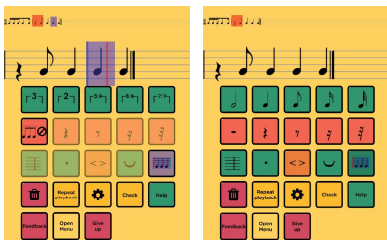


The Rhythmic Dictator: Does Gamification of Rhythm Dictation Exercises Help?

Abstract

We present the development and evaluation of a gamified rhythmic dictation application for music theory learning. The application's focus is on mobile accessibility and user experience, so it includes intuitive controls for input of rhythmic exercises, a responsive user interface, several gamification elements and a flexible exercise generator. We evaluated the rhythmic dictation application with conservatory-level music theory students through A/B testing, to assess their engagement and performance. The results show a significant impact of the application on the students' exam scores.



Rhythmic dictation exercise interface with primary and secondary inputs.

Motivation

Music theory learning in its current form presents several challenges, for both teachers and students.

Students' challenges:

- Usually done with pen and paper
- Takes too long to get feedback

Overhead for teachers:

- Preparation of exercises
- Obtaining and grading hand-written exercises

Solution

Our goal is to address these needs by developing a framework for computer-assisted music theory learning. Through interviews we obtained the following requirements:

- Framework should automatically generate exercises, collect responses, give instant feedback and „grade“ the responses
- Track students' progress and points/badges
- Provide a progression structure (levels)
- Free to use, easily upgradable
- Should be accessible to students on their phones
- Modifiable to meet the curriculum standards
- Modifiable to meet the needs of students on different learning levels

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The Rhythmic Dictator

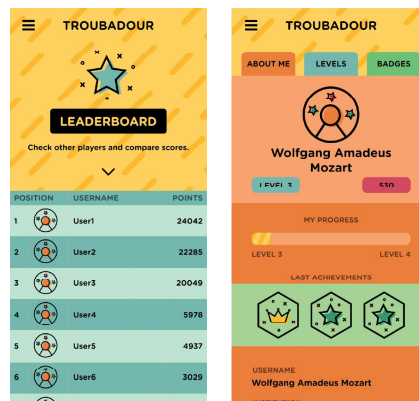
We developed the Rhythmic Dictator - an application for rhythmic dictation training with an intuitive environment for ear training. The application automatically generates the exercises with varying difficulty, based on the achieved difficulty level. It gives instant feedback and rewards the player with badges and points for each solved exercise. The application is incorporated into the Troubadour platform, which is our open-source mobile-friendly web platform, which integrates gamification elements, user management and statistics. It is easily upgradable with new applications and supports simple maintenance and development of new applications (no native mobile development needed).

Technical details

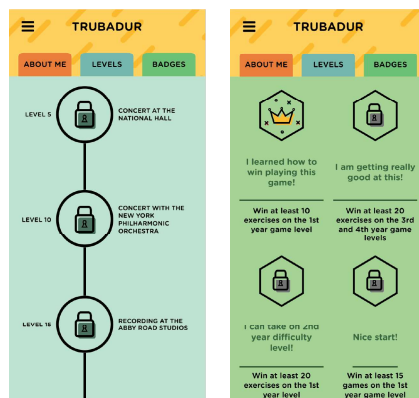
- Laravel backend (PHP) + MySQL
- Frontend in Vue.js (API communication with backend)
- JavaScript libraries: Axios, Loadash, Moment.js, BEM

Gamification elements

We incorporated several gamification elements into the platform, including instant feedback, points, badges, levels, time limit, progress bars and avatars.



Leaderboard and the user profile with avatar, levels and progress bars in the platform.

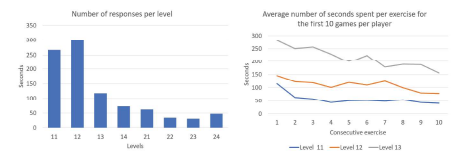


Progression levels and achieved badges for a variety of difficulty levels, different time-limited and performance challenges.

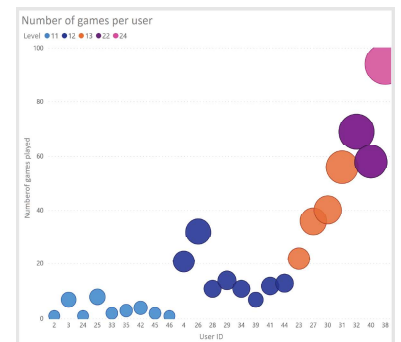
Experiment

We performed an experiment in which we gave access to the application to two student test groups, one first- and one second-year at the Conservatory of music and ballet, Ljubljana.

We compared their results to two control groups in a conventional rhythmic dictation exam. The test groups students, who used the rhythmic dictation application, achieved a better score: a **4% grade increase** among the first-year students, and a **19% grade increase** among the second-year students. The comparison between the control and the test groups showed a positive impact of the application's use on exam results, which was statistically significant for second year test student group.



We also evaluated the user interface and the students' experience with the application. Additionally, we tracked their engagement through exercises. The time spent per exercise gradually decreased within each level.



Number of games per individual users and the levels they achieved.

The students also reported a very positive experience with the application, which was further substantiated by the claim that most of them would recommend the application to their friends. The students, therefore, supported the idea of an application, which offers them a modern medium of learning music theory as an additional tool for ear training and music theory learning. The developed interface for rhythmic dictation was considered easy to use.

Future work

Our future work includes new applications (chord dictations, progressions, harmonization), as well as new platform support modules, such as exams, multiplayer challenges and individualization of exercises. We also plan on including more advanced gamification aspects. To aid students with different levels of knowledge, we plan on further exploring personalised scenarios and personalised automated exercise generation to ease the learning curve, retain engagement and consequently improve performance.