The structural coherence of problem-based projects

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Roundtable discussion:

The structural coherence of problem-based projects

Background

The *problem-based project* is a much-applied method for facilitating learning experiences that mirror engineering practice. Problem-based projects have many names. Examples are problem-based learning, challenge-based learning, design-implement experience, and capstone design project. Using problem-based projects as learning method supports active learning where students construct internal knowledge about a topic throughout the project.

In problem-based projects, teams of students design solutions to problems. These problems often reside with an 'industrial partner', i.e. a firm with which the student team cooperates. Examples of industrial partners are manufacturers, public utilities, software developers, contractors, and entrepreneurs.

In engineering, problem-solving projects usually either improve an existing entity or design a new entity from scratch. Improving an existing entity is e.g. lengthening a machine's durability. The project team develops a solution, which might be a combination of a new material and an improved machine maintenance policy. Designing a new entity is e.g. a project that designs a building. In this project, the solution is constituted by the drawings of the building and perhaps a small-scale building model.

The perhaps most prevalent and yet most vaguely defined terms for a great problem-based project is 'structural coherence'. Synonyms for the concept are 'project flow', 'red line' or 'red thread', and 'inherent logic'. In the spoken language, an often used *antonym* for structural coherence is "apples and oranges".

The structural coherence of a project refers to how the elements of the project fit together. These elements are often (1) problem statement, (2) methodology, (3) analysis, (4) solution design, and (5) implementation.

Purpose of roundtable discussion

The purpose of this roundtable discussion is *to operationalize the term structural coherence*. The objective is to reach a set of criteria that students and lecturers can use to evaluate a project's structural coherence. Operational criteria are easier to understand for students that the abstract term itself, and discussing an explicit set of criteria decreases the term's vagueness.

Roundtable discussion procedure

The roundtable discussion will deal with the relationships between the structural elements of a project following the sequence below:

1. The relationship between problem statement and methodology
2. The relationship between methodology and analysis
3. The relationship between analysis and solution design
4. The relationship between solution design and implementation

For each of the discussion's points, the roundtable hosts will prepare a tentative statement about a relationship between two elements. These tentative statements will inspire discussions about (1) the generic relationships between structural elements, (2) differences across engineering fields, and (3) differences between projects that improve existing entities and projects that design new entities.

Outcome:
Participants can expect to gain an increased understanding of the concept of structural coherence in problem-based projects. For the roundtable hosts, the discussion will feed into an ongoing research project about the nature and quality of problem-based projects as a cross-disciplinary learning method.

Relevant participant preparation:
For a fruitful discussion, participants are encouraged to bring with them their recent experience of two or three problem-based projects. The discussion