Brief:

What we're building is a support system for teachers , not a replacement for human-led lessons in any sense. In most classrooms, delivering a lesson to the entire class isn’t the primary challenge, since many students are learning the same material. However , the real challenge arises when it comes to addressing individual student doubts. This requires the teacher to provide personalized attention and cater to each student’s unique needs. In low-resource settings where the teacher-to-student ratio is heavily skewed, it's often difficult for teachers to give each student the support they need. That's where our assistant comes in — to ease this burden by helping manage individual student interactions more effectively.

This is where our solution, DART (Dynamic Agentic Reflective Tutor) comes in. We’re building a system designed to help students with their individual questions, based on what was taught in class, and in a way that feels truly personalized.

Right from the start, we’ve taken inspiration from real teachers. What we noticed is that teachers usually approach student doubts from two angles. The first is shaped by their long-term experience , general teaching wisdom which is not specific to any subject or student and consist of things like how to structure explanations, when to give examples, and how to pace a lesson. The second is much more student-specific. A good teacher picks up on patterns , maybe a student tends to miss small details, or lacks some background knowledge that’s needed for the current topic. In those cases, the teacher adjusts their approach, often going back a step to build that missing foundation.

That’s exactly the kind of thoughtful support we’re aiming to replicate with DART.

We try to extract both long-term and short-term insights using different agents.

For global (long-term) insights, we use Expel-Agents. These agents are provided with pairs of successful and failed learning trajectories — where success or failure is determined by whether the student scores above a certain threshold in the corresponding questionnaire. These trajectory pairs span a wide range of topics and include various types of queries. The agent contrasts them to identify patterns , what generally works and what doesn’t. Since these queries come from diverse topics, the resulting insights are broad and widely applicable. We start by providing the agent with one trajectory pair, which yields some initial insights. As we add more pairs, the agent refines its understanding — adding, editing, or discarding insights based on whether they generalize across the new data. The key advantage of this approach is that as more students use the platform and more trajectories are stored in the database, the quality and depth of our insights will continue to grow similar to how a teacher gets more and more experienced with time.

For student-specific insights, we use Reflective Reinforcement Agents. The goal here is to replicate a student's behaviour based on their persona — including variables like educational background, weaknesses, familiar topics, and more. These persona details are provided to an agent, which is then prompted to respond as the student would. The idea is to simulate how the student might think or behave while answering questions on a given topic and identify the points where they might go wrong. We then use a Reflexion Agent to analyse these responses and extract student-specific insights, helping us understand their weak areas so that these can be addressed while explaining the topic. For example, if a student's background is in Hindi-medium education, including key terms in Hindi might significantly enhance their understanding.

Here, teachers can upload the materials they have used in class — whether PDFs, videos, presentations, or other formats. When a student submits a query, our framework first analyzes the question to uncover any hidden intents behind it. It then recommends the most relevant materials that can collectively answer all aspects of the student’s query — similar to how a teacher selects the best resources to help a student understand a concept.

Next, we extract global insights from the Expel Agent and begin the chapter or explanation that directly addresses the student’s question. If the student still struggles to understand the concept on the first attempt, we generate local insights for that specific topic. These include all the possible reasons why the student may have failed to grasp the concept — such as knowledge gaps or individual weaknesses. Using this, we prepare revision material tailored to the student’s needs.

Throughout this process, we keep track of all related topics where the student continues to face difficulty. If the student fails to understand even after the revision and localized support, we recommend a joint session involving other students who are struggling with the same topics. This approach helps reduce the burden on teachers — instead of addressing similar doubts one-on-one, they can focus on shared sessions that address common issues. It also allows teachers to target specific topics more precisely rather than responding to vague individual questions.