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Revisiting Lesson and Learning Studies:
Accessibility, Quality, and Sustainability

Teachers as Designers: Embedding Lesson Study in Makerspaces to Create Artefact-Based Interdisciplinary STEAM Activities

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Integrative STEAM education through teacher training

Growing call for interdisciplinary and student-centered approaches to STEAM learning (Science, Technology, Engineering, Arts and Mathematics). (Kim et al., 2021)

Impeded by

- traditional disciplinary structures, logistical requirements (Abd-El-Khalick, 2004)
- inadequate teacher preparation (e.g., Faikhamta, 2020)

Teacher education as a window of opportunity.

→ How to engage student teachers in the development of novel approaches to STEAM learning?

Prior Work: Integrating Lesson Study in interdisciplinary teacher training

Lesson Study in Teacher Ed: Teachers of different disciplines collaboratively experiment with novel **interdisciplinary** and **student-centered** approaches.

Project 2020: Pre-service high school teachers in Biology and Physics

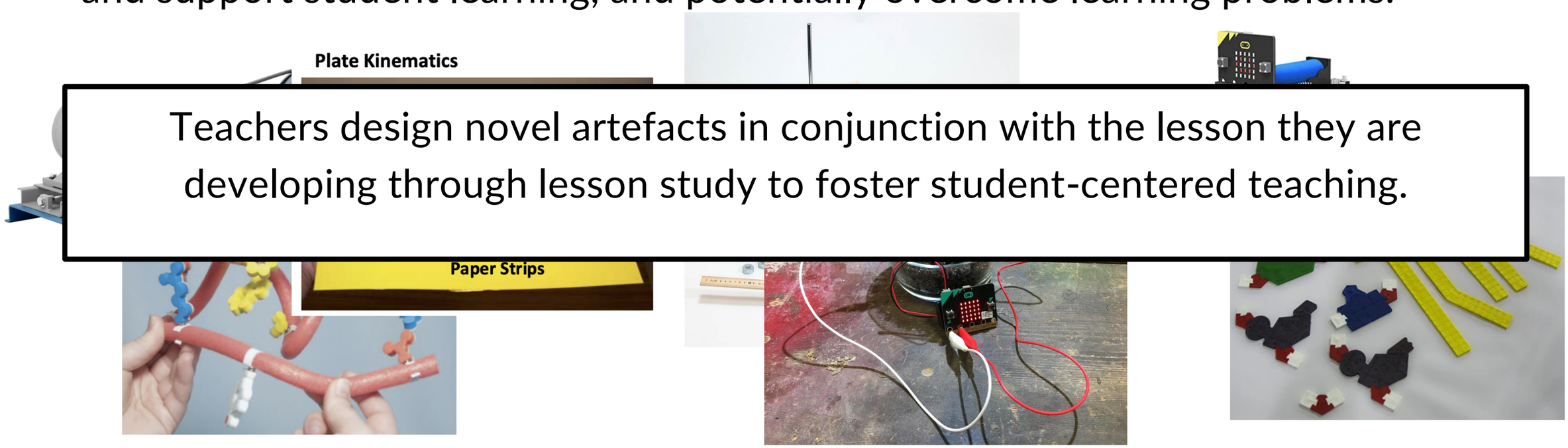
- Currently evaluating the projects in terms of level of interdisciplinarity and teaching approach (student- versus teacher-centered) (e.g. Finson, 2016)

Preliminary Results:

- Learn about different perspectives on same topic.
- Significant time needed to converge on interdisciplinary views of content. Final lessons consisted mainly of **traditional teaching**, at the cost of student learning.

Expand on this prior: Integrating the design of teaching and learning artefacts into lesson studies

Teaching and learning artefacts: Objects that help teachers to enable, structure and support student learning, and potentially overcome learning problems.



Teachers design novel artefacts in conjunction with the lesson they are developing through lesson study to foster student-centered teaching.

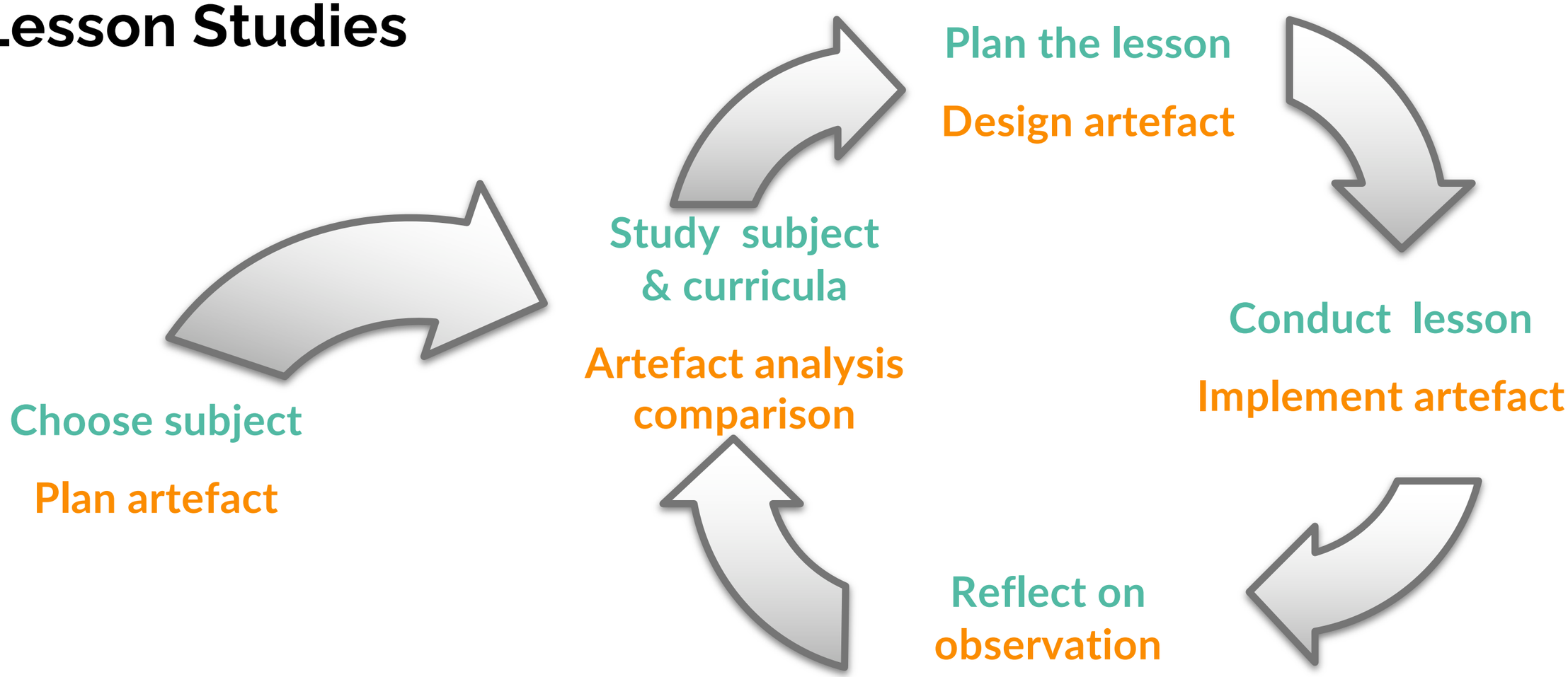
Lesson Studies and Makerspaces: Integrating two hitherto disconnected research fields

Makerspaces

- Learning spaces for students through project-based learning (e.g., Hira et al., 2014).
- Production spaces, i.e. spaces to develop artefacts in service of learning (e.g., Han, 2019).

→ Enrich teachers' ideas for possible artefacts through availability of new tools and technologies.

Nested Loop model of artefact design integrated in Lesson Studies



Study context

- Teacher University Lausanne; teacher training for high school; Physics & Biology
- 23 pre-service teachers, organized in 5 interdisciplinary groups

Fall Semester 2021		**Spring Semester 2021**	
5 sessions	Develop lesson plan & artefact	3 sessions	Test, evaluate and refine

Data Collection

System put in place for data collection by summer 2022:

- Audio recording of group discussions
- Field notes of facilitators
- Lesson plans & artefacts
- Self-reflections of teachers on development and implementation
- Evaluation of student learning

Research Questions

1. How does the integration of artefact development during lesson study influence how teachers co-develop a lesson plan?
2. Does the integration of artefact development during lesson study foster the development of student-centered interdisciplinary lesson plans?
    - Nature of learning activities
    - Helping students overcome the problems in the subject-specific learning process

Preliminary observations for RQ1

Artefacts offer a new entry point for designing interdisciplinary, student-centered lesson plans: Some groups focus first on the target problems, others on the kinds of artefacts.

Preliminary observations for RQ1

	Interdisciplinary lesson themes	**Learning Problems**	**Artefacts**
Group 1	Neurons	Concept abstraction, 2D vs 3D	Neural circuitry with fluids
Group 2	Energy flow	Differentiate the types of Energy	Flow chart, board game
Group 3	Wavelengths on mutations	Credibility of false news	Mediator artefact Physics=>Biology
Group 4	Echolocation	n/a	Navigate a robot just with sensorial data
Group 5	Optic	n/a	Bio-physical optical models

Next steps

1 month between recording and showing video presentation. → We will have more data on the development process to present and discuss with you.

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Thank you

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