

Enhancing Synchronous Collaborative Learning with AI-Supported Audience Response Systems: The *echoQuiz* Approach

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Outline

1 Background

2 Approach & System

3 Methodology

4 Pilot Study

5 Discussion

6 Conclusion & Outlook

Motivation & Context

- Synchronous (online) teaching increased during COVID-19 (Brünner et al., 2024)
 - Pros: accessibility, flexibility
 - Challenges: active participation, cooperation (Ferri et al., 2020)
- Audience Response Systems (ARS) boost interactivity (Ebner, 2015)
 - *interactivity* as the most valued feature of the learning experience in our previous study (Brünner et al., 2025)
 - most tools focus on closed formats (MC/SC)
 - open-ended responses are richer but hard to process live

Project Goal of echoQuiz

- Open-source, AI-supported ARS for open-ended questions
- Real-time assistance for instructors
 - AI as assistant, not replacement

Research Questions

- **RQ1:** How can an AI-supported ARS be technically and didactically implemented to support open, adaptive interaction in synchronous (online) teaching?
- **RQ2:** To what extent do students perceive this approach as engaging and helpful for their learning process?

Challenges of Open-Ended Responses

- Live settings
 - high cognitive load for instructors
- Pedagogically valuable
 - thinking processes become visible
- Anonymity encourages risk-taking
- Real-time answering creates bottlenecks

AI in ARS as Educational Technology

- Role of AI
 - assistant for instructors
 - Open Educational Resources (OER) as contextual input
- Gap
 - few transparent, open ARSs with AI integration

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The *echoQuiz* Approach

Echo**Quiz**

Quiz Phase

Name an SDG

**Lecturer**

asks open-end question

Students

answer open-end question

& rate other responses

Quality education



Echo Phase

Lecturergets instant
AI-supported feedback

& rates answers

& highlights one answer

Studentsreflect on the selected
anonymous answerQuality
education

Echo Quiz

8

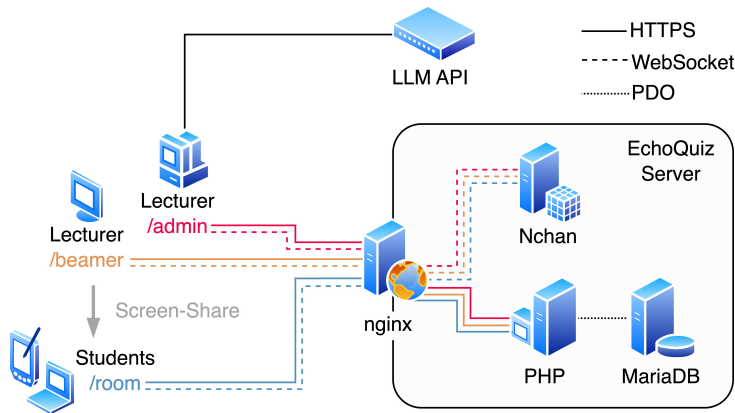


Quality education



Name an SDG

System Overview



Browser ↔ nginx/Nchan (WebSockets) ↔ PHP/MariaDB

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Educational Design Research (EDR) (McKenney & Reeves, 2025)

- Cycles
 - analysis → design → evaluation & reflection

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Setting & Participants

- Regular courses at TU Graz (CS education, maker education)
- Formats: synchronous online & synchronous in-person
- N = 62 (anonymous, voluntary; *echoScore* as incentive)

Example Question from Lecture

- „Name an SDG“
 - Introduction to Makerspaces and Maker Education
 - Lesson 2
 - Sustainable Development Goals

SDG

SUSTAINABLE DEVELOPMENT GOALS



<https://unric.org/en/sdg/>

Rating by AI without Context

Nennen Sie ein SDG

Antworten Fragen-Kontext

3

Bildung

Antwort ungenau, Bildung ist kein spezifisches SDG.

Hochwertige Bildung

Richtiges Beispiel für ein SDG.

SDG 4: Hochwertige Bildung

Richtiges SDG genannt.

Rating by AI with Context and Output-Format

Nennen Sie ein SDG

Antworten Fragen-Kontext

3

Akzeptiere bereits nur den Namen (englisch oder deutsch) und gib mir im Feedback die Nummer sowie den ganzen Namen in beiden Sprachen.
Bewerte streng.

Bildung

SDG 4: Qualität Bildung / Quality Education



Hochwertige Bildung

SDG 4: Hochwertige Bildung / Quality Education



SDG 4: Hochwertige Bildung

SDG 4: Hochwertige Bildung (Quality Education)



Friendly Rating by AI with Context and Output-Format

Nennen Sie ein SDG

Antworten **Fragen-Kontext**

3 Akzeptiere bereits nur den Namen (englisch oder deutsch) und gib mir im Feedback die Nummer sowie den ganzen Namen in beiden Sprachen. Bewerte freundlich.

Bildung

SDG 4: Qualität der Bildung, Quality Education

Hochwertige Bildung

SDG 4 - Hochwertige Bildung / Quality Education

SDG 4: Hochwertige Bildung

Richtig! SDG 4: Hochwertige Bildung / Quality Education

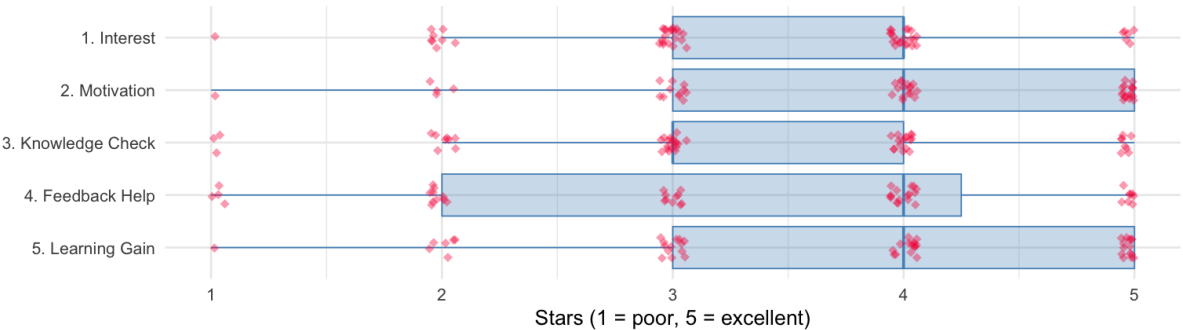
     

Feedback Questions in echoQuiz

1. The quiz sparked my interest in the content
2. The interactive format was fun and motivating
3. I was able to effectively test my knowledge with the quiz
4. The feedback helped me understand my mistakes
5. I feel like I've learned something new from taking this quiz

Feedback Analysis of echoQuiz

- Item distributions visualized (box plots)



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Strengths & Limitations

- Authentic use in regular courses
- Low barrier for students
- Richer, student-driven discussions
- Sample size ($N = 62$)
- AI feedback not directly visible to students
- Tech-friendly context (generalizability to be explored)

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Contribution

- *echoQuiz*: AI-supported, open-ended ARS for synchronous teaching
- Strengthens student agency, dialogue, and adaptive teaching in real time

For Instructors: Start Now

- Code: `github.com/ed-tech-at/echoQuiz-eu`
- Admin: `echoQuiz.eu/admin`
- Write open, reflective questions (avoid binary questions)
- Provide OER context to improve AI hint quality

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Open Questions



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