Music Blocks

What is Music Blocks?

- Music Blocks is a visual programming language for music.
- Music Blocks is an open-ended tool for learning.

A teacher and a student using the Music Blocks software in music class
The potential of children is limitless.

• An important concept embodied by this software is:
  - Low Floor (低い床)
  - Wide Walls (広い壁)
  - High Ceiling (高い天井)

• Anyone can start easily, do many things, and achieve a very high level with the Music Block software.
Teaching for Understanding

“You never understand something unless you understand it in more than one way.”

「ひとつ以上の方法を知るまでは、ものごとを理解したことにはならない。」
- マービン・ミンスキー
Marvin Minsky

Marvin Minsky

日本国際賞
1990年
「人工知能の確立」
マービン・ミンスキー
Math and Programming through Music

- Children who are already comfortable with music learn math and/or programming by making music.
- Children who are more comfortable with math and/or programming will reinforce their knowledge as well as learn more about music, an important skill.
Interdisciplinary Approach

● Music, math, and computer programming share many of the same fundamental concepts. By learning concept in one discipline, it prepares you for another discipline.

● Moreover, a cross-disciplinary approach is critical to achieving a working understanding of a subject.
Music Fundamentals

• Unlike other coding languages (e.g. Scratch), Music Blocks was created with tools that are important to making music.

• Music pedagogy has a well-established history and reputation that can be used to maximize learning.

ミュージック・ブロックスからエクスポートされた「キラキラ星」の歌の楽譜です。
What is essential to Education?

Freedom

• Music Blocks is licensed as “free software” (自由ソフトウエア).

• Free Software has four important freedoms. In practical terms, those freedoms allow students to exercise creativity.
Collaboration with Children Worldwide

- The source code for Music Blocks is published on Git Hub (github.com).
- Students from around the world have contributed, learning valuable skills in the process.
Music and Math Data Visualization
Movement over Time, Dance

ネズミのキャラクターがリズムカルなダンスをするようにプログラミングが作れます。
MIT と NEC の教授の共同

マサチューセッツ工科大学 (MIT)
Mr. ワルター・ベンダー

ニューハイグランド音楽院 (NEC)
デビン・ウリバリ

- OLPC「子供一人に一つのパソコン」と共同設立者
- SugarLabs「シューガー・ラボ教育ソフト」共同設立者
- MIT メディアラボ 2 代目所長

- CMIE (私立音楽教育センター) 学生向け音楽カリキュラム研究者兼編集者
- MA 州モルデン市公立中学校「Learn Code and Music! 」教師
MB のそれぞれのウェブサイト

ミュージック・ブロックス (MB) のリンク

・ ブログ - https://musicblocks.net
・ 試せるリンク - https://play.musicblocks.net
・ 案内書 (日本語) - https://github.com/walterbender/musicblocks/guide-ja/
・ 案内書 (英語) - https://github.com/walterbender/musicblocks/guide/
・ ソース・コード (Javascript) - https://github.com/walterbender/musicblocks/
Music Blocks in Japan

2017年末、日本（京都）の中学生の授業（パンがエアン）
Benefits of Musician-Teachers

● Music pedagogy does well to teach young children (i.e. from elementary grade level) to do relatively complex tasks (e.g. perform complex pieces of music).

● Music pedagogy already has many valuable resources that may be utilized.

● Music has been proven to make you smarter, happier, and improve socio-emotional skills.

● Music is a “universal language”; multicultural
Utilizing Japan’s Trained Musicians: Jobs

<table>
<thead>
<tr>
<th>What:</th>
<th>Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musicians in Japan</td>
<td>115,020</td>
</tr>
<tr>
<td>Full-Time, Hired</td>
<td>17.9%</td>
</tr>
<tr>
<td>Part-Time, Hired</td>
<td>8.2%</td>
</tr>
<tr>
<td>Non-hired:</td>
<td>73.9%</td>
</tr>
</tbody>
</table>

*ref.: 2005 national census by Ministry of International Affairs and Communications
# Breakdown: Elementary School Lesson

<table>
<thead>
<tr>
<th>Time Range</th>
<th>Activity Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>~7-15 minutes</td>
<td>Musical Warm-up. No computers. Singing, Instruments, and Ear Training.</td>
</tr>
<tr>
<td>~7-15 minutes</td>
<td>Structured Activity. Students use Computers. Create a particular song, learn a key concept.</td>
</tr>
<tr>
<td>~7-15 minutes</td>
<td>Open-ended Activity. Students utilize the skills learned to create their own projects.</td>
</tr>
<tr>
<td>~5-10 minutes</td>
<td>Presentations and Reflection. Students show their work to their peers. Students reflect upon what they have learned.</td>
</tr>
</tbody>
</table>

[Click Here for Example Lesson](#)
## Breakdown: Elementary School Term

<table>
<thead>
<tr>
<th>Before Classes (if possible)</th>
<th>Assess students’ familiarity with music, math, and coding</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1st Phase: First Few Weeks</strong></td>
<td>Reinforce basic musical concepts (pitch, rhythm, musical structure)</td>
</tr>
<tr>
<td><strong>2nd phase</strong></td>
<td>Slowly introduce abstract concepts in an age-appropriate way.</td>
</tr>
<tr>
<td>Whenever Possible</td>
<td>Presentations for peers and for school.</td>
</tr>
<tr>
<td><strong>3rd phase</strong></td>
<td>Begin larger projects that utilize multiple fundamental concepts simultaneously.</td>
</tr>
<tr>
<td><strong>Final Projects</strong></td>
<td>Students Showcase their work at their school as well as community spaces.</td>
</tr>
<tr>
<td><strong>Optional</strong></td>
<td>5th grade students participate in regional competitions; possibly utilizing simple robotics as well.</td>
</tr>
</tbody>
</table>
Elementary School: Possibilities

中学生がミュージック・ブロックスで作った
「チューリップ」の曲
Scaffolding for Success

• Music: Many elementary school age children taking are already learning complex tasks.

• Musician Teachers: Already skilled in teaching music, which would be the starting point for Music Blocks education.

• Shared Concepts: A successful class is one where the shared concepts between disciplines are pointed out.
Simple Beginnings: Shared

• Preparing for complexity requires reinforcement of basic concepts.
• Music shares fundamental concepts with other disciplines.
Simple Beginnings: Unique

- Although music shares concepts with other subjects, it is unique as well.
- Learning harmonic and counterpoint reinforce important cognitive skills that are impossible to learn solely with other disciplines.
What are the “shared concepts”?

- Different forms of literacy, critical to understanding
- Mathematical concepts
- Form and structure
- Teamwork, harmony
- Work ethic (preparing presentations of one’s work)
Shared Concept: Arithmetic, Ratios

2 \times 2

5:10 hertz
1:2

2:1

Armstrong-Schöck 91035t fr 55Hz 110Hz 220Hz 440Hz 880Hz 22Hz

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ミュージックブロックス
Shared Concept: Graph Literacy
Shared Concept: Retrograde and Inversion

A plot generated with Music Blocks software, created from Bach’s Crab Canon (18th century)
Shared Concept: Logic
Shared Concept: History and Innovation
Shared Concept: Math and Geometry
Shared Concept: Variables
# Shared Concept: Fractions

<table>
<thead>
<tr>
<th>Scale Degree</th>
<th>Interval</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perfect Unison</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Major 2nd</td>
<td>9/8</td>
</tr>
<tr>
<td>3</td>
<td>Major 3rd</td>
<td>81/64</td>
</tr>
<tr>
<td>4</td>
<td>Perfect Fourth</td>
<td>4/3</td>
</tr>
<tr>
<td>5</td>
<td>Perfect Fifth</td>
<td>3/2</td>
</tr>
<tr>
<td>6</td>
<td>Major Sixth</td>
<td>27/16</td>
</tr>
<tr>
<td>7</td>
<td>Major Seventh</td>
<td>243/128</td>
</tr>
<tr>
<td>8 (= 1)</td>
<td>Perfect Octave</td>
<td>2/1</td>
</tr>
</tbody>
</table>
Musical Pedagogy: A Rich History

Image taken from an old general music textbook.

There is a long history and Cultural in music pedagogy of successfully teaching children complex concepts from a young age.

“The Farmer in the Dell”  
English Children’s Song

Source: “Dance in Elementary School Education” – Ruth Murray
Musical Representations from Field

Context: Elementary School Age Children (5-9)

Skills Learned:

- Reading Letters
- Reading Symbols
- Pitch over time (2D graph)
- Relations, Proportions
Lilypond Code in Primary Education

Context: Music class with elementary school-age children

Skills Learned:

- Interpretation of abstract information
- Decoding information
- Reinforcement of learned concepts

Image of Lilypond output given to elementary school children. Music Blocks exports to Lilypond.
Math and Code, Learned with Heart

- Creative activities makes learning fun.
- Music is a fun way to learn math and code.

Scaling for a National Program

Presenting Music Blocks at to guest students from China.
# National Program: Needs

<table>
<thead>
<tr>
<th>Need</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>A network of teachers, primarily made up of musician-teachers, trained to teach math and code through music.</td>
</tr>
<tr>
<td>Teacher Trainers</td>
<td>A network of trainers prepared to work together with teachers to help them teach music in a multi-disciplinary way.</td>
</tr>
<tr>
<td>Translators</td>
<td>A small team to help translate unit and lesson plans as well as worksheets that would be utilized by teachers and students within the classroom.</td>
</tr>
<tr>
<td>Channels of communication at all levels</td>
<td>We need to communicate and coordinate our efforts to ensure that teachers are getting the support that they need in order to effectively teach, and that trainers and administrators get feedback as to what is effective</td>
</tr>
</tbody>
</table>
Obstacles and Opportunities

Photo by Devin Ulibarri.
Albuquerque, NM 2016
Thank you!

Let’s discuss the opportunities and challenges and create an action plan.