GraphWiseLearn

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The Problem

One-size-fits-all Approach: Standardized teaching methods fail to address individual learning needs.
Limited Engagement: Students may feel disconnected and less motivated due to a lack of personalization.
Diverse Learning Styles: Different students have unique ways of learning, which are often not catered to.
Pacing Issues: Uniform pace of instruction doesn't accommodate faster or slower learners.
Retention and Understanding: Traditional lectures can result in lower retention and understanding of material.

The Ideal

Personalized Instruction: Tailoring educational content to individual students' needs, styles, and paces, enhancing engagement and efficacy.
Private Tutors: Engaging multiple special educators for personalized attention.
Adaptability: Flexibility to adjust learning materials and methods according to each learner's progress.
Active Learning: Encouraging hands-on activities and practical application of knowledge to foster a deeper understanding.
Continuous Feedback: Providing regular, individualized feedback to help students understand and improve continuously.

Research Questions

RQ1: What changes in the cost/benefit ratio occur with the introduction of LLM-generated content that is quality-enhanced through a cost/benefit- optimizing workflow?

RQ2: How does providing individualized and adaptive learning paths based on such assessments, as proposed, affect the learning experience of individual learners?

RQ3: What insights and quality improvement approaches are possible based on the empirical data that is gathered using this approach?

Five Core Components

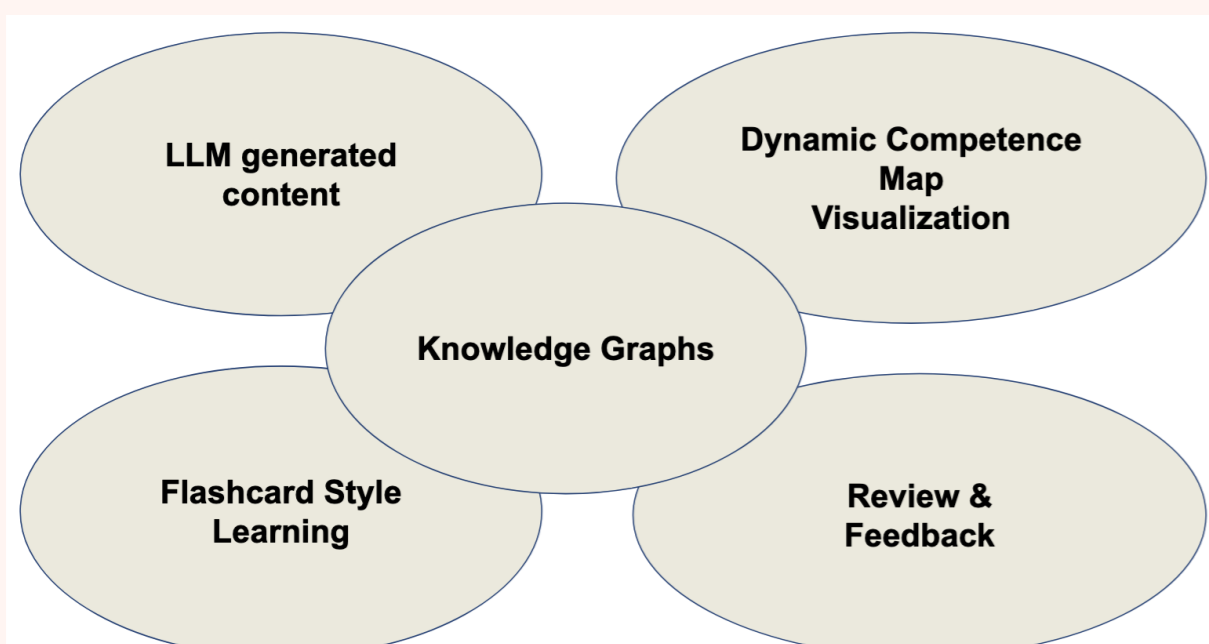GraphWiseLearn is a TEL environment using a unique combination of five core components:

Figure 1. Five core components of GraphWiseLearn
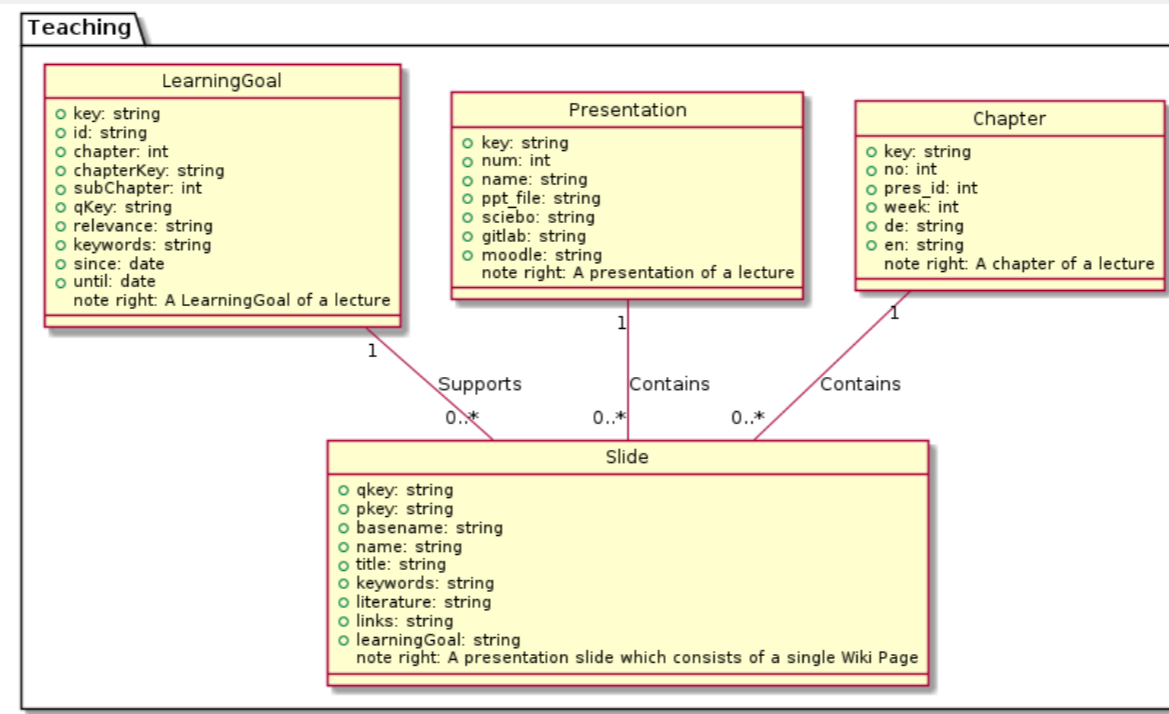
Knowledge Graphs

Figure 2. UML class diagram for some teaching entities

Semantified Learning Content is created from diverse traditional sources such as PowerPoint presentations, PDF documents or Moodle content.
Links to original material, examples and other learning resources such as OERs are provided.
FAIRness is a guiding principle for the gestalt of the Knowledge Graph.

LLM generated content

LLMs are capable of generating individual content. The **learners background** needs to be provided as a context.
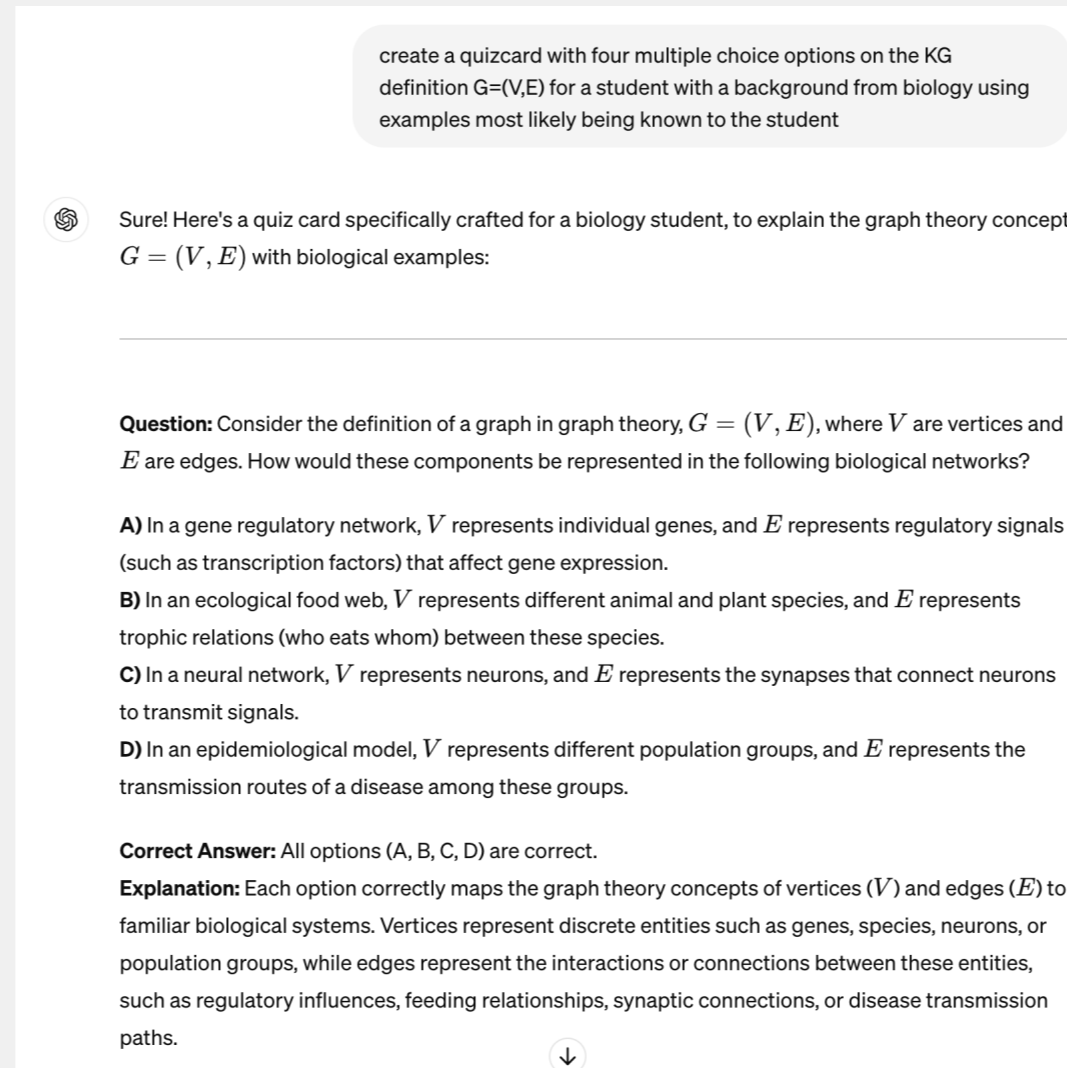

Figure 3. ChatGPT flashcard creation example

Flashcard Style Learning

Figure 4. Software Architecture course Mock Exam Quiz Card.

Increased memory retention: Utilizes spaced repetition and active recall, proven to work well by platforms such as Duolingo and Anki.
Personalized Content: Generates flashcards based on individual background and competency levels to provide customized learning trajectories.
Interactive and Engaging: Incorporates interactive quizzes and exercises within the flashcards to enhance engagement and facilitate active learning.
Continuous Improvement: Continuously refines and updates flashcard content based on direct feedback and performance analytics to enhance learning efficacy.

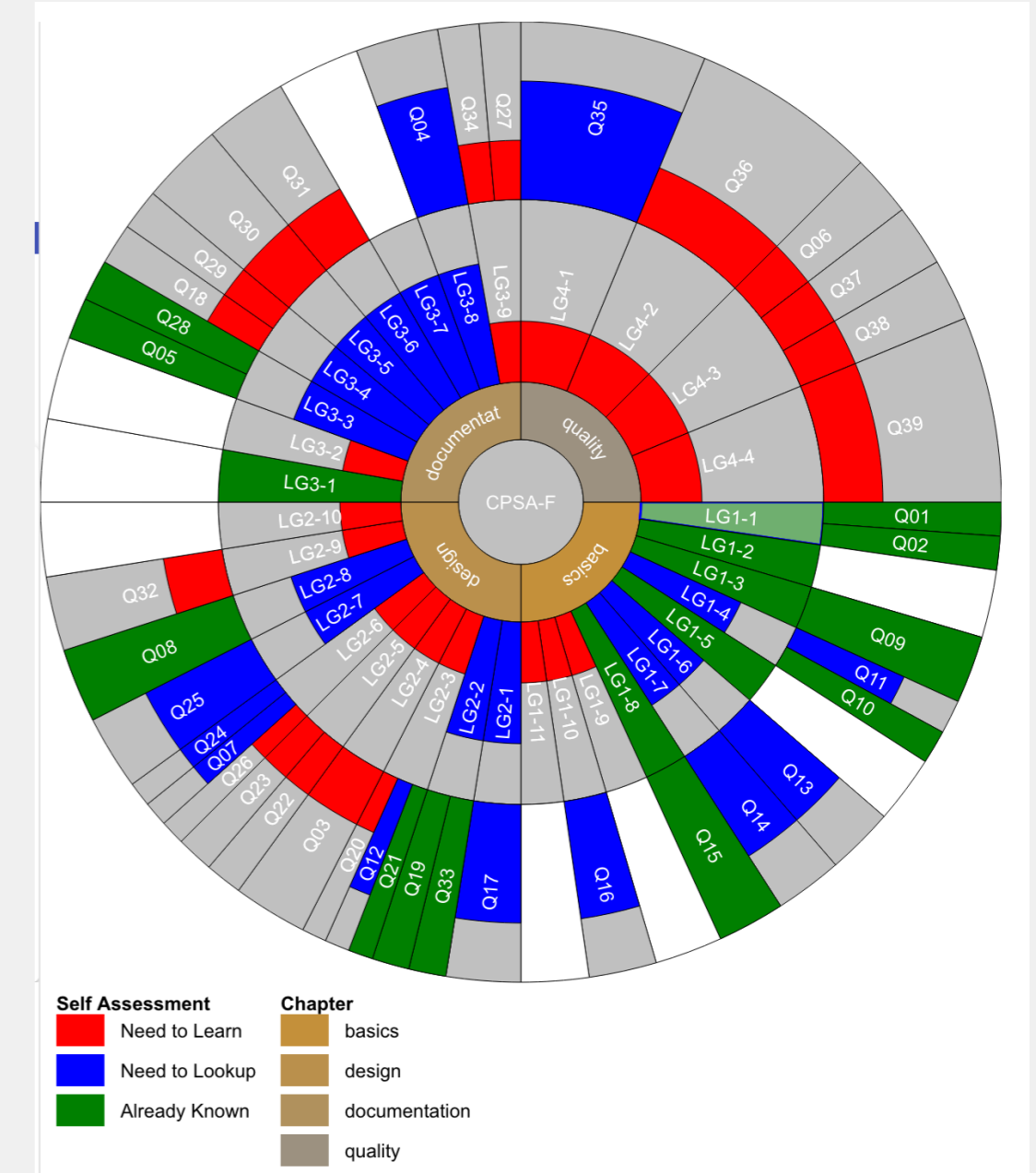## Dynamic Competence Map Visualization

Figure 5. Selfassessment visualized as Dynamic Competence Map

Progress Tracking: Maps display real-time mastery of competencies, enhancing understanding of personal educational growth.
Skill Wheels and Radar Charts: Tools like skill wheels and radar charts provide snapshots of competency levels, highlighting areas of strength and needed improvement.
Adaptation to Learner's Pace: DCMs dynamically adjust to the pace of the learner, allowing for a tailored educational journey.
Integration with Assessments: Continuous linkage with LLM-generated assessments ensures that the maps reflect up-to-date learner achievements and areas for development.

Review and Feedback

To economically use human resources, LLM generated content is **peer reviewed** and rated along the supervisor hierarchy. A **Star rating** is applied, with the rating options being dependent on the level of the rater in the hierarchy. **Rejections** of LLM generated content are possible on all levels.

Results

Individual and group feedback on **self-assessments**, visualized with **radar charts**, guides supervisors and learners in focusing on relevant content. The feedback from stakeholders is positive.
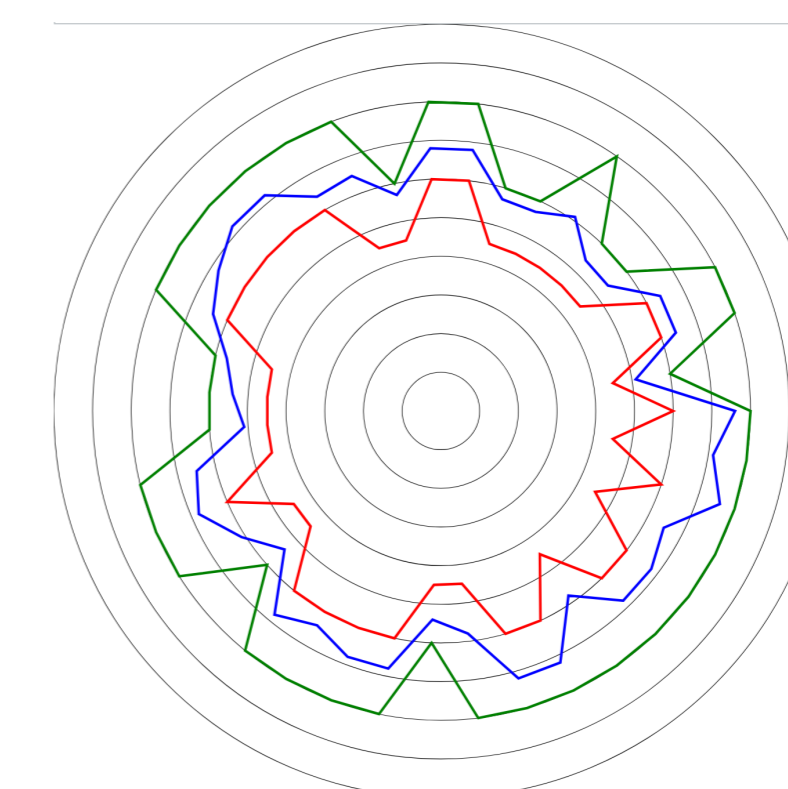

Each concentric circle represents 10% of the total score needed to pass (60%). The colored lines represent the self-assessment score before the training.
- **Red:** minimum
- **Blue:** median
- **Green:** maximum

Figure 6. Radarchart of self assessment for software architecture course