A case study of first-year students’ adaptation to problem-based learning at a Japanese medical university

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Introduction

- **Research Aim**: To obtain a better understanding of first-year students’ learning processes in PBL tutorials.

  → the need for discourse analysis and ethnographic study in clinical education to investigate what actually happens in PBL tutorials (Hak & Maguire, 2000; Leung, 2002, Imafuku, 2012).

- **Research Questions**

  1). What are the characteristics of verbal participation of Japanese students in PBL tutorials at different stages of their first year?
  Focus: Students’ use of speech functions (Frequency) and their knowledge & cognitive process (Quality) during PBL discussions.

  2). What are the main factors that shape the new learning process of students in PBL tutorials?
  Focus: Students’ introspection (Reasons behind students’ actual participation patterns in PBL tutorials)
Research Context

- **Showa University** (Tokyo campus) – Medicine, Dentistry, Pharmaceutical sciences, Nursing, Physical Therapy & Occupational Therapy (2nd - 6th year education)
- Medium of instruction - Japanese
- Interdisciplinary curriculum, inc. PBL tutorial.

- **First-year education** (Fujiyoshida campus, Yamanashi pref.)
  - Residential college system: All first-year students are required to reside in dorms.
  - Around 600 students on Fujiyoshida campus
  - Interdisciplinary PBL tutorial
  - They were divided into 66 PBL groups in 2010
## Research Participants

- **6 PBL groups (First-year students)** – Each group consists of 9 students
- **9 focal students, their 45 group members & 12 facilitators**

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Gender</th>
<th>Age</th>
<th>Faculty/School</th>
<th>First semester</th>
<th>Second semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hide</td>
<td>Male</td>
<td>22</td>
<td>Medicine</td>
<td>Group 1</td>
<td>Group 4</td>
</tr>
<tr>
<td>Hiroko</td>
<td>Female</td>
<td>18</td>
<td>Medicine</td>
<td>Group 2</td>
<td>Group 5</td>
</tr>
<tr>
<td>Genki</td>
<td>Male</td>
<td>18</td>
<td>Dentistry</td>
<td>Group 3</td>
<td>Group 6</td>
</tr>
<tr>
<td>Hitomi</td>
<td>Female</td>
<td>18</td>
<td>Dentistry</td>
<td>Group 2</td>
<td>Group 4</td>
</tr>
<tr>
<td>Rina</td>
<td>Female</td>
<td>20</td>
<td>Pharmaceutical sc.</td>
<td>Group 2</td>
<td>Group 6</td>
</tr>
<tr>
<td>Miu</td>
<td>Female</td>
<td>18</td>
<td>Pharmaceutical sc.</td>
<td>Group 3</td>
<td>Group 4</td>
</tr>
<tr>
<td>Naoki</td>
<td>Male</td>
<td>18</td>
<td>Pharmaceutical sc.</td>
<td>Group 1</td>
<td>Group 5</td>
</tr>
<tr>
<td>Aya</td>
<td>Female</td>
<td>18</td>
<td>Physical Therapy</td>
<td>Group 1</td>
<td>Group 6</td>
</tr>
<tr>
<td>Makoto</td>
<td>Female</td>
<td>18</td>
<td>Occupational Therapy</td>
<td>Group 3</td>
<td>Group 5</td>
</tr>
</tbody>
</table>
## Data collection & analysis procedures

<table>
<thead>
<tr>
<th>Research foci</th>
<th>Main data sources</th>
<th>Data analysis procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of contribution [RQ1]</td>
<td>Video-recordings of PBL sessions Classroom observations</td>
<td>Bloom’s Taxonomy-The knowledge type &amp; the cognitive process dimensions (Bloom, 1957, Anderson &amp; Krathwohl, 2001)</td>
</tr>
<tr>
<td>Factors affecting students’ PBL learning [RQ2]</td>
<td>86 interviews ((with 9 focal students and 30 group members))</td>
<td>Grounded Theory Approach (Strauss &amp; Corbin, 1998)</td>
</tr>
</tbody>
</table>

**First Semester**
- **First tutorial (April/May)**
  - Environmental issue (Mt. Fuji & garbage problem)
  - Video-recordings
  - Classroom observation
  - Interview with students

**Second Semester**
- **Second tutorial (May/June)**
  - Nutritional balance & Osteoporosis
  - Video-recordings
  - Classroom observation
  - Interview with students

**Third tutorial (Sept/Oct)**
- Rehydration & Heatstroke
  - Video-recordings
  - Classroom observation
  - Interview with students

**Fourth tutorial (November)**
- Decomposition & Food poisoning
  - Video-recordings
  - Classroom observation
  - Interview with students

### 4 sets of data collection
Finding 1: Frequency of Hiroko’s verbal participation

To identify what kinds of speech acts each student performed in discussion, all utterances in the PBL sessions were encoded based on:
- A list of speech functions, including, questioning, develop, agree, disagree, challenge etc. (Eggins & Slade, 1994)
- Discourse acts-Initiation, Response, and Follow-up (Tsui, 1994)

<table>
<thead>
<tr>
<th></th>
<th>First semester (April-July)</th>
<th>Second semester (Sept-Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Tutorial</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Tutorial</td>
</tr>
<tr>
<td></td>
<td>(April/May) (n=9+ Facilitator)</td>
<td>(May/June) (n=7+ Facilitator)</td>
</tr>
<tr>
<td>Total number (%) of Hiroko’s contributions</td>
<td>13 (3.0%)</td>
<td>40 (5.0%)</td>
</tr>
<tr>
<td>Total number of contributions in the PBL group</td>
<td>430 (+60)</td>
<td>793 (+27)</td>
</tr>
<tr>
<td>Mean of the total in the group (SD)</td>
<td>47.77 (48.96)</td>
<td>113.28 (73.28)</td>
</tr>
</tbody>
</table>

Table 1: The total number of contributions made by Hiroko
Revision of Bloom’s Taxonomy (Anderson & Krathwohl, 2001)

**Knowledge & Cognitive Process Dimensions**

**Knowledge**
- **Concrete**
  - Factual
  - Conceptual
  - Procedural
  - Meta-cognitive
- **Abstract**

**Cognitive Process**
- **Remember**
- **Understand**
- **Apply**
- **Analyze**
- **Evaluate**
- **Create**

**Factual:** The basic elements students must know to be acquainted with a discipline.

**Conceptual:** The interrelationships among the basic elements within a larger structure that enable them to function together.

**Remember:** Retrieving knowledge from memory.

**Understanding:** Constructing meaning from instructional messages, including oral, written, & graphic communication.

Bloom’s Taxonomy was applied to analyze discourse data in order to explore the “quality” of students’ contribution to discussion (cf., DeVito and Grotzer, 2005).
Finding 2: Cognitive process of Hiroko’s initiation acts

Initiation acts – Acts to start a new talk (proposition) in discussion by questioning, giving information, getting addressee to perform, or getting addressee to comply etc.

<table>
<thead>
<tr>
<th></th>
<th>First semester (April-July)</th>
<th>Second semester (Sept-Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Tutorial (April/May)</td>
<td>2nd Tutorial (May/June)</td>
</tr>
<tr>
<td></td>
<td>(n=9 + Facilitator)</td>
<td>(n=7 + Facilitator)</td>
</tr>
<tr>
<td>Total number (%) of Hiroko’s initiation acts</td>
<td>3 (6.0%)</td>
<td>6 (4.7%)</td>
</tr>
<tr>
<td>Total number of initiation acts in the group</td>
<td>50 (+10)</td>
<td>129 (+4)</td>
</tr>
<tr>
<td>Mean of the total in the PBL group</td>
<td>5.55</td>
<td>14.33</td>
</tr>
</tbody>
</table>

Knowledge & cognitive process dimensions in Hiroko’s use of initiation acts (Anderson & Krathwohl, 2001)

<table>
<thead>
<tr>
<th></th>
<th>First semester (April-July)</th>
<th>Second semester (Sept-Dec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remembering factual knowledge</td>
<td>3 (100%)</td>
<td>5 (83.3%)</td>
</tr>
<tr>
<td>Understanding conceptual knowledge</td>
<td>0</td>
<td>1 (17.7%)</td>
</tr>
<tr>
<td>Analysing conceptual knowledge</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 2: Initiation acts performed by Hiroko
## Finding 2: Knowledge & cognitive process dimensions

### Excerpt 1: First semester: Second tutorial (May, 2010)

<table>
<thead>
<tr>
<th></th>
<th>Hiroko</th>
<th>And, how about studying a kind of low-calorie foods?</th>
<th>Initiate: Elicitation [Remembering factual knowledge]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hitomi</td>
<td>Yes, I agree.</td>
<td>Response: Agree</td>
</tr>
<tr>
<td></td>
<td>Hitomi</td>
<td>This matter includes an issue of whether konjac jelly is actually a low-calorie food.</td>
<td>Continue: extend</td>
</tr>
<tr>
<td></td>
<td>Rina</td>
<td>Yeah うん</td>
<td>Follow-up: Acknowledge</td>
</tr>
<tr>
<td></td>
<td>S10</td>
<td>Yup うん</td>
<td>Follow-up: Acknowledge</td>
</tr>
<tr>
<td></td>
<td>Hitomi</td>
<td>I think we’d better writing konjac jelly on the whiteboard there, because we want to know if konjac jelly can be grouped in low-calorie food within the category of “Food”.</td>
<td>Re-initiation: Develop</td>
</tr>
<tr>
<td></td>
<td>Hiroko</td>
<td>And, how about checking nutrition balance?</td>
<td>Initiate: Elicitation [Remembering factual knowledge]</td>
</tr>
<tr>
<td></td>
<td>Rina</td>
<td>Nutrition balance, umm, yeah. We need to check what happens when nutrition balance breaks down.</td>
<td>Re-initiation: Develop</td>
</tr>
<tr>
<td></td>
<td>Hitomi</td>
<td>Oh, when nutrition balance breaks down. If we do this issue, we can also study nutritional elements of soybean flour and brown sugar ((which are foods appeared in the scenario)) バランスが崩れるとどうなるか。そうするときな粉と黒砂糖って調べられるかな</td>
<td>Re-initiation: Develop</td>
</tr>
</tbody>
</table>
### Excerpt 2: Second semester: Fourth tutorial (Nov, 2010)

<table>
<thead>
<tr>
<th></th>
<th>Hiroko</th>
<th>Is there any cause-and-effect relationship between bacteria and decomposition?</th>
<th>Initiation: Elicitation</th>
<th>Understanding conceptual knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S32</td>
<td>Umm, do bacteria go rotten? そういえば、菌ってくさってるの?</td>
<td>Re-initiation: Clarify</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S35</td>
<td>I think milk can be turned sour caused by not mould but bacteria. That’s why it has a foul smell. 牛乳とかは菌じゃないの。カビじゃないくて、で、においを発するんじゃないの</td>
<td>Response: Resolve</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Naoki</td>
<td>However, bacteria themselves would not go rotten. 一体、でも腐っていないでしょう</td>
<td>Response: Disagree</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S31</td>
<td>I don’t think bacteria themselves go rotten. Bacteria cause a kind of chemical reaction, so that food becomes rotten. 因って、だれがくさってるんじゃないでしょ。菌が化学反応でくさせるんじゃないの</td>
<td>Re-initiation: Develop</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S32</td>
<td>Oh, bacteria cause rotten foods. 菌が腐らせるみたいな</td>
<td>Follow-up: Acknowledge</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S32</td>
<td>Umm, but I don’t know exactly relationship between them ((bacteria and rotten foods)). そのつながりがよくわからないな</td>
<td>Response: Withhold</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>S36</td>
<td>I try to write it on the problem-map. I’ll just connect it with the rotten foods. なんとなく書いて見る。腐ったものにつなげればいいんでしょ</td>
<td>Follow-up: Acknowledge</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Hiroko</td>
<td>Bacteria and mold can be seen as the cause of rotten foods, can’t they? 腐った原因に菌とカビがあるんじゃなくて？</td>
<td>Re-initiation:</td>
<td>Informative-Develop</td>
</tr>
<tr>
<td>9</td>
<td>S35</td>
<td>We can connect these groups first. After studying, we will know the matter. とりあえずつなげて、調べて分かったらそれでいいんじゃないの。</td>
<td>Follow-up: Endorsement</td>
<td></td>
</tr>
</tbody>
</table>
Case-diagram in the second semester
(Fourth tutorial, 22 November 2010)

Hiroko directly contributed to the group’s product (“problem-map”) in the fourth tutorial (Nov).

→Connection between bacteria and rotten foods (in red).

English version of problem-map

- Digestion
- Symptom
- Human
- Enterobacteria
- Probiotic Bacteria
- Bacteria
- “Best before” date
- “Consume by” date
- Fermentation?
- Stomachache, fever, diarrhea = Food poisoning?
- Rotten foods?
- Mould
- Foods: Cheese, yogurt etc
- Foods in fridge: Milk, raw fish etc

Original data of problem-map
Finding 3: Factors affecting students’ learning in PBL

- Identity as a member
- Difficulties encountered in PBL participation
- Perceptions of effective participation in PBL
- Conceptions of PBL learning
- Interpersonal relationship in PBL group
- Self-group relationship
- Prior learning experience
- Future prospective for medical professional

Actual participation in PBL
Finding 3: Hiroko’s introspection

- **Self-group relationship**

Hiroko: When I was about to give voice to my thoughts, I often got tense in the discussion.
Int: Is it because of the fear of mistake?
Hiroko: Not really, it’s because I’m worried whether I would disturb group members’ learning. (June 7, 2010)

- **Conceptions of PBL learning**

Hiroko: In the first semester, I didn’t understand why we had to do interdisciplinary PBL, … I thought this PBL was useless. However, recently I became aware that communication with future dentists and pharmacists in the first year might be meaningful for my future career as a medical doctor. … I started to think that PBL might be useful for my studying. Without PBL learning, I would not change in my attitude toward group learning. In this regard, PBL leads me to be more active learner in a context of small group. (Oct 5, 2010)

- **Identity as a group member**

Hiroko: Other members may regard me as a very quiet person in the discussion. Because I’m not good at expressing my opinion, I want to contribute to group learning in other situations than the PBL discussion. (May 11, 2010)

Int: In the last interview, you said that you wanted to return to the main theme when the topic went off in the future tutorial. Could you achieve this aim today?
Hiroko: Yes, I could do a little bit. I tried to do my best to manage the flow of discussion today. I think through PBL, I became a little bit more active participant in the discussion. I could have a stronger desire to be involved in the discussion as a main member, but in fact I couldn’t actively participate in the discussion, haha (Nov 22, 2010)
Conclusions

- Hiroko has been considered as a very quiet member throughout the year. -Frequency of her contributions

- In the second semester, she could make contributions at cognitively more complex level (Understanding conceptual knowledge) -Quality of her contributions

- She has constantly attempted to shape her own learning and participation by negotiating the membership in the given classroom context. (e.g., Self-group relationship, Conceptions of PBL learning, Identity as a group member)

- Exploring students’ learning trajectories provided a broad view of learning, including their ways of knowing, doing and being a member in the particular context (Herrenkohl & Mertl, 2010).
References


