Oregon State University

COLLEGE OF ENGINEERING | School of Chemical, Biological, and Environmental Engineering

Students' Responses to Professionally Contextualized Activities in a Studio Class

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Overview

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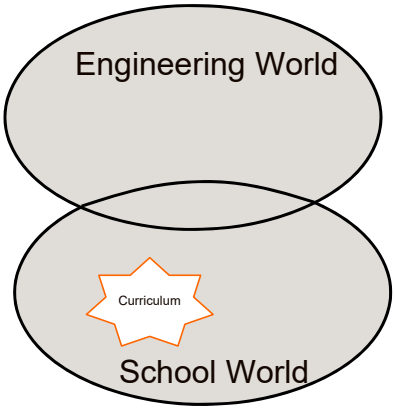

Re-situate the curriculum

- Curricular change enacted as part of Revolutionizing Engineering and Computer Science Departments Consortium
- Thinking & acting like engineers is more likely if students are immersed in professional contexts (engineering world) rather than thinking like engineering students (school world)

Studio Classes

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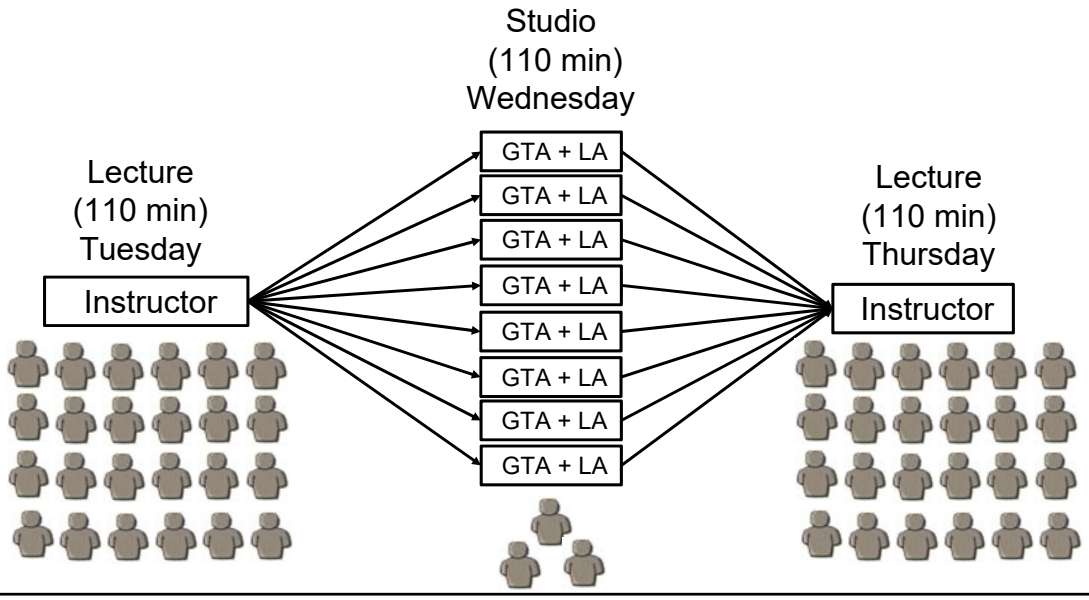

Conceptual Framework

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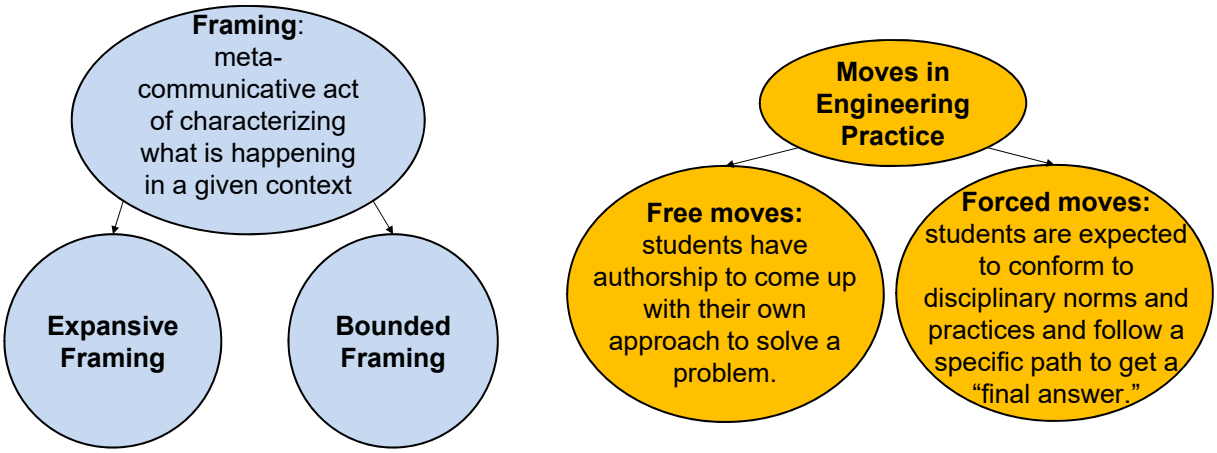

Studio 1.0 vs Studio 2.0 Design

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	Studio 1.0	Studio 2.0
Description	Force learners to follow a specific path to get to a "final answer." Learners have limited opportunity to express their creativity and problem solving skills	Activities are more open ended. Learners are presented with professionally contextualized problems. They are encouraged to work with their group to come up with their own path
Framing	Bounded	Expansive
Moves Involved	Mostly forced	Free and forced

Studio 1.0 vs Studio 2.0 Design

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There were nine studios through out the term. Five of which used a Studio 2.0 design; the other four were Studio 1.0 designs.

Studio	Design	Activity
Studio 1	2.0	Hydraulic Fracturing
Studio 6	2.0	Sucrose Kinetics: Regression
Studio 7	2.0	Potato Chip Bag Sealer: ANOVA
Studio 8	2.0	Sucrose Batch: SPC
Studio 9	2.0	DOE: VCVD
Studio 2	1.0	Coin flips (samples/populations)
Studio 3	1.0	Monte Carlo (Sampling Dist)
Studio 4	1.0	Conceptual / MATLAB
Studio 5	1.0	Conceptual

Participants

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- Sophomore level studio class serving chemical, biological, and environmental engineering students
- 224 students participated
- The study was approved by the Institutional Review Board and students consented to participation

Survey

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- Survey was delivered three times during the term through The Concept Warehouse

AIChE Education Division CONCEPT WAREHOUSE

- Two questions were asked:
  1) The studio activity helped you learn the course content [Likert scale (1 = strongly disagree to 5 = strongly agree)].
  2) Write down one thing that you learned from the studio activity [free response]
- A total of 1865 responses were received for each item

Likert Analysis

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Table 1. Likert responses if students believed the studio activity helped them learn the course content. (1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree). Studio 1.0 below the dotted line, 2.0 above.

Likert	Design	Activity	1	2	3	4	5	n	Avg	StD
Studio 1	2.0	Hydraulic Fracturing	3	14	56	116	24	213	3.68	0.66
Studio 6	2.0	Sucrose Kinetics: Regression	4	8	41	111	60	224	3.96	0.76
Studio 7	2.0	Potato Chip Bag Sealer: ANOVA	5	4	27	102	55	193	4.03	0.74
Studio 8	2.0	Sucrose Batch: SPC	3	3	46	96	45	193	3.92	0.67
Studio 9	2.0	DOE: VCVD	5	11	27	76	72	191	4.04	0.99
Studio 2	1.0	Coin flips (samples/populations)	4	15	42	116	39	216	3.79	0.78
Studio 3	1.0	Monte Carlo (Sampling Dist)	3	15	40	97	57	212	3.90	0.86
Studio 4	1.0	Conceptual / MATLAB	5	10	28	117	40	200	3.89	0.76
Studio 5	1.0	Conceptual	8	6	33	121	51	219	3.92	0.82

Free Responses Coding

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- A coding scheme was developed to evaluating free responses.
- Three code categories:
  1) Application of learning
  2) Context
  3) No learning
- Coding scheme was applied by two independent researchers. A Cohen's kappa value of 0.76 was achieved suggesting a suitably reliable coding scheme.

Free Responses Coding

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Application of learning:

Integrated: Students stated that they learned something that was relevant to engineering practice but went beyond what was specifically stated as an outcome of the studio.

Ex. "I learned that there isn't always a right answer. In fact, in many cases there are no right or wrong answers. However, you MUST be able to provide an answer with sufficient evidence and support. I think that this studio helped me realize that the real world isn't perfect after school, and that trouble shooting and problem solving are more important than a plug and chug mentality."

Free Responses Coding

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Application of learning:

Isolated: Students stated that they learned something that was specifically stated as an outcome of the studio.

Ex. "I learned how to do linear regression and better understood how to do that week's homework more quickly."

Free Responses Coding

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Contextual:

Definition: Students mentioned something that is specific to the context of the studio.

Ex "I learned about how hydraulic fracturing works, and how it effects the environment."

No learning:

Definition: Students fail to identify any learning outcome in the survey.

Ex. "hmm i dont really remember this one all too well"

Free Responses Analysis

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Table 2. A contingency table that relates studio with the coding category. The numbers represent the frequency of responses for each code category.

Free Response	Design	Integrated and contextual	Integrated and not contextual	Isolated and contextual	Isolated and not contextual	No learning	Total
Studio 1	2.0	15	59	12	98	22	206
Studio 6	2.0	26	97	35	38	24	220
Studio 7	2.0	2	57	4	117	18	198
Studio 8	2.0	6	40	2	106	40	194
Studio 9	2.0	4	60	2	96	34	196
Studio 2	1.0	0	36	0	134	37	207
Studio 3	1.0	3	42	5	122	34	206
Studio 4	1.0	1	69	1	120	28	219
Studio 5	1.0	0	65	0	123	31	219

Free Responses Analysis

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Table 3. The results of correspondence analysis performed for different groups of studios. The critical Chi-square value is based on the corresponding degrees of freedom and a 95% confidence level.

Group		Test Statistic χ^2	Critical Value	Statistically different
All studios (1-9)		348.3	46.19	Yes
Group 1	Studio 6	–	–	–
Group 2	Studio 1	–	–	–
Group 3	Studios 4, 5, 7, and 9	18.65	21.03	No
Group 4	Studios 2, 3, and 8	15.13	15.51	No

Free Responses Analysis

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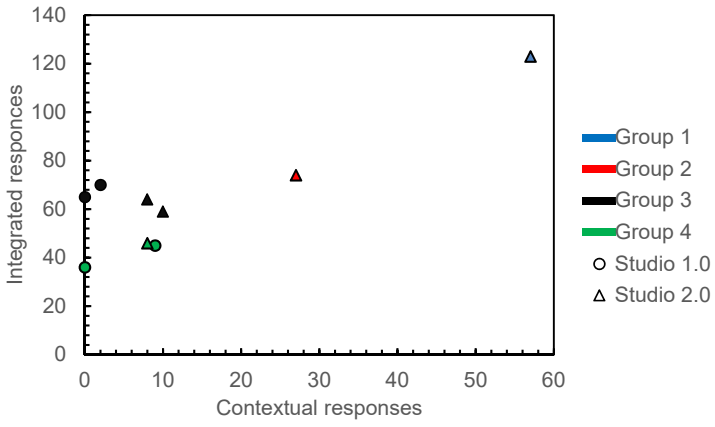
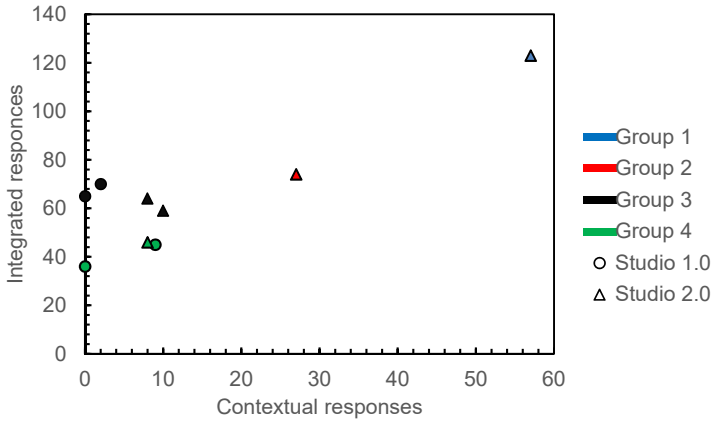
- The frequency of the responses showed a positive correlation coefficient of +0.87
- Studio 6 and Studio 1 showed the most integrated and contextual responses
- The other three Studio 2.0 design preformed similarly to Studio 1.0



Conclusions



- Some of the Studio 2.0 design elicited more integrated responses
- Research is needed to better understand the aspects that elicit these responses

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