggestions to improve singing or proper maintenance of the instrument are shown at the bottom of the screen. Also a progress card is shown to the right of the interface.

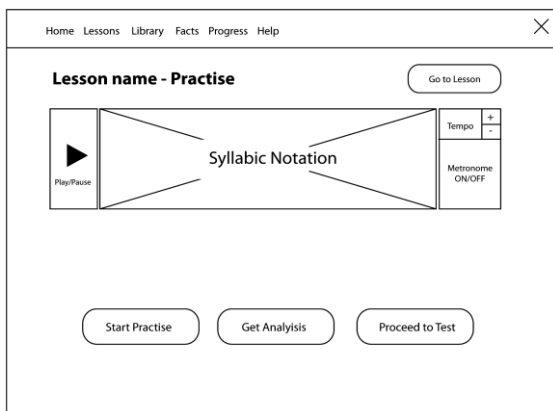


**Fig. 13: Wireframe of Home screen**



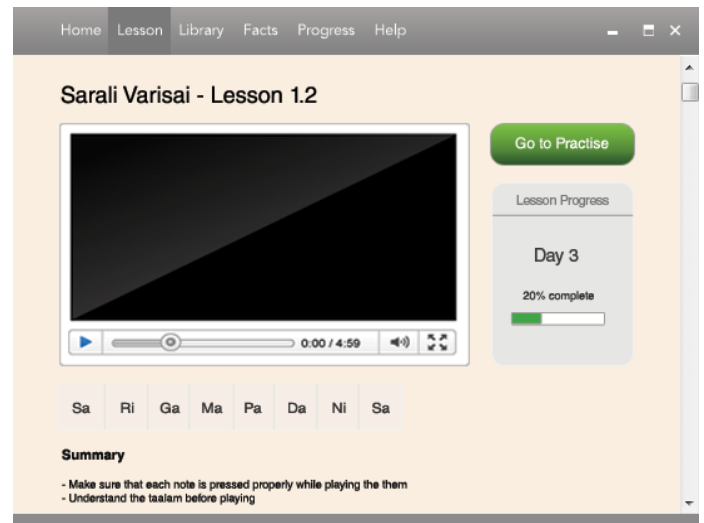
**Fig. 14: Wireframe of Lesson screen**

Here, a summary of the important points mentioned by the teacher when instructing the lesson are given. Progress bar to the right shows the progress in that particular lesson.



**Fig. 15: Wireframe of Practice screen**

Here, the student has the option for using a metronome (clicking pendulum to help adapting the tempo of a piece of music) while practising. Also, the tempo control is given to enable to student to adjust the tempo of the lesson so that he/she can increase it from slow initially to the actual tempo. Fig. 16 is a high fidelity wireframe showing the lesson screen of the tutor.



**Fig. 16: High-fidelity wireframe**

### VIII. CONCLUSION

In this paper we have discussed the problems and difficulties encountered while learning music in the initial stages, frameworks of the western music tutoring systems and the strategies adopted by them in tutoring music. After getting a basic understanding of the culture and music differences of the two styles of music, we propose a set of features that must be incorporated into the design of a framework for South Indian Classical Music (Carnatic) tutor.

This study stresses the importance of incorporating the experiences gained by learning from an actual teacher into the computer assisted tutor. Ear training has been identified as a very important aspect of learning Carnatic music as also slow pacing, countless repetition and breaking down of lessons to smaller modules which are important for efficient instruction and learning of this style of music.

An efficient music tutoring system can be designed on the basis of the proposed key features. To illustrate the implications suggested, an architecture and wireframes for a tutor are presented in this paper. The researchers further plan to implement the conceptualized framework into the designing of such a product.





**International Journal of Recent Development in Engineering and Technology**  
**Website: www.ijrdet.com (ISSN 2347 - 6435 (Online)) Volume 4, Issue 11, November 2015)**

*Acknowledgement*

The authors thank all students, experts and teachers who volunteered during data collection and analysis.

**REFERENCES**

- [1] Askenfeld, A. et. al., 2002. IMUTUS An Interactive Music Tuition System. In: Acoustical Society of America Journal, 2348.
- [2] Carnaticindia, 2006. Learn Carnatic Music Online [online]. Available from: [http://www.carnaticindia.com/learn\\_music.html](http://www.carnaticindia.com/learn_music.html), [Accessed 8th February 2014].
- [3] Carnatic Music Basics, Geethams & Varnams Audio Lessons Archive [online]. Available from <http://www.shivkumar.org/music/varnams/index.html>, [Accessed 8th February 2014]
- [4] Carnatic Web Ring. Sishya - Carnatic Music Tutor [online]. Available from: <http://carnatic2000.tripod.com/sishya.htm>, [Accessed 8th February 2014].
- [5] Dannenberg, R., B., et. al., 1989. Computer-Based Multi-Media Tutor for Beginning Piano Students, Journal of New Music Research, 19(2-3), 1990, pp. 155-173.
- [6] Dannenberg, R., B. et. al., 1993. Results from the Piano Tutor Project, In: Proceedings of the Fourth Biennial Arts and Technology Symposium, Connecticut College, pp. 143-150.
- [7] David and Chandrakantha Courtney, 2012. Music of India [online]. Available from: [http://chandrakantha.com/articles/indian\\_music/violin.html](http://chandrakantha.com/articles/indian_music/violin.html), [Accessed 8th February 2014].
- [8] Experience Based Learning Systems, Inc., 2012. Learning styles and disciplinary differences [online]. Available from: <http://learningfromexperience.com/media/2010/08/Learning-styles-and-disciplinary-difference.pdf>, 235-236 [Accessed 9th March 2014].
- [9] Hofstede, G., 2001. Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations, Second Edition, Thousand Oaks CA: Sage Publications.
- [10] Krishnaswamy, A., Multi-Dimensional Musical Atoms In South Indian Classical Music. [online] Available from: <https://ccrma.stanford.edu/~arvindh/cmt/icmpc04.pdf>, [Accessed 8th March 2014].
- [11] Pesch, L., 2009. The Oxford Illustrated Companion to South Indian Classical Music. New Delhi: Oxford University Press.
- [12] Raptis, S. et. al., 2005. IMUTUS – An Effective Practicing Environment For Music Tuition. In: Proceedings of International Computer Music Conference, United States, 383-386.
- [13] Webster, P., R., 2005. Computer-Based Technology and Music Teaching and Learning [online]. Available from: <http://www.peterwebster.com/pubs/Bresler.pdf>, [Accessed 9th March 2014].