Curistro: Learning by Teaching

Presented by Team: AI Pathfinders

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1. Executive Summary

Curistro is an educational platform designed to revolutionize how learners assimilate and retain knowledge. Instead of the traditional model where students passively receive information from an AI or human tutor, Curistro flips the script—**the learner becomes the teacher.** By instructing a virtual AI "student," users must articulate, structure, and refine their understanding of a subject in ways that passive study simply cannot match.

Once the teaching session ends, an AI judge evaluates how effectively the AI student understood the material, relying on metrics such as clarity of explanation, logical flow, and conceptual accuracy. This output is tied directly to the quality of the user's teaching. In practical terms, Curistro provides feedback that pinpoints exactly where the user excelled in clarity and where they fell short, prompting them to revisit weak points. Beyond improving comprehension, it enhances the user's communication skills by stressing active expression rather than mere information consumption.

By combining these elements—user as teacher, AI student, AI judge, and robust feedback—Curistro harnesses a deeply engaging, **learning-by-teaching** approach. This proposal lays out how we plan to bring this idea to life, its theoretical underpinnings, and the roadmap for implementing a Minimum Viable Product (MVP) that can be tested, refined, and scaled.

2. Background

Modern personalized education platforms—be they language apps, MOOC platforms, or AI-driven tutors—largely follow a one-directional flow. Students consume courses, quizzes, or

interactive lessons, and are assessed on how well they recall or apply the information. While effective, such systems risk encouraging **passive learning**, where students are not necessarily forced to deeply process or reorganize the information in their own words.

Curistro fills an important gap in this ecosystem by adopting a **role-reversal** approach, inspired by educational psychology principles such as the Feynman Technique. Research consistently demonstrates that when individuals must teach a concept to another entity—especially in a structured way—they gain a deeper understanding and retain information longer. The act of teaching compels learners to identify gaps in their knowledge, organize concepts coherently, and address misunderstandings head-on. This concept builds on the extensive body of research on **constructivist** and **heutagogy-based** learning strategies, where students benefit from higher autonomy and self-direction.

Furthermore, by introducing an AI student that can **simulate misunderstandings** or knowledge gaps, Curistro offers an experience closer to real-life teaching, where the "student" may need clarifications or repeated explanations. This ensures that the user remains engaged, actively reflecting on how to convey content clearly and effectively.

3. Proposed Solution

3.1 General Workflow

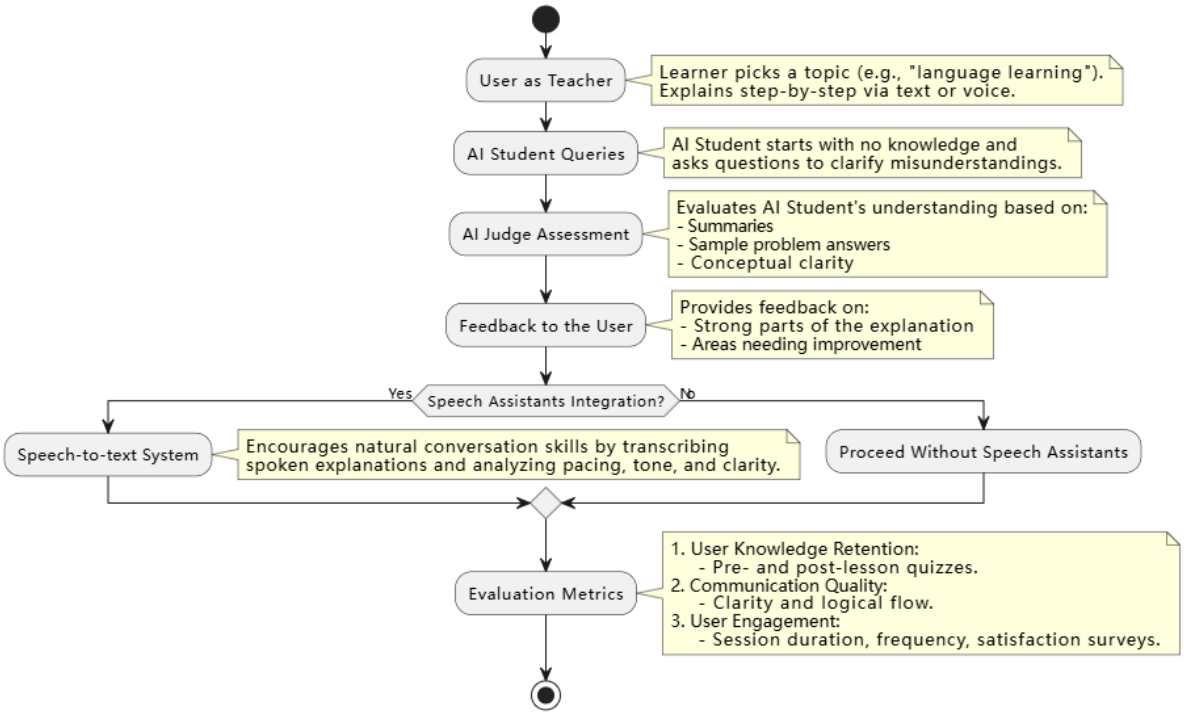

Fig 1. General Workflow

1) **User as Teacher**: The learner selects a topic—e.g., “Basic French Greetings”—and explains it step-by-step to the AI student. This can happen via a text interface or through a spoken explanation (recorded and transcribed in real time).
2) **AI Student Queries**: The AI student, programmed to emulate someone lacking prior knowledge, listens carefully to the user’s explanation and asks targeted questions. These questions surface potential areas of ambiguity or gaps in the user’s explanation.
3) **AI Judge Assessment**: After the session, an AI judge evaluates how well the AI student has “understood” the topic. This is done by analyzing the student’s generated summaries, its ability to correctly answer sample problems or questions, and its conceptual clarity regarding the topic. The judge’s report directly correlates to the

user's teaching effectiveness.

4) **Feedback to the User**: Finally, the user receives a comprehensive feedback report. It details which parts of their explanation were strong, which areas might need clarification, and how the user's communication style might be improved.

This workflow also integrates **Speech Assistants** for those who prefer or require voice-based interaction. This element not only boosts accessibility—making the platform more usable for visually impaired individuals—but also provides a more natural way to practice and hone verbal communication skills. By analyzing pacing, tone, and clarity, the system can offer detailed insights into how the user can refine their delivery.

On the measurement side, three key metrics are highlighted:

- **Knowledge Retention**: Pre- and post-lesson quizzes to gauge how effectively the user's teaching helped them internalize concepts.
- **Communication Quality**: Metrics include clarity, logical flow, the ability to handle the AI student's questions, and the efficiency of re-explanations.
- **User Engagement**: Examined through session duration, frequency of teaching interactions, and user satisfaction surveys to ensure the experience is both enjoyable and effective.

3.2 Technical Feasibility

- **Language Models**: Two distinct but related Large Language Models (LLMs) drive this experience. One model (the AI student) is configured to ask clarifying questions and occasionally display misunderstandings, while the second model (the AI judge) is

calibrated to evaluate the student's level of understanding. The judge uses a rubric-based scoring system, factoring in completeness, accuracy, and conceptual coherence.

- **Speech Recognition**: For speech-based teaching, Curistro relies on robust, widely adopted APIs such as the Whisper API or other leading speech-to-text services. This ensures minimal friction for voice input and maintains high accuracy in transcriptions. Advanced or custom solutions can also analyze paralinguistic cues, such as intonation or speaking tempo.
- **Adaptive Difficulty**: As the user grows more proficient, the AI student can incorporate increasingly challenging questions or more nuanced misunderstandings. This ensures that users consistently operate at the edge of their comfort zone, propelling them to higher levels of mastery.
- **Data & Security**: All user interactions, including transcribed voice data, are stored securely, ensuring privacy. The platform will adhere to common data protection regulations (e.g., GDPR). In a competition or prototype environment, storing minimal personal data and focusing on anonymized usage metrics can facilitate safer testing.

3.3 Elementary Design

Mascot: A friendly AI "student" character—perhaps a small robot figure—could appear throughout the interface, asking questions and displaying "confusion" or "aha!" moments. This humanizes the AI interaction, making the user's role as a teacher more tangible and engaging. In initial stages, design can be minimal, but as Curistro matures, consistent branding and UI elements will be crucial for user retention and identity.

3.4 Theoretical Support: The Feynman Technique

The Feynman Technique serves as the conceptual backbone of Curistro's methodology. Originally championed by the physicist Richard Feynman, it suggests simplifying complex topics by explaining them in one's own words—often to an imaginary or real listener. A recent empirical study evaluating the technique within K-12 environments found that students employing the Feynman approach not only scored higher on posttests but also demonstrated better learning gains than their control group peers (Rayes et al., 2021).

This study underscores several advantages aligned with Curistro:

1. **Deep Comprehension**: Breaking down information into digestible chunks fosters in-depth processing rather than superficial memorization.
2. **Constructivist Approach**: Students build their own knowledge structures through active teaching rather than passively receiving information.
3. **High-Level Autonomy**: By forcing students to generate explanations, the Feynman Technique increases self-regulation and independence—critical in remote or e-learning contexts.

Curistro effectively **automates and gamifies** this Feynman approach. Instead of learning in isolation, users verbally or textually articulate lessons to a "real" AI student, receiving instant feedback from an AI judge. This **closed-loop system** of instructing, questioning, and reflecting amplifies the technique's benefits, making it more accessible and engaging in an online environment.

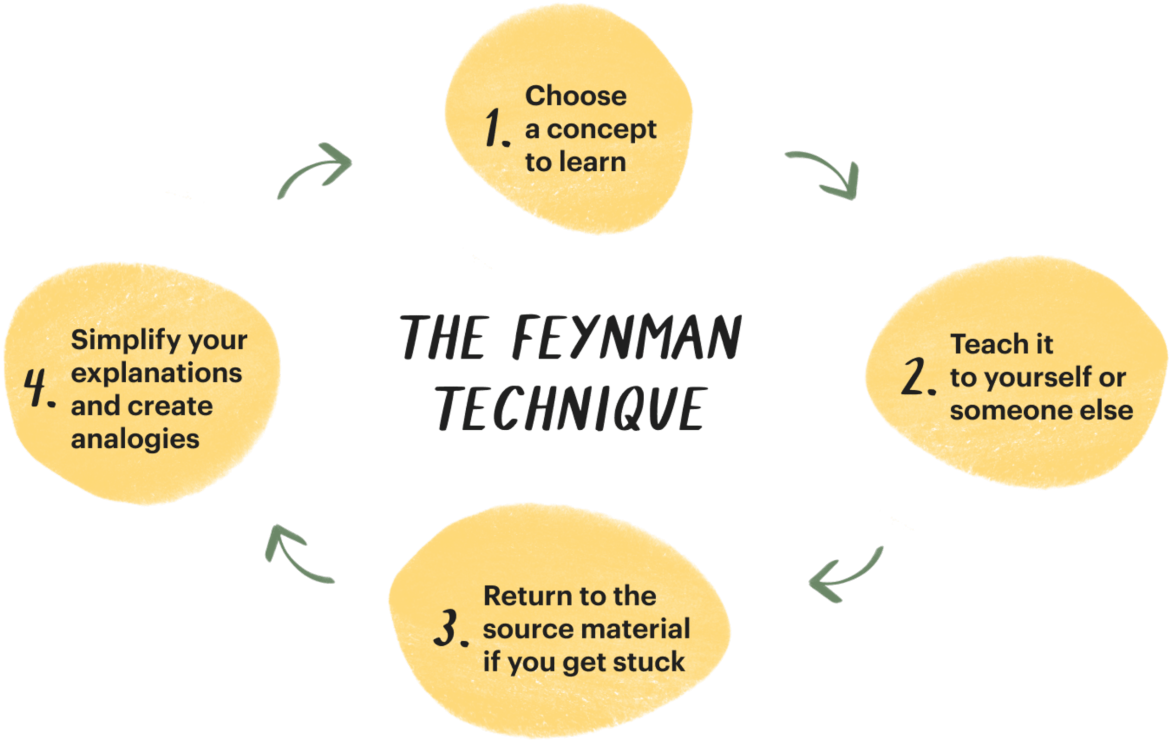

Fig 2. Illustration of the Feynman technique from *Todoist*

4. Deliverables and Goals

Curistro's main deliverable is a functioning prototype that demonstrates the learning-by-teaching paradigm. This prototype will feature:

- A user-friendly interface (either web-based or app-based) allowing text or voice input.
- The AI student model that simulates knowledge gaps and prompts the user for clarification.
- The AI judge model that analyses how effectively the user taught the subject.
- A feedback dashboard summarizing user performance, highlighting both strengths and areas for improvement.

Beyond the initial prototype, the overarching goal is to validate the teaching **role-reversal**

approach as a means of deeper learner engagement, increased retention, and improved communication skills. Ultimately, Curistro aspires to become a transformative tool in the ed-tech space, complementing existing AI-driven solutions by filling the crucial niche of active, reflective learning.

5. Implementation Roadmap

Phase 1: MVP Development

- Build out the user interface for text-based teaching and a simple version of the AI student with a basic AI judge.
- Conduct small-scale user tests to refine user interface, clarity of instructions, and the logic behind the AI student's questions.

Phase 2: Speech Integration & Multi-Subject Expansion

- Speech-based Teaching: Incorporate APIs like Whisper to enable automatic transcriptions and real-time feedback on speech clarity.
- Multi-Domain coverage: Extend coverage to include additional language topics, STEM fundamentals, and humanities.
- Improve the AI judge's rubric to handle multiple question types and adapt to a variety of topics. (e.g., foreign language grammar vs. math proofs).

Phase 3: Advanced Feedback & Gamification

- Add emotional tone analysis, enabling the system to detect user frustration or hesitation and respond with supportive cues.
- Introduce gamified features such as achievements ("Master Teacher" badges) to

reward consistent use and high-quality explanations.

Analytics & Personalization

- Integrate deeper analytics: track user improvement over time and personalize the AI student's questions based on user performance trends.
- Expand pilot programs with educational institutions, gathering broader feedback to refine the platform further.

Throughout these phases, the concept of an MVP remains front and center—launch quickly with a core feature set, gather user insights, and iterate based on real-world experience.

6. Partnerships & Resources

- **Educational Institutions**: Collaborating with schools, tutoring centers, and online course providers can offer real learners to pilot the solution, provide feedback, and generate data on its efficacy across different age groups and subject matters.
- **Technology Partnerships**: Working alongside cloud service providers (e.g., AWS, Azure) ensures the solution can scale to many users without performance bottlenecks. Partnerships with popular ed-tech platforms can enable deeper integration, such as single sign-on, shared analytics, or cross-promotion.
- **Research Collaborations**: Partnering with universities or educational psychology labs can bring academic rigor to the assessment of Curistro's impact, providing peer-reviewed validations and suggestions for iterative improvement.

In terms of resources, the project will require:

- **Computational Infrastructure**: Servers or cloud-based containers to host the AI models and handle data securely.
- **Developer Expertise**: Skilled developers to maintain front-end and back-end systems.
- **Data Analysts & Educational Psychologists**: To evaluate user metrics, pilot study results, and learning outcomes for continuous refinement.

7. Conclusion

Curistro is poised to redefine personalized education by shifting learners from passive recipients to active teachers. Embedding the principles of the Feynman Technique—as supported by recent experimental research—positions Curistro as a credible and powerful solution for improving learning outcomes in remote, hybrid, or traditional classroom settings. From an MVP web application focused on text-based instruction to a full-fledged ecosystem integrating speech recognition, emotional analytics, and multi-subject coverage, Curistro aims to offer a comprehensive answer to the ever-present challenge of learner disengagement. This method fosters deeper comprehension and more robust knowledge retention while simultaneously building crucial 21st-century skills in communication, critical thinking, and autonomous learning.

We anticipate that Curistro, through strategic pilot programs and iterative design, will evolve into a highly scalable, user-centric platform—one that stands out in the ed-tech landscape for its unique and empirically grounded approach to teaching and learning.

8. References

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