Guided Tours in ALeA

Assembling Tailored Educational Dialogues
from Semantically Annotated Learning Objects

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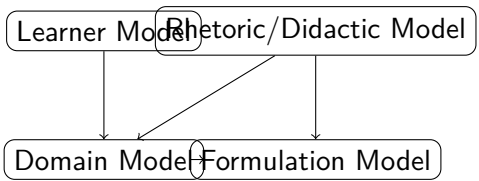
Motivation

Context: ALeA



Semantic annotation on the *concept level* in course materials.

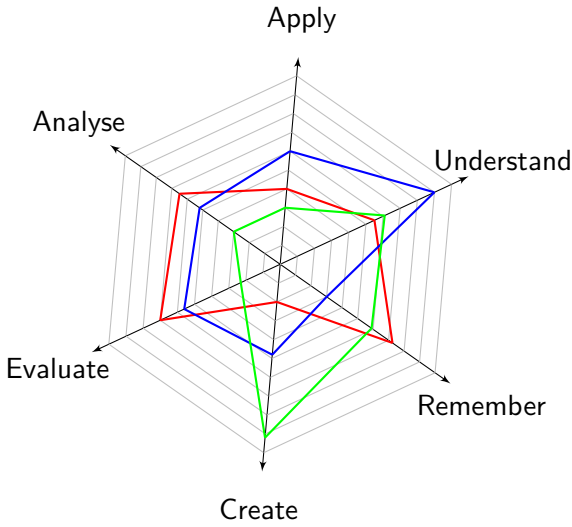
```
\begin{sassertion}[name=Pythagorean Theorem]
  \importmodule[geometry]{right-triangle}
  In a \symname{right triangle}, the \symname{square} of the
  \symname{hypotenuse} is \symname{equal} to the \symref{plus}{sum}
  of the \symnames{square} of the other two \symnames{side}.
  Often, this is expressed as the formula
  $\definiens{\equal{\plus{\square \a, \square \b}, \square \c}}$.

  \includegraphics{right_triangle.png}
\end{sassertion}
```

An Example sTEX Fragment

The Learner Model

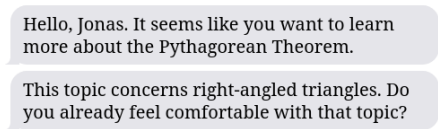
foo bar



Educational Dialogues

Educational Dialogues good!

Educational Dialogues



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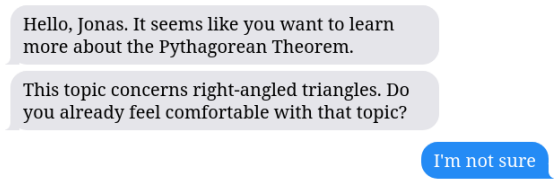

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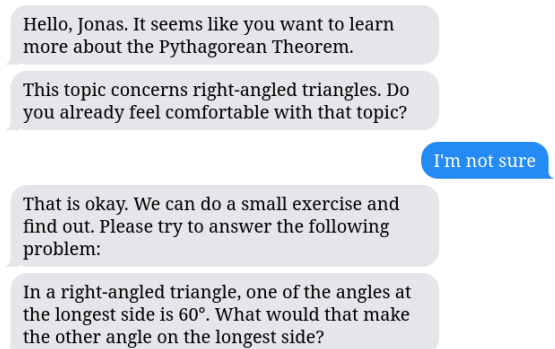

Educational Dialogues

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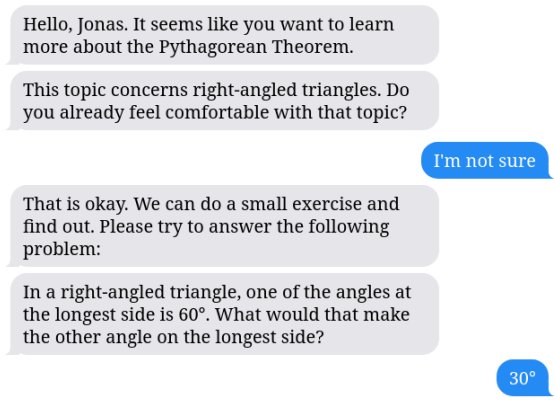

Educational Dialogues

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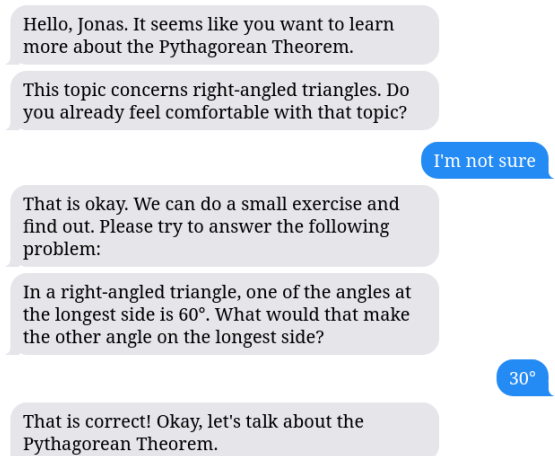
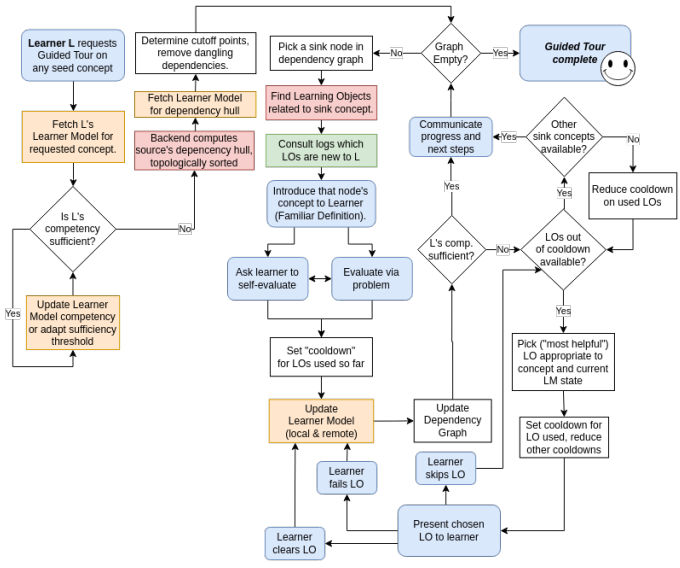
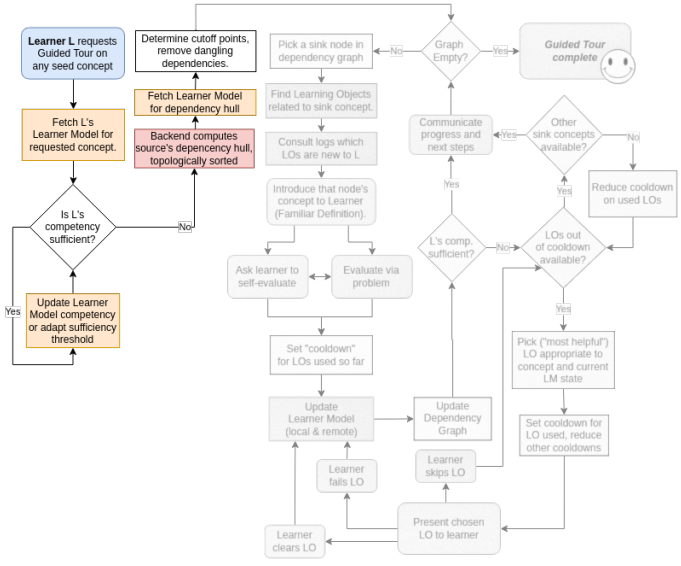


Overview

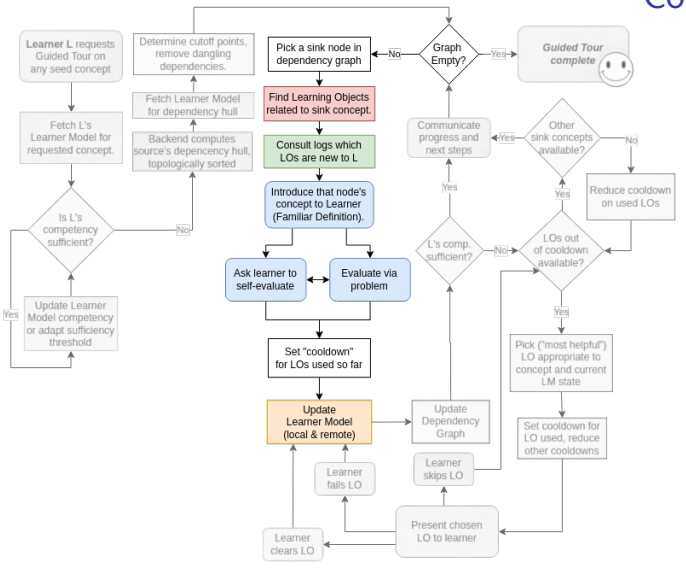


The complete algorithm for guided tours in ALEA.

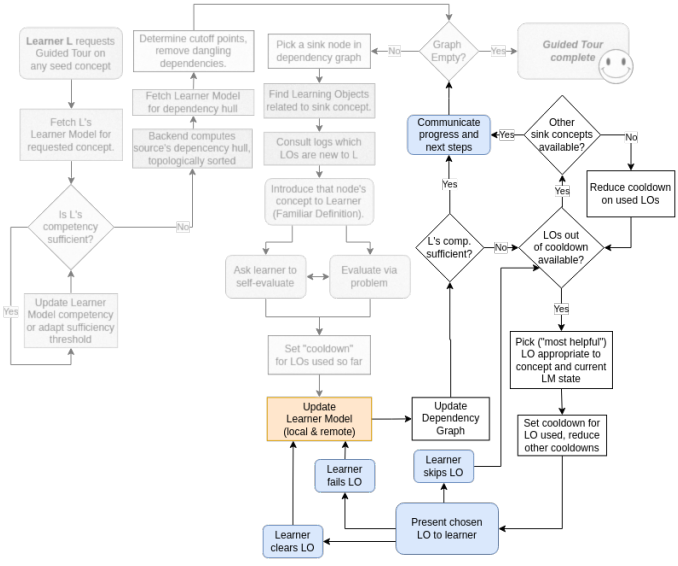
Initialisation



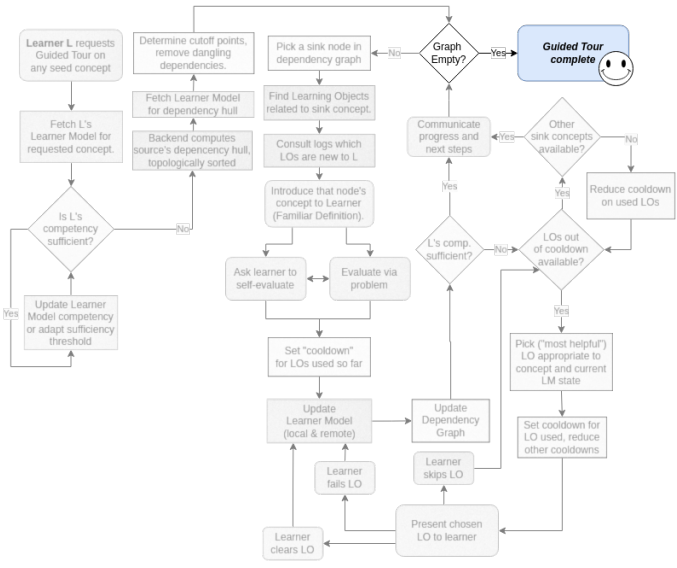
Concept Introduction



Learning


Learner L requests Guided Tour on any seed concept
Determine cutoff points, remove dangling dependencies.
Pick a sink node in dependency graph
No
Graph Empty?
Yes
Guided Tour complete
Fetch L's Learner Model for requested concept.
Fetch Learner Model for dependency hull
Find Learning Objects related to sink concept.
Communicate progress and next steps
Yes
Other sink concepts available?
No
Backend computes source's depencency hull, topologically sorted
Consult logs which LOs are new to L
Yes
Yes
Reduce cooldown on used LOs
Is L's competency sufficient?
No
Introduce that node's concept to Learner (Familiar Definition).
L's comp. sufficient?
No
LOs out of cooldown available?
Yes
Ask learner to self-evaluate
Evaluate via problem
Update Learner Model competency or adapt sufficiency threshold
Set "cooldown" for LOs used so far
Pick ("most helpful") LO appropriate to concept and current LM state
Update Learner Model (local & remote)
Update Dependency Graph
Set cooldown for LO used, reduce other cooldowns
Learner fails LO
Learner skips LO
Present chosen LO to learner
Learner clears LO

Finish


Learner L requests Guided Tour on any seed concept
Determine cutoff points, remove dangling dependencies.
Pick a sink node in dependency graph
No
Graph Empty?
Yes
Guided Tour complete
Fetch L's Learner Model for requested concept.
Fetch Learner Model for dependency hull
Find Learning Objects related to sink concept.
Communicate progress and next steps
Yes
Other sink concepts available?
No
Backend computes source's depencency hull, topologically sorted
Consult logs which LOs are new to L
Reduce cooldown on used LOs
Is L's competency sufficient?
No
Introduce that node's concept to Learner (Familiar Definition).
Yes
Yes
L's comp. sufficient?
No
LOs out of cooldown available?
Ask learner to self-evaluate
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Set "cooldown" for LOs used so far
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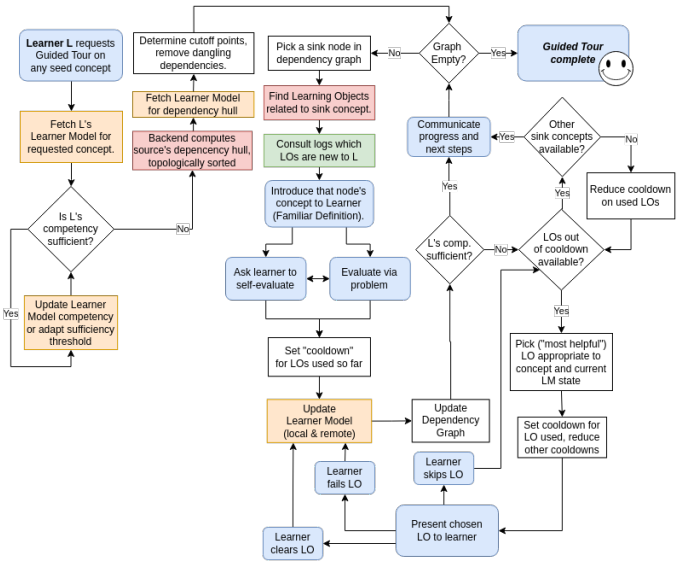
Update Learner Model (local & remote)
Update Dependency Graph
Set cooldown for LO used, reduce other cooldowns
Learner fails LO
Learner skips LO
Present chosen LO to learner
Learner clears LO

Recap



The complete algorithm for guided tours in ALEA.