Overall Comparative Evaluation: RAG-Based vs Non-RAG Methods

Comparative Evaluation of RAG-Based and Non-RAG Methods for Teaching OOP Topics

Overview of Evaluation Dimensions

This evaluation compared the RAG-based and non-RAG methods for generating problem statements, evaluation rubrics, and feedback across 10 topics in Object-Oriented Programming (OOP). The key focus areas were:

1. **Problem Statement Quality**

- Clarity, comprehensiveness, and alignment with the intended topic.

- Real-world applicability and intellectual challenge.

2. **Evaluation Rubric**

- Specificity and relevance of criteria for assessing solutions.

- Ability to differentiate levels of understanding effectively.

3. **Feedback Quality**

- Constructiveness and depth of feedback provided to students.

- Ability to highlight strengths, address weaknesses, and encourage further learning.

Overall Comparison Across 10 Topics

Problem Statement Quality

- **RAG-Based Method:**

- Crafted complex and realistic problem statements.

- Incorporated real-world scenarios, enhancing relevance and engagement.

- Balanced conceptual depth with practical implementation challenges.

- **Non-RAG Method:**

- Simpler and less challenging problems.

- Limited scope often focused on straightforward implementations without encouraging exploration.

Evaluation Rubric

- **RAG-Based Method:**

- Provided detailed and specific rubrics covering multiple aspects, including readability, edge cases, and advanced OOP principles.

- Ensured alignment with learning objectives and fairness in evaluation.

- **Non-RAG Method:**

- Minimalist rubrics focusing on correctness and readability.

- Often lacked criteria for advanced concepts, resulting in superficial assessments.

Feedback Quality

- **RAG-Based Method:**

- Constructive and actionable feedback that highlighted strengths and weaknesses.

- Encouraged exploration of advanced concepts and provided specific improvement suggestions.

- **Non-RAG Method:**

- Feedback often lacked depth and focused more on correctness.

- Missed opportunities to motivate students to explore beyond the basics.

Quantitative Insights

- Topics with well-crafted problem statements (out of 10):

- RAG-Based Method: **9/10**

- Non-RAG Method: **5/10**

- Detailed rubrics covering multiple aspects (out of 10):

- RAG-Based Method: **8/10**

- Non-RAG Method: **4/10**

- Feedback rated as highly actionable (out of 10):

- RAG-Based Method: **9/10**

- Non-RAG Method: **5/10**

Conclusion

The RAG-based method consistently outperformed the non-RAG method across all dimensions. It provided challenging, real-world problems with detailed rubrics and actionable feedback that fostered deeper learning. While the non-RAG method offered simpler problems and evaluations, it often fell short in promoting exploration and mastery of OOP principles.