



Programming STEAM projects in Scratch



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About Scratch

- developed & managed by the Lifelong Kindergarten Group at the MIT Media Lab, led by Mitchel Resnick
- follower of Logo culture, supporting constructionist approach to learning, “imagine, program, share”
- satisfies good properties for programming language for pupils – low-floor, high-ceiling, and wide-walls
- online community (<http://scratch.mit.edu/>), Scratchers can share, discuss and remix their artifacts (interactive stories, games, animations, and simulations) each other



Learning objectives (1)

- to understand commands in Scratch for playing sounds, setting and getting sound parameters and to apply them for programming of sound and music projects,
- to strengthen basic programming concepts (e.g. variables, loops, branching, procedures, lists, recursion, concurrent execution of code, broadcasting),
- to develop musical skills and creativity of pupils by creation of useful and valuable musical artifacts,

Learning objectives (2)

- to develop inquiry skills and understanding of basic concepts of physics, music, languages by development of tools in Scratch for data visualization and audialization,
- to learn more about pupils' abilities in perception and making of sounds and music,
- to develop communication and team skills, thanks to publishing, commenting, sharing and remixing projects in Scratch community.

Conditions for Learning (1)

- inducing creative, open and pleasurable atmosphere in a class, where pupils can solve their own problems with none or little help from a teacher and discuss freely,
- preparing collections of interesting and valuable projects which are suitable for ordinary pupils not only for audio and music enthusiasts,
- preparing various types of teaching aids, e.g. motivational video, stories and ready-made projects, half-baked projects, worksheets,



Conditions for Learning (2)

- using heuristic dialogues which support pupils' understanding of subject matter and also their inquiry skills,
- establishing of Scratch studios on Scratch portal where teacher and pupils can publish, comment and remix projects with sounds and music.



A screenshot of the Scratch portal showing a list of four studios. Each studio entry includes a thumbnail image, the studio title, creation date, owner name, and a 'Delete' button. The studios are:

Thumbnail	Studio Title	Created	Owner	Actions
	Výučba programovania v Scratch	21.03/2014	Owner	9 0 Delete
	Klub učiteľov informatiky	28/11/2013	Owner	21 0 Delete
	Let's do music	01/11/2013	Owner	9 0 Delete
	Informatický krúžok	14/10/2013	Owner	20 0 Delete

Sound and music projects

- Motivational
- Bridging programming & musical concepts
- Inquiring pupils' abilities in perception & making sounds
- Creative



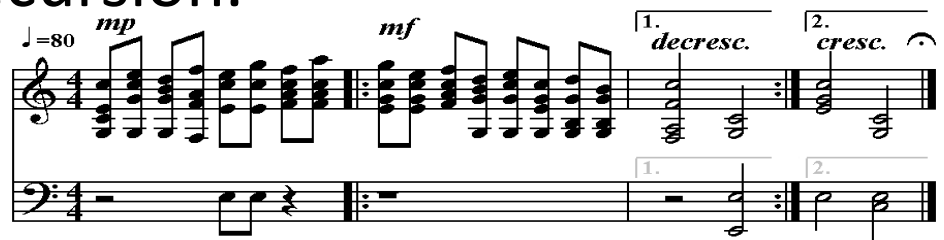
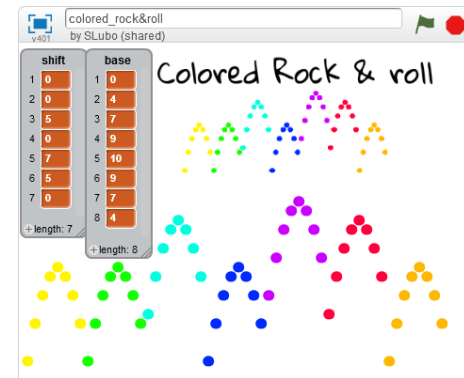
Motivational projects

- Animated and musical greetings cards
- Jokes and stories
- Multimedia dictionary (with Makey-Makey)
- Musical instrument
- Multimedia visit card
- ZOO
- Multimedia encyclopedia of musical instruments
- Jukebox



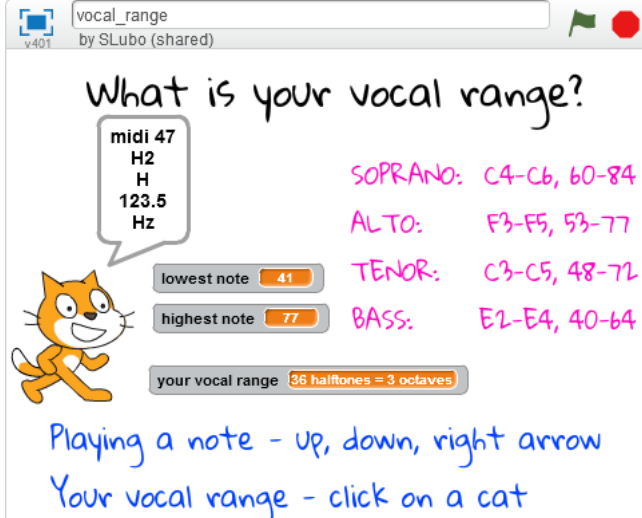
Projects bridging programming & musical concepts

- Pairs: playing chords – threads (parallelism), sequences of notes – data structure list, repetition of notes – loop, prima/seconda volta – branching, song refrain – procedure
- [Jingle](#) – parallelism.
- [Karaoke of a children song](#) – procedures.
- [Colored rock-n-roll](#), [visualized own song](#) – loops, lists.
- [Singing binary tree](#) – recursion.



Projects inquiring abilities in perception & making sounds

- [What is my vocal range?](#)
- [Vocal warm-up](#)
- Sound pexeso
- Sound quizzes
- Rhythmic clapping game



vocal_range
by SLubo (shared)

What is your vocal range?

midi 47
H2
H
123.5
Hz

lowest note 41

highest note 77

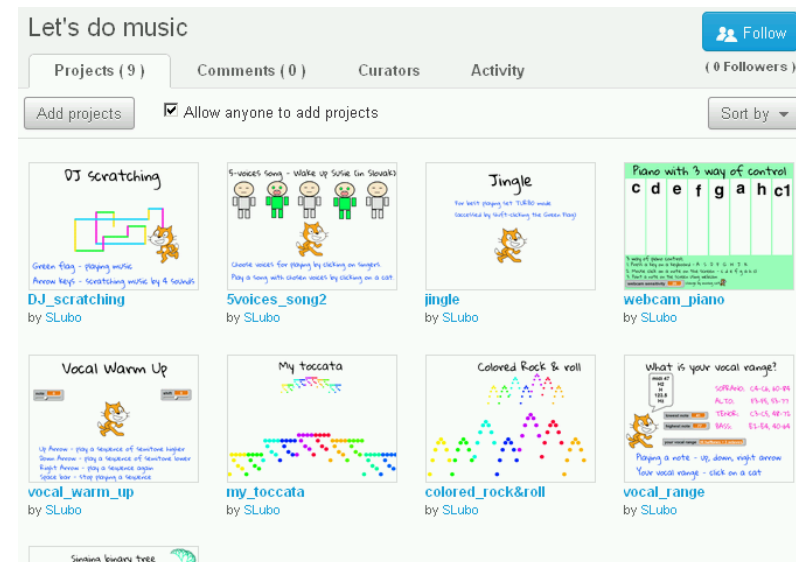
your vocal range 36 halfnotes = 3 octaves

SOPRANO: C4-C6, 60-84
ALTO: F3-F5, 53-77
TENOR: C3-C5, 48-72
BASS: E2-E4, 40-64

Playing a note - up, down, right arrow
Your vocal range - click on a cat

Musical & programming creative projects

- [5-voices song](#) – song with 5 harmonized voices which can be selected for playing.
- [Jingle](#) – midi-like composition with 1 leading melody and 3 drums.
- [DJ](#) – song with 4 scratching sound effects.



Conclusions

- Our methodology – not only pure programming, development of musical and programming creativity, connections with physics, music
- Constructionistic approach – useful artifacts creation
- Online community - learning and living collaboratively
- Designing of methodology in design cycles – studying, programming, preparing teaching aids, teaching, discussing and publishing results

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