Facilitating Synchronous Team Design Activities to Promote Cognitive Presence in a Remote Engineering Laboratory Class

Baiyun Chen, Center for Distributed Learning
Ronald F. DeMara, College of Engineering & Computer Science
Laurie O. Campbell, College of Community Innovation & Education

Agenda

1. Background
2. Methods
3. Findings
4. Conclusions

Background

Remote team design learning & Community of Inquiry

RTDL Benefits

Remote team design learning
History of team design problem solving in STEM education
Team design in industry product development and research

RTDL Challenges

Challenges to implement team design in remote engineering courses
Challenges to promote cognitive presence, especially higher levels, in online learning

Community of Inquiry

Social presence
Cognitive presence
Educational experience
Interaction re. guidance
Teaching presence
Purpose

Q1: To what extent do students gain social, teaching or cognitive presences in remote team design activities?

Q2: What levels of cognitive presence are demonstrated during the learning activity?

Q3: How do students perceive learning through remote team design activities?

Methods

Context & Design

Context

• 79 students enrolled in an undergraduate Engineering lab course, Computer Organization, Summer 2020
• Remote teaching course due to the COVID-19 pandemic restriction
• One remote lab session with 8 randomly assigned groups
• Learning approach: collaborative construction of a working design in software simulator after completing mixed-mode video and face-to-face weekly components
• Lab objective: acquire assembly language coding and design skills including loops

Groups

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>Pioneer Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>8</td>
</tr>
<tr>
<td>Group 2</td>
<td>10</td>
</tr>
<tr>
<td>Group 3</td>
<td>9</td>
</tr>
<tr>
<td>Group 4</td>
<td>8</td>
</tr>
<tr>
<td>Group 5</td>
<td>6</td>
</tr>
<tr>
<td>Group 6</td>
<td>6</td>
</tr>
<tr>
<td>Group 7</td>
<td>5</td>
</tr>
<tr>
<td>Group 8</td>
<td>7</td>
</tr>
<tr>
<td>Absent</td>
<td>21</td>
</tr>
</tbody>
</table>

Research Design

- Exploratory research design
- Quantitative content analysis
- Coding/BusParugs
- Two groups in lab
- Two groups in schedule
- Survey results
- Quantitative
- Qualitative

Excerpt of Example Chat Log

- [Chat log content]
- [Additional chat log content]
Coding Procedure

Analyzed EduPad logs of 8 randomly assigned group for one remote lab session

Two raters coded independently the logs

An inter-rater reliability of 88%

All discrepancies were resolved for a 100% agreement

Community of Inquiry Coding Template

<table>
<thead>
<tr>
<th>Code Categories</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cognitive Presence</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Triggering Event</td>
</tr>
<tr>
<td>2</td>
<td>Exploration</td>
</tr>
<tr>
<td>3</td>
<td>Integration</td>
</tr>
<tr>
<td>4</td>
<td>Resolution</td>
</tr>
<tr>
<td><strong>Social Presence</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Emotional Expression</td>
</tr>
<tr>
<td>6</td>
<td>Open Communication</td>
</tr>
<tr>
<td>7</td>
<td>Group Cohesion</td>
</tr>
<tr>
<td><strong>Teaching Presence</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Instructional design and organization</td>
</tr>
<tr>
<td>9</td>
<td>Facilitating discourse</td>
</tr>
<tr>
<td>10</td>
<td>Direct instruction</td>
</tr>
</tbody>
</table>

(Garrison, Anderson, & Archer, 2000, p. 4)

Community of Inquiry Survey (v. 14)

- **Cognitive Presence** 9 questions 3 categories
- **Social Presence** 12 questions 4 categories
- **Open ended** 3 Questions

Findings

Three Research Questions

RQ1: To what extent do students gain social, teaching or cognitive presences in remote team design activities?

Findings:

- Presences do not follow a consistent pattern among groups.
- Pioneer groups (G3 & G5) exhibited relatively high levels of cognitive presence.
Q2: What levels of cognitive presence are demonstrated during the learning activity?

Cognitive Presence

- Higher levels of cognitive presence were observed across groups.
- Attendance of remote labs led to higher scores in online exam 1.
- MPV students scored much higher in all major exams.

Survey Results

Q3: How do students perceive learning through remote lab design activities?

Perception of Cognitive Presence

- Higher levels of exploration and resolution.
- Consistent with EduPad log observations in resolution.
- Different from EduPad log observations in exploration.

Perceptions of Social Presence

Group cohesion ranks the lowest compared with open communication and affective expression.

Conclusions
Conclusions

Remote team design activities promoted higher levels of cognitive presences in this engineering lab class

Remote team design sessions supported students’ lab learning outcomes

Students perceived high levels of cognitive and social presences in the remote lab session

References