

Math Agent - Problem Solving

Components:

1. Concept learning (Enabling the Fractions.json into the current Science module minor modifications if needed. Sim_cc to be removed)
2. Maths problem solving

1. Maths Problem solving when $T_a & T_u > 0.6$:

1. Post a math problem,
2. Ask for the approach. If the approach and understanding $T > 0.6$, then ask the student to solve and share the steps either through photo or through voice.
3. Have option for voice, text and If they upload the photo, scan them through the MathOCR (cloudflare Maverick MM model integration)
<https://docs.google.com/document/d/1UqkQW0h-0-kRcSI5lubCEiDFIznsUvsgzEABPAsii1w/edit?usp=sharing>)
4. If the answer is correct, fair enough. Appreciate and ask if they want to think of solving it any other way fully or from any steps or logic.
5. If yes then nudge them through the alternatives
6. If no then move to next steps
7. If the answer is not correct or the steps taken to arrive is not correct then, identify the gap. Point them the gap. Nudge them to think why it is wrong (max 3 interactions). If they are still not able to figure out, then if they are missing on the simple aspect then help them by giving out the answer. If they are missing big time, then take them step by step similar to the flow defined below.

2. Maths Problem solving when $T_a \text{ or } T_u < 0.6$:

1. Post a math problem,
2. Ask for their understanding and the approach. If the approach and/or understanding $T < 0.6$, then acknowledge the efforts and point out that they have missed some of the key elements. Ask them if they want to restate the approach. If $T > 0.6$ again, then go to 1. Or else, ask if the student wants to know the key important element missing, or the agent shall help step by step, solving.
3. Step-by-step solving: The steps needed to solve the problem shall need to be defined in the respective JSON beforehand itself (similar to the ground truth of Science). The overall steps shouldn't exceed 7-10 steps. The first step shall involve making sure the student understands the question.

4. Take them step by step. At every step, if they are struggling and didn't get the underlying concept, then explain the underlying concept and then go to the next step. Stepwise constraint can be kept at 3 or 4.
5. After completing all steps, acknowledge, appreciate and then ask them whether they understood and liked the interactions. And if any doubts. The constraint can be kept at 3 or 4.

3. Maths Problem solving when they have zero idea $T_a & T_u < 0.6$:

1. Post a math problem,
2. Ask for their understanding and the approach. If the approach $T_a & T_u < 0.6$, then go to Step-by-step solving 1.

Model to be used for Image to text:

<https://developers.cloudflare.com/workers-ai/models/llama-4-scout-17b-16e-instruct/>

Way forward:

1. Interactively taking the user inputs on the Android UI needs to be explored
2. Math concept learning piece needs to be created by tweaking the existing text-text Agent
3. Simulations/Image based problem solving needs to be explored
https://docs.google.com/document/d/18Um71D7RlxQvdxFGJGf5xdXv5bQDkaFVwpoL_cBXaUY/edit?usp=sharing

Examples:

Example 1: Missing Core Concept (Fraction / Denominator Unknown)

(Concept Remediation → Resume Problem)



Solve: $34 + \frac{3}{4} + \frac{1}{4}$



What does $34\frac{3}{4}$ mean to you?



Student

I don't know what that means.



Agent

No worries — let's quickly understand this first.

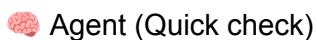


Agent

Imagine a pizza cut into 4 equal pieces.

- The denominator (4) means total pieces
- The numerator (3) means pieces taken

So $\frac{3}{4}$ means 3 out of 4 pieces.



Agent (Quick check)

If you have 1 piece out of 4, what fraction is that?



Student

1/4



Agent

Perfect A thumbs up icon.

Now let's return to the question.

If you add 3 out of 4 pieces and 1 out of 4 pieces, how many pieces do you have?



Student

4 out of 4.



Agent

Exactly!

So the answer is $4 = \frac{1}{4} + \frac{4}{4} = \frac{5}{4}$

Example 2: No Idea / Very Low Confidence

($T_a < 0.6$ AND $T_u < 0.6 \rightarrow$ Full Scaffold Mode)



Problem

Solve: $58 - 14\frac{5}{8} - \frac{1}{4}85 - 41$



Agent

What do you think this question is asking, and how would you solve it?



Student

I don't know.

($T_a = 0.1$, $T_u = 0.2$)



Agent

That's completely okay 😊

Let's solve it together step by step.



Agent

Step 1: These are fractions. Do they have the same denominator?



Student

No.



Agent

Step 2: Let's convert $14\frac{1}{4}$ into a fraction with denominator 8.

What does it become?



Student

$28\frac{2}{8}$



Agent

Step 3: Now subtract.

$$58 - 28 = \frac{5}{8} - \frac{2}{8} = \frac{3}{8}$$



Student

$$38 - 28 = \frac{3}{8}$$



Agent



Correct!

Did this explanation help you understand how subtraction of fractions works?

Example 3: Partial Understanding / Weak Approach

($T_a < 0.6$ OR $T_u < 0.6 \rightarrow$ Guided Solver)



Problem

$$\text{Solve: } 23 + 16 - \frac{2}{3} + \frac{1}{6} = ?$$



Agent

What do you understand from this question, and how would you start?



Student

I'll just add 2 and 1, and 3 and 6.

($T_a = 0.3$, $T_u = 0.4$)



Agent

I like that you tried thumbs up

But a key idea is missing in this approach.

Would you like to:

- 1 Try explaining your approach again
- 2 Know what important idea is missing
- 3 Solve it step by step together



Student

Step by step.

 Agent

Step 1: Do both fractions have the same denominator?

 Student

No.

 Agent

Correct.

Step 2: What common denominator can we use for 3 and 6?

 Student

6.

 Agent

Great.

Step 3: Rewrite $\frac{2}{3}$ with denominator 6.

 Student

$\frac{4}{6}$

 Agent

Step 4: Now add the fractions.

 Student

$\frac{5}{6}$

 Agent

 Well done.

Did this step-by-step method make sense to you?

Example 4 : Strong Understanding & Clear Approach

(Ta > 0.6 AND Tu > 0.6 → Coach Mode)

 Problem

Solve: $34 + 18 \frac{3}{4} + \frac{1}{8} 43 + 81$

 Agent

Before solving, tell me how you would approach this.

 Student

I'll convert both fractions to the same denominator and then add.

($Ta = 0.8$, $Tu = 0.7$)

 Agent

Good approach. Go ahead and solve it.

You can type, speak, or upload a photo of your steps.

 Student (photo upload)

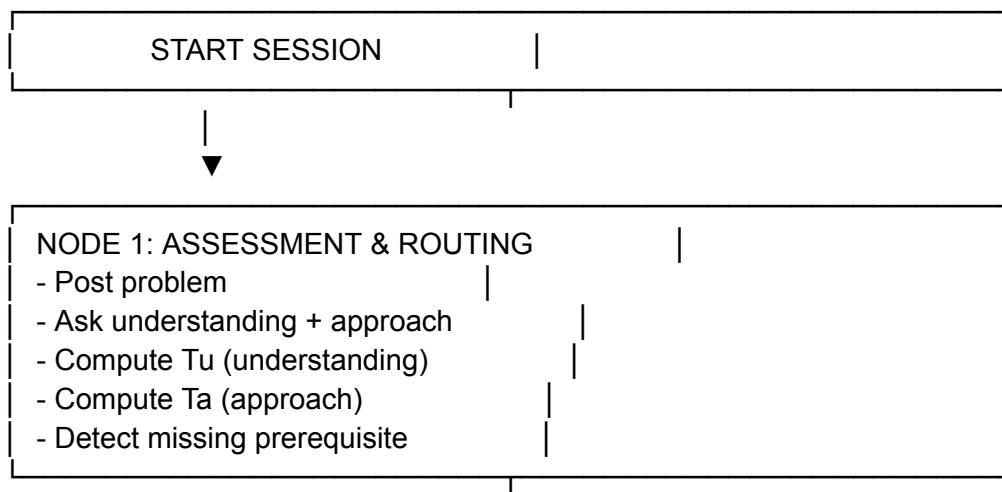
$$34 = 68 \frac{3}{4} = \frac{6}{8} 43 = 86$$

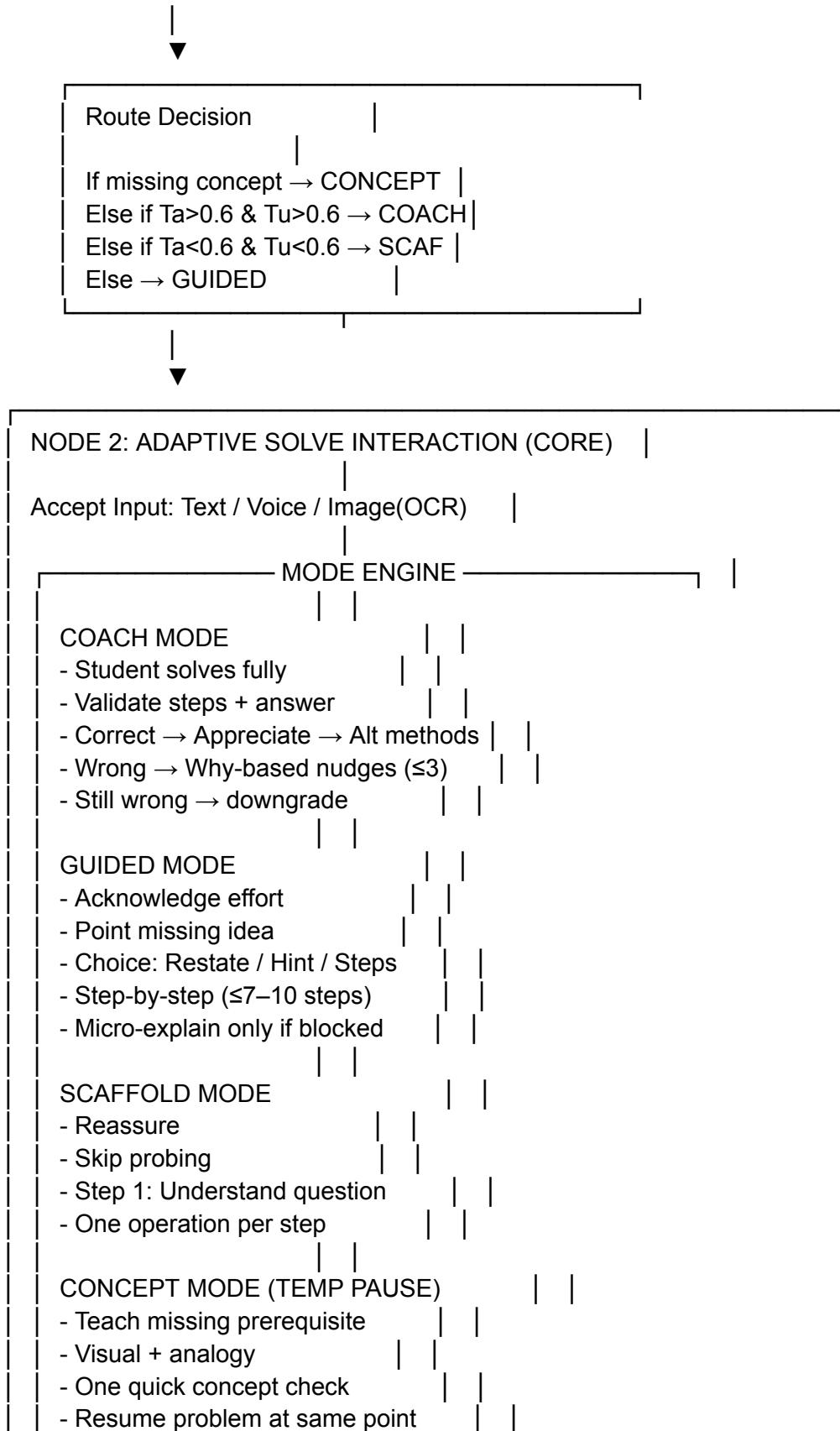
$$68 + 18 = 78 \frac{6}{8} + \frac{1}{8} = \frac{7}{8} 86 + 81 = 87$$

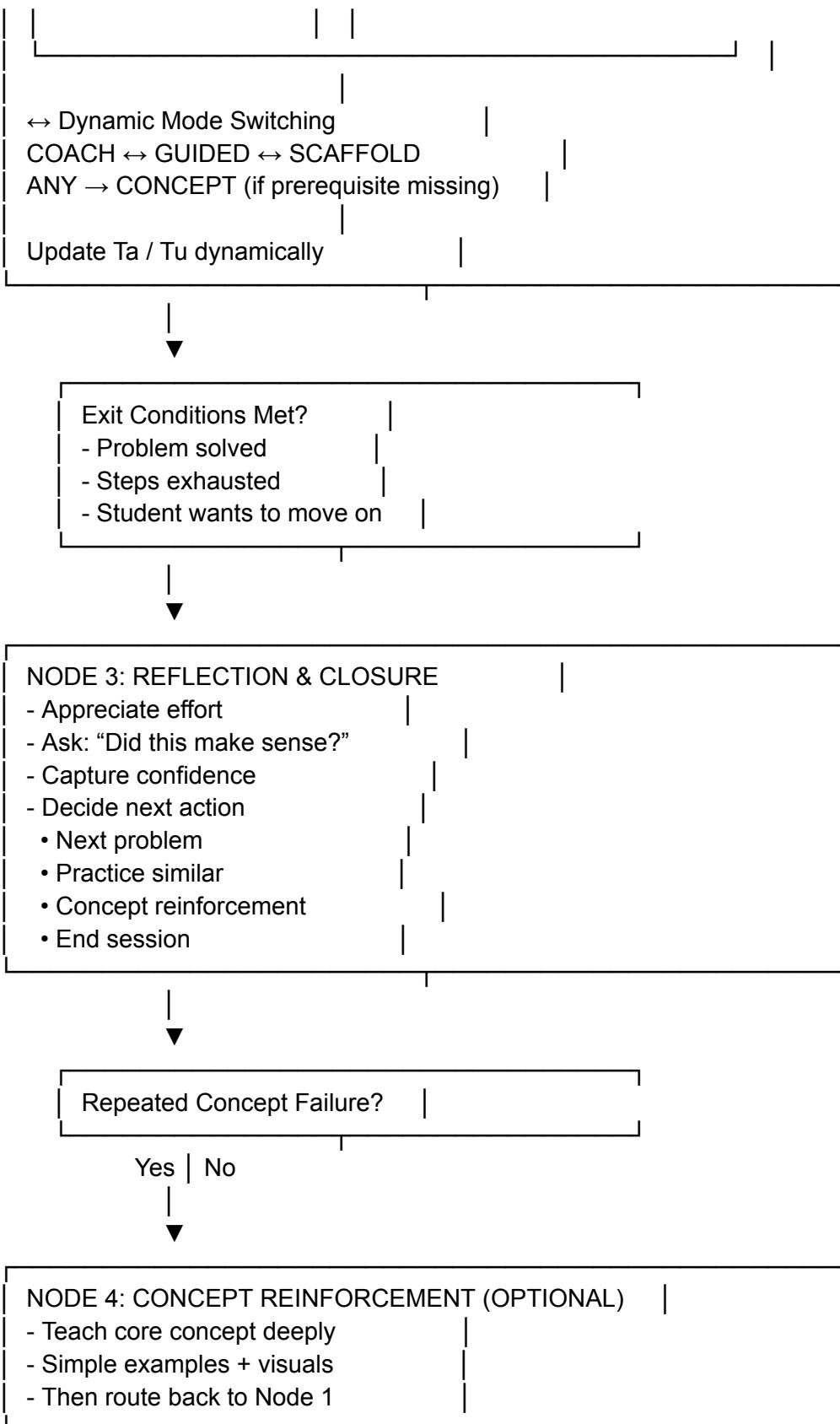
 Agent

 Correct — your steps are clear and accurate.

Probable solution:







—————END SESSION—————