universität innsbruck

BlockQuiz: Web-Based Block Programming Platform with Auto-Grading for students

Quality Engineering Research Group

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Outline

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2. Requirements
3. Planned features
4. Blockly
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Motivation

Teaching children programming in an engaging way:

- **Problem:** Existing tools (Scratch, Tynker, MakeCode) are too open-ended or game/hardware-bound
- **Need:** Focused, auto-graded puzzles with clear learning goals per task

Solution: A web-based platform with short, constrained programming exercises inspired by Brilliant.org

Requirements

- Customizable block based programming examples
- Content management system for courses and exercises
- Easy to use interface for students and teachers
- Auto-graded, grading support for exercises
- Feedback support for students

Planned Features

- Generated output: Text, code or 2D graphic
- Per-exercise constrained block toolbox (reduces cognitive load)
- Multi-level hints system
- Deterministic auto-grading with public & hidden test cases
- JSON-based import/export for blocks

Out of Scope:

- Full classroom management (Kahoot-style)
- Complex simulators beyond 2D turtle graphics

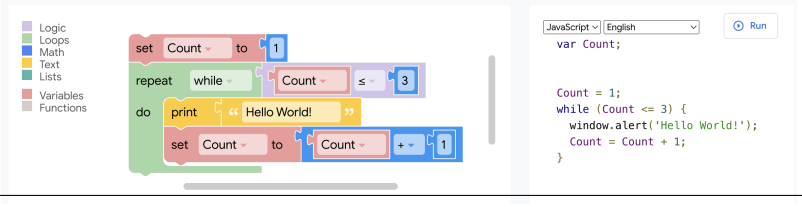
Blockly

Blockly [1] is a visual programming editor from Google

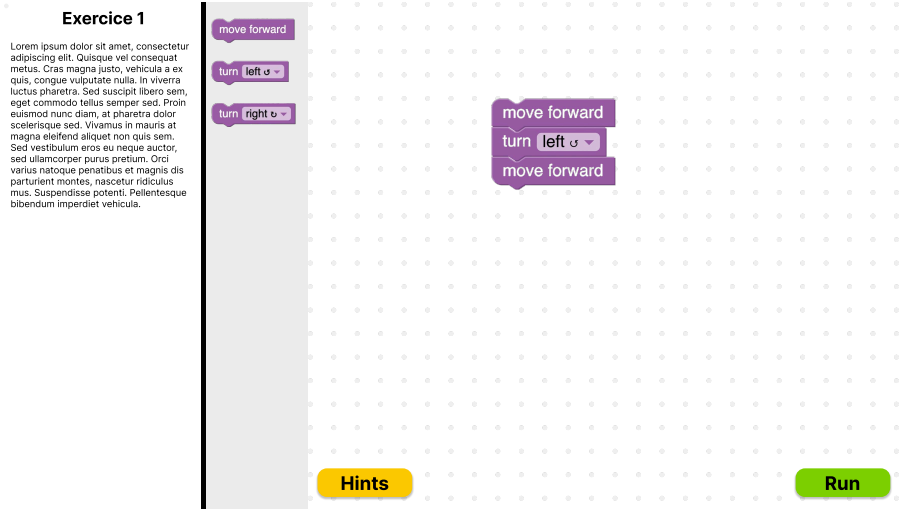
- Drag-and-drop blocks generate executable code
- Fully customizable: per-exercise toolbox, block definitions, code generators
- Ideal for constrained learning environments

Why Blockly over MakeCode? [2]

- Library vs. platform: full control over UI and grading logic
- Easy integration with SvelteKit and custom CMS
- Flexible for quiz-driven workflows



Mockup


Exercice 1
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move forward
turn left
turn right
move forward
turn left
move forward
Hints
Run

Implementation Challenges

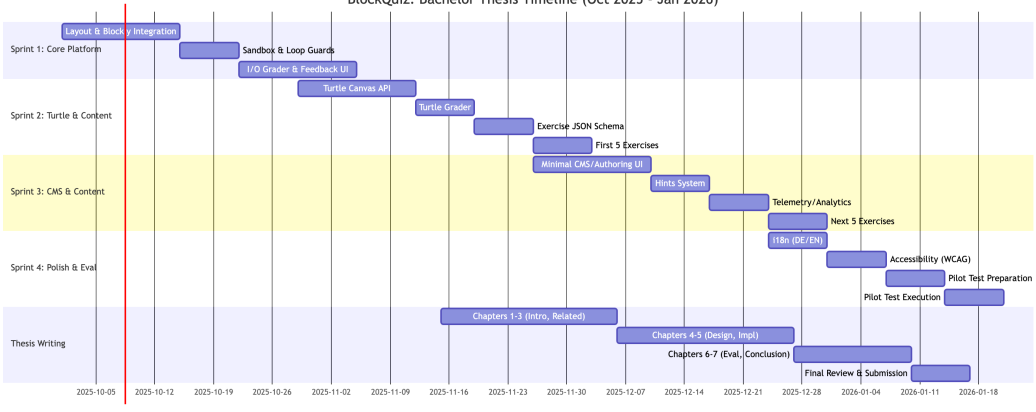
Technical:

- Sandboxed execution with loop detection and timeouts
- Deterministic grading with seeded RNG
- Multi-language support (i18n) for content and UI

Design:

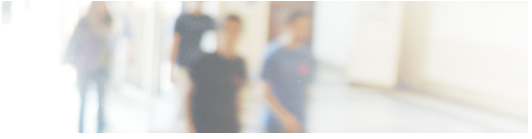
- Defining good exercise criteria (one concept per puzzle, minimal toolbox)
- Effective hint system (scaffolding without spoilers)
- Age-appropriate feedback and error messages
- Balancing expressiveness with cognitive load

Timeline


BlockQuiz: Bachelor Thesis Timeline (Oct 2025 - Jan 2026)
Sprint 1: Core Platform
Layout & Block y Integration
Sandbox & Loop Guards
I/O Grader & Feedback UI
Sprint 2: Turtle & Content
Turtle Canvas API
Turtle Grader
Exercise JSON Schema
First 5 Exercises
Sprint 3: CMS & Content
Minimal CMS/Authoring UI
Hints System
Telemetry/Analytics
Next 5 Exercises
Sprint 4: Polish & Eval
I18n (DE/EN)
Accessibility (WCAG)
Pilot Test Preparation
Pilot Test Execution
Thesis Writing
Chapters 1-3 (Intro, Related)
Chapters 4-5 (Design, Impl)
Chapters 6-7 (Eval, Conclusion)
Final Review & Submission
2025-10-05
2025-10-12
2025-10-19
2025-10-26
2025-11-02
2025-11-09
2025-11-16
2025-11-23
2025-11-30
2025-12-07
2025-12-14
2025-12-21
2025-12-28
2026-01-04
2026-01-11
2026-01-18

Thank You

Questions?



References I

[1] *Blockly is a visual programming editor by Google that uses drag-and-drop blocks.* URL: https://developers.google.com/blockly/.

[2] *Microsoft MakeCode is a free online learn-to-code platform where anyone can build games, code devices, and mod Minecraft!* URL: https://www.microsoft.com/en-us/makecode.