

“Hearing the Stars”: Is every Informatics teacher a STEAM teacher?

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Abstract. As school curricula increasingly promote integrated STEM/STEAM education, informatics teachers are expected to connect Informatics concepts with phenomena from other disciplines. However, implementing interdisciplinary activities often requires skills that extend beyond traditional Informatics teaching. This interactive workshop introduces “How to Hear the Stars”, a hands-on STEAM activity developed at the Vilnius STEAM Education Centre (Vilnius University) for lower-secondary school students (grades 7-10). Using Arduino Uno microcontrollers, piezo buzzers, and addressable NeoPixel RGB LED strips, the activity combines physics concepts (stellar classification, frequency, and wavelength) with CS concepts. The workshop invites participants to experience a condensed version of the activity and collaboratively identify the practical skills required for successful STEAM integration. Participants will analyse both CS-specific skills (e.g., programming, debugging) and cross-curricular skills (e.g., facilitating inquiry, interpreting scientific concepts). The outcome of the workshop will be a collaborative mapping developed by participants, identifying the skills required for informatics teachers to implement interdisciplinary activities.

Keywords: Informatics Education, Physical Computing, STEAM Integration, Teacher Skills.

Workshop Metadata

Format: Workshop (Interactive Session)

Duration: 80–90 minutes

Number of participants: no more than 16

Target Audience: Researchers (and interested upper secondary school teachers).

1 Introduction and Motivation

The integration of Informatics with other school subjects, particularly within STEM/STEAM education, creates valuable learning opportunities but also introduces pedagogical challenges. While Informatics teachers often excel in teaching programming, computational thinking, and algorithmic reasoning, they may have limited preparation for integrating concepts from disciplines such as physics, astronomy, or environmental science. Likewise, science teachers may have limited experience with programming, hardware, or physical computing. These challenges raise broader questions about the skills required for interdisciplinary STEAM teaching and how teacher education can better prepare educators for such roles. To address this issue, future and current teachers need opportunities to experience interdisciplinary teaching in authentic contexts. This workshop uses the

real-world STEAM activity as a catalyst for collaboratively exploring the knowledge and skills that Informatics teachers need to design and implement interdisciplinary learning activities.

2 The “How to Hear the Stars” Activity

The workshop centers on a practical activity designed for lower-secondary school students, successfully implemented at the Robotics and Mobile Technologies Laboratory of the Methodological Vilnius STEAM Centre.

2.1 The Concept

The activity addresses the abstract concept of cosmic radiation and wave translation. Since students cannot “see” cosmic signals directly, they use Arduino Uno microcontrollers to prototype a star. By manipulating RGB codes (reflecting stellar surface temperature) and adjusting tone frequencies (reflecting sound/wave propagation), students simulate how radio telescopes capture and process data.

2.2 Educational Value

It bridges the gap between physics (wave theory, spectrum classes O-M, frequency, amplitude) and cs (physical computing, analog-to-digital coordination, conditional logic, and external library integration like Adafruit NeoPixel).

3 Interactive Workshop Structure and Timeline

The workshop is designed to be participatory, shifting quickly from brief context-setting to hands-on experience and collaborative mapping. The workshop structure is summarized in Table 1.

Table 1. Workshop structure, methods, and timing.

Session Phase	Duration	Core Activity and Participant Methods
Part I: Context	15 minutes	Presentation of the activity and discussion on typical barriers.
Part II: Hands-on	20 minutes	Individual prototyping using physical kits or Tinkercad simulation.
Part III: Mapping	20 minutes	Breakout groups and collaborative mapping of teacher skills.
Part IV: Reflection	15 minutes	Group presentations and synthesis for teacher training programs.

3.1 Part I: Context & Pedagogical Framework (15 minutes)

The workshop starts with the presentation of the “How to Hear the Stars” activity and its implementation in the Lithuanian STEAM center network. This is followed by an open discussion on the typical barriers faced by informatics teachers when executing integrated lessons, such as fear of non-CS subject matter, managing breadboard circuit connections, and physical computing confidence.

3.2 Part II: Mini Hands-on Experience (20 minutes)

Participants will use physical Arduino Uno kits or/and the web-based Tinkercad simulation environment.

- **Task:** Participants will open a pre-structured code template in the Arduino IDE/Tinkercad, correct specific lines to change the star's color (RGB values) and frequency (*tone(pin, frequency, duration)*), and compile the program.
- **The Star Symphony:** Participants will align their prototypes by frequency and temperature to create a collaborative “star symphony” where parameters must be validated in real-time.

3.3 Part III: Collaborative Skills Mapping (20 minutes)

Participants will be divided into small breakout groups to identify needed skills for this activity implementation on sticky notes, focusing on two main areas:

- **Informatics Specific Skills:** What Informatics skills does a teacher need here? (e.g., modifying and testing code).
- **Cross-Curricular & Soft Skills:** What non-Informatics subject specific skills are required? (e.g., explaining physics concepts in accessible ways).

3.4 Part IV: Reflection and Teacher Skills Mapping (15 minutes)

Presentation of group findings and mapping results. The workshop concludes with a collective discussion on the practical skills required for STEAM-oriented teaching and their implications for teacher preparation.

4 Expected Outcomes and Contribution to ISSEP

With the focus area “Teaching of informatics in relation to other school topics (incl. STEM/STEAM)”, this workshop offers three main contributions:

- **Practical Material:** Dissemination of a tested STEAM activity (“How to Hear the Stars”) that educators can immediately replicate in their schools.
- **Teacher Skills Mapping:** A collaboratively generated overview of informatics-specific and cross-curricular skills required for implementing STEAM activity.
- **Dialogue on Teacher Training:** Insights on how to prepare future informatics teachers for multi-disciplinary collaboration and integration.

Technical Requirements

The workshop requires a projector and screen for the introductory presentation, alongside a reliable Wi-Fi connection for participants. Participants are requested to bring their own laptops. The workshop lecturers can provide a limited number of physical Arduino Uno kits (with breadboards, piezo buzzers, and NeoPixel strips), but the session is fully optimized to run via web-based Tinkercad simulation if required.

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