Master´s thesis

Educational design for sustainable building use: Co-design interactive learning activities

Why it matters
What if school buildings didn't just use energy, but helped students learn about using it wisely?

Many schools today are equipped with advanced technologies to improve indoor climate and reduce energy use, but there's a catch: the way people use these systems makes a big difference. Even the most efficient buildings can waste energy if users don't understand how their behaviour impacts performance. This mismatch between design and reality is known as the "performance gap." That's where your thesis comes in.

Project background
This master's thesis is part of the research project "User-Oriented, Decentralized, and Simple HVAC and ICE," which addresses the performance gap through practical strategies tested in a real-world setting — the newly built school campus in Aschheim.

One promising approach involves decentralized ventilation systems: compact, local units that adjust flexibly to changing conditions and can be controlled directly by users. When combined with intuitive interfaces and educational support, these systems can enhance comfort, reduce energy demand, and spark awareness of sustainable building operations. But how can we support that awareness in everyday school life?

Thesis objective
This master's thesis aims to design **hands-on learning activities** and **instructional materials** to help students and teachers understand how their everyday actions influence energy use in school buildings.

Focusing on decentralized ventilation systems as a real-world example, your goal is to make building technology tangible, age-appropriate, and engaging. You'll develop materials that encourage students and teachers to interact meaningfully with the systems around them, and to see themselves as active participants in making their school more sustainable. Your final concepts should be ready for integration into everyday school life and adaptable to different age groups or classroom settings.

Your tasks
1. Conduct a literature review on sustainable building operation, decentralized ventilation systems, and the influence of user behaviour; with support from the project team for technical input.
2. Develop playful, age-appropriate learning activities and instructional materials that explain how students and teachers can engage in building systems.
3. Work with a real school to test and refine your materials in an authentic setting.
4. Write up your results in a practice-oriented thesis for use by educators and researchers.

Requirements

- A bachelor's degree in educational sciences, in vocational education in a related field, in architecture, environmental engineering, or a similar field
- Interest in sustainable building technologies and educational design
- The ability to work independently and take initiative

What we offer

- Potential employment as a student research assistant (ca. 6 months | 6 h/week | €391/month)
- A highly applied thesis topic linked to a real-world research and construction project
- The opportunity to test your materials in a real school environment

- A chance to work on interdisciplinary educational and sustainability challenges
- Close supervision and collaboration with a diverse project team

Application
Please submit a compelling application, including a cover letter and current CV, via email to:

anna.keune@tum.de
david.briels@tum.de

Supervisors
Prof. Dr. Anna Keune
Prof. Dipl.-Ing. Thomas Auer
Prof. Dr. Eveline Wittmann
Dr.-Ing. Karl Martin Heißler
David Briels, M.Sc.

Technical University of Munich

TUM School of Social Sciences and Technology
Professorship of Learning Sciences and Educational Design Technologies
Chair of Vocational Education

TUM School of Engineering and Design
Chair of Building Technology and Climate Responsive Design

https://www.edu.sot.tum.de/lsdesign/
https://www.arc.ed.tum.de/klima/