Students’ engagement in their own and other students’ process of inquiry

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Background

Metacognition
"The set of higher knowledge and skills to monitor and regulate manifest cognitive processes of self and others.” (Garrison & Akyol, 2011)

Monitoring of cognition
The reflective dimension of metacognition is the awareness of the thinking and learning process.

Regulation of cognition
The regulation dimension of metacognition is on the action dimension of the learning experience.

Knowledge of cognition
Knowledge of cognition refers to awareness of self as a learner in a broad sense.

Garrison & Akyol (2011), Assessing metacognition in a community of inquiry
Background

Metacognition

Taking responsibility for teaching presence
Collaborative process
Engaged in asking for help and in the help of others

When students engage in an online discussion in mathematics, how
• does the interaction look like.
• do students support their own process of inquiry.
• do students support other students’ process of inquiry.
Conclusions

Students engage in their own learning

Students engage in other students learning

Synchronously
Participants

Upper secondary school
Teacher students

>50 active students
5 tutors

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# Course 2

Cher

- **Student 1:** Hi! How do I solve the equation $77 = 16.5 \cdot 1.0085^t$?
- **Student 2:** I understand that I should divide with 16.5 on both sides, but when I logarithmize it turns out wrong.
- **Student 3:** Hi, how do I solve this? The picture I added
- **Student 4:** Student 1, I think that if you logarithmize both sides you'll get $t = \log_{1.0085} 77 = 16.5 \ln 77$.
- **Student 2:** Since $\log 1.0085 = \text{the same as } t \cdot \log 1.0085$
- **Student 1:** Thank you! I did that and got the answer $t=180$, but it doesn't fit the problem. I should be 20 or larger.
- **Student 2:** I got $t=180$ too, that's weird.
- **Student 1:** No, my mistake: 180 is correct.
- **Student 2:** Thanks for your help!
- **Student 3:** Grat. No problem.

**Student 3:** I have a question about a problem that goes: A person's money $K(t)$ grows in the bank during years according to the formula $K(t) = 2500 \cdot 10^{0.05t}$. How large is the interest?

- **Student 4:** Does anyone know how to solve the problem in the picture?

**Student 5:** Anyone who knows what real solutions are?

**Student 6:** Real solutions are all solutions that are 0 or larger.

**Student 6:** i.e. all positive numbers

**Student 7:** Real solutions are all the numbers that are on a number line.

**Student 8:** Hi, could someone be able to explain problems 16 and 17 on the National test from 2012?

**Student 8:** Especially, how $r = \sqrt{2} \cdot a = \text{ax}$ become $r = a(\sqrt{2} - 1)$ in problem 16.

**Student 2:** Hi, can someone help me and explain how you solve this equation $(2x-8)(x+5)=0$?

**Student 2:** No one can?

**Student 3:** Should be $x=-4$ and $x=5$.

**Student 3:** Since the answer is zero the two parentheses should cancel each other out so $2x-8=0$ and $3x+10=0$.

**Student 5:** That's right, thank you so much.
Theoretical framework
One to one - Relationships of Inquiry

| Teaching presence | Anderson, Rourke, Garrison, & Archer, (2001) |

<table>
<thead>
<tr>
<th>Element</th>
<th>Category</th>
<th>Indicators (examples only)</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cognitive presence (COG)</td>
<td>Triggering event (TE)</td>
<td>Stating a problem, changing direction.</td>
<td>“Here’s the problem: ...”</td>
</tr>
<tr>
<td></td>
<td>Exploration (EX)</td>
<td>Brainstorming, broad search for insights, information exchange.</td>
<td>“I have another issue.”</td>
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<tr>
<td></td>
<td>Integration (IN)</td>
<td>Connecting ideas, computations.</td>
<td>“Perhaps I could use…”</td>
</tr>
<tr>
<td></td>
<td>Resolution (RE)</td>
<td>Achieve solution, analysis of solution, implementation.</td>
<td>“Am I thinking right here?”</td>
</tr>
<tr>
<td>Teaching presence (TEA)</td>
<td>Design and organization (DO)</td>
<td>Establishing interaction, setting parameters for the inquiry.</td>
<td>“What is a square root?”</td>
</tr>
<tr>
<td></td>
<td>Facilitating discourse (FD)</td>
<td>Stimulating constructive inquiry, assessing process.</td>
<td>“I can combine … with …”</td>
</tr>
<tr>
<td></td>
<td>Direct instruction (DI)</td>
<td>Providing steps to solution, summarizing the discussion.</td>
<td>“7/12 – x = 1/4”</td>
</tr>
<tr>
<td>Social presence (SOC)</td>
<td>Open communication (OC)</td>
<td>Acknowledging, trivial expressions.</td>
<td>“The answer is 3!”</td>
</tr>
<tr>
<td></td>
<td>Relationship cohesion (RC)</td>
<td>Greetings, vocatives, building links.</td>
<td>“I made a mistake with…”</td>
</tr>
<tr>
<td>Emotional presence (EMO)</td>
<td>Activity emotion (AE)</td>
<td>Emotion about the inquiry.</td>
<td>“Then the apple is cheaper…”</td>
</tr>
<tr>
<td></td>
<td>Outcome emotion (OE)</td>
<td>Emotion about the consequence of the inquiry.</td>
<td></td>
</tr>
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<td></td>
<td>Directed affectiveness (DA)</td>
<td>Emotion towards the other person.</td>
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Stefan Stenbom

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WCOL2019 | Dublin, Irland | contact: maljan@kth.se
<table>
<thead>
<tr>
<th>Category</th>
<th>Indicator</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; organization</td>
<td>Establishing interactions, Setting parameters for the inquiry</td>
<td>&quot;I'm having some trouble understanding the linear equation. Could someone explain?&quot;</td>
</tr>
<tr>
<td>Facilitating discourse</td>
<td>Engaging in discussion, Assessing process</td>
<td>&quot;I would insert the points and perhaps try and see what you get, since it's parallel it has the same K-value, then you can look at the m-value from the point you have.&quot;</td>
</tr>
<tr>
<td>Direct instruction</td>
<td>Providing steps for solution, Summarizing the discussion, Providing solution</td>
<td>&quot;If the term under the radical sign can’t be solved, it’s not a real number.&quot;</td>
</tr>
</tbody>
</table>
## Results

### Interactions

Total of 662 message
- 334 from tutors
- 328 from students

<table>
<thead>
<tr>
<th>Coding</th>
<th>Tutor</th>
<th>Student</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching presence</td>
<td>299</td>
<td>86</td>
<td>385</td>
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<tr>
<td>Cognitive presence</td>
<td>0</td>
<td>208</td>
<td>208</td>
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<tr>
<td>Social presence</td>
<td>58</td>
<td>77</td>
<td>135</td>
</tr>
<tr>
<td>Emotional presence</td>
<td>50</td>
<td>60</td>
<td>110</td>
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</tbody>
</table>
## Results

### Teaching presence

<table>
<thead>
<tr>
<th>Teaching presence</th>
<th>Tutor</th>
<th>Student</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design &amp; organization</td>
<td>81</td>
<td>70</td>
<td>151</td>
</tr>
<tr>
<td>Facilitating discourse</td>
<td>94</td>
<td>2</td>
<td>96</td>
</tr>
<tr>
<td>Direct instruction</td>
<td>131</td>
<td>14</td>
<td>145</td>
</tr>
</tbody>
</table>

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Results
Teaching presence

Facilitating discourse Student; 2
Direct instruction Student; 14
Design & organization Student; 70
Design & organization Tutor; 81
Facilitating discourse Tutor; 94
Direct instruction Tutor; 131

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Conclusions

Students engage in their own learning
• Establishes interaction, expresses want they need help with, analyses their own solutions

Students engage in other students learning
• Switches from tutor to student, suggests ideas for solutions, corrects misunderstandings, provides explanations
• More likely to aid another student when no tutor was online

Synchronously
• Student were more likely to interact when the communication was synchronous
Questions?

TalkMath.org  maljan@kth.se