



Designs for Social and Systemic Innovation in Undergraduate Engineering Education

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Abstract

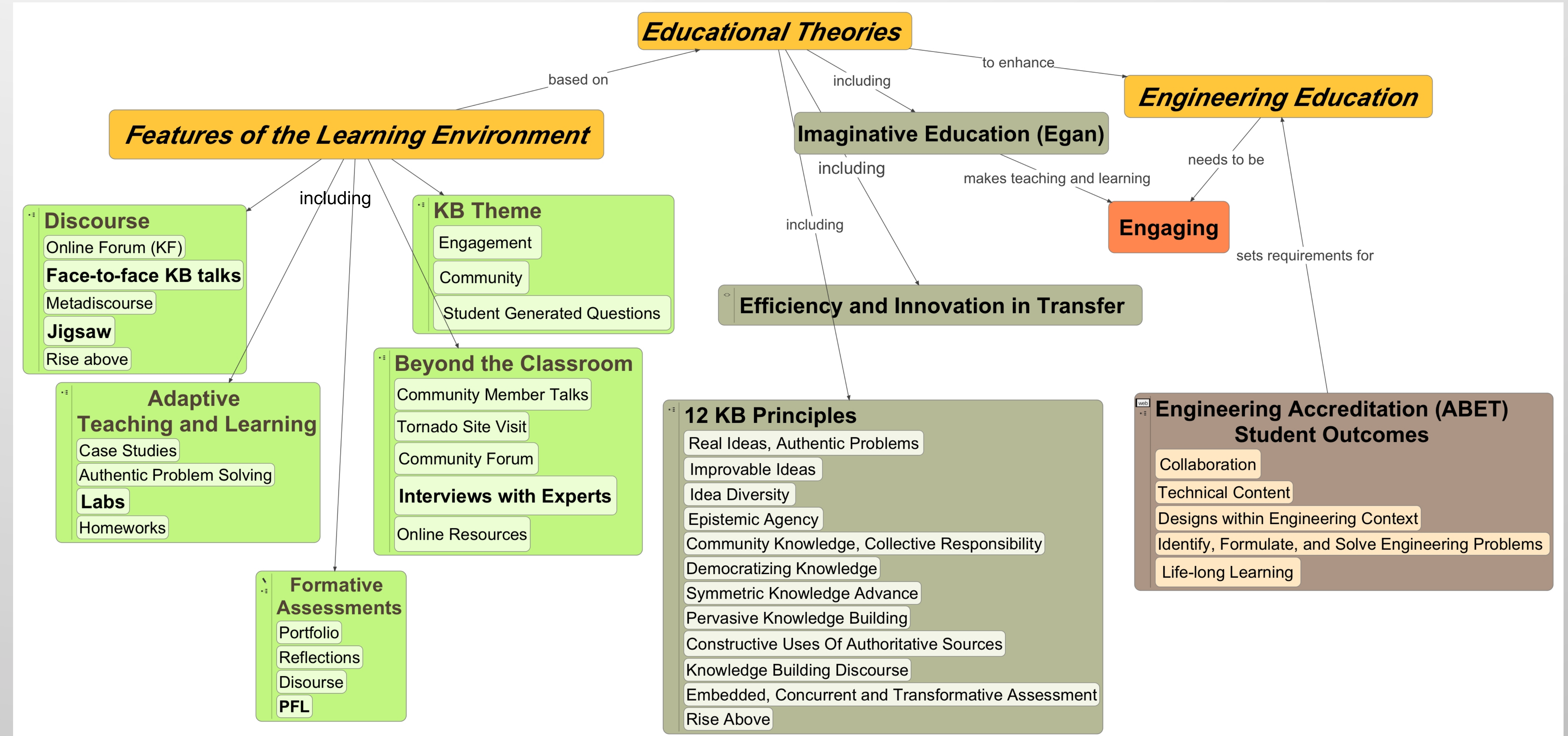
To understand how to bring Knowledge Building into the context of engineering education, an instructional prototype was designed and implemented in an undergraduate engineering course. The prototype included several features intended to facilitate various aspects of knowledge building. The student discourse generated on Knowledge Forum is being analyzed to assess the strengths and weaknesses of the current instructional design. Preliminary results suggest an impact of the designed features of the learning environment on student participation and idea-improvement. The results also show spontaneous engagement in the ethical, social, and cultural dimensions of the students' knowledge building work.

Features of The Learning Environment



Pre- and Post- Survey Responses

Question: What is the role and responsibility of the teacher in advancing knowledge in this class?	Pre-survey	Post-survey
Pay attention to individuals	24%	3%
Explain clearly	31%	22%
Motivate students by making material interesting	24%	8%
Demonstrate real life examples	20%	5%
Enable students to apply concepts to various situations	9%	22%
Provide tools for students to solve complex problems	0%	19%
Provide fundamental (big) ideas	2%	14%
Provide resources	9%	3%
Create a robust learning environment	2%	14%
Guide students to self-direct their own learning	0%	11%
Challenge students and their ideas	9%	22%
Help students when they get stuck	0%	14%
Encourage creative ideas and innovation	7%	11%
Facilitate student collaboration	7%	14%



Questions Raised

Formative Assessment

- Does knowledge building strengthen interpretive understanding of technical content? How can this be assessed?
- Does knowledge building help engineering students acquire 21st century skills and meet the engineering accreditation (ABET) outcomes?

Metadiscourse

- What is the impact of metadiscourse on the quality of the overall discourse?
- How to best start and sustain a metadiscourse?

Idea Improvement

- How often do misconceptions arise? How are they dealt with?
- Does the nature of student questions progress?
- What happens to promising ideas and questions?
- How do other aspects of the teaching and learning environment affect idea improvement in the discourse?

Group Differences in KB Discourse

- How do dynamics of participation and distribution of roles affect the productivity of each KB group?

KB Activities and KF Average Writing Activity



Student Quotes on their KB Experience

- "Through discourse, learning is achieved in a community rather than an individual."
- "Discourse challenges you to put your knowledge into words some one else would understand. This allows you to notice 'gaps' in what you know, which you can formulate into specific questions. These questions lead to a deeper understanding of the material."
- "... Disagreements and challenges are also necessary for moving forward."
- "The idea that our group came up with that were most promising stemmed from incorporating our resources with our values as a group."