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Spring 2025 Meeting
01-03 APRIL
Daytona Beach, FL

Problem-Based Learning Approaches for Cross-Disciplinary Teaching

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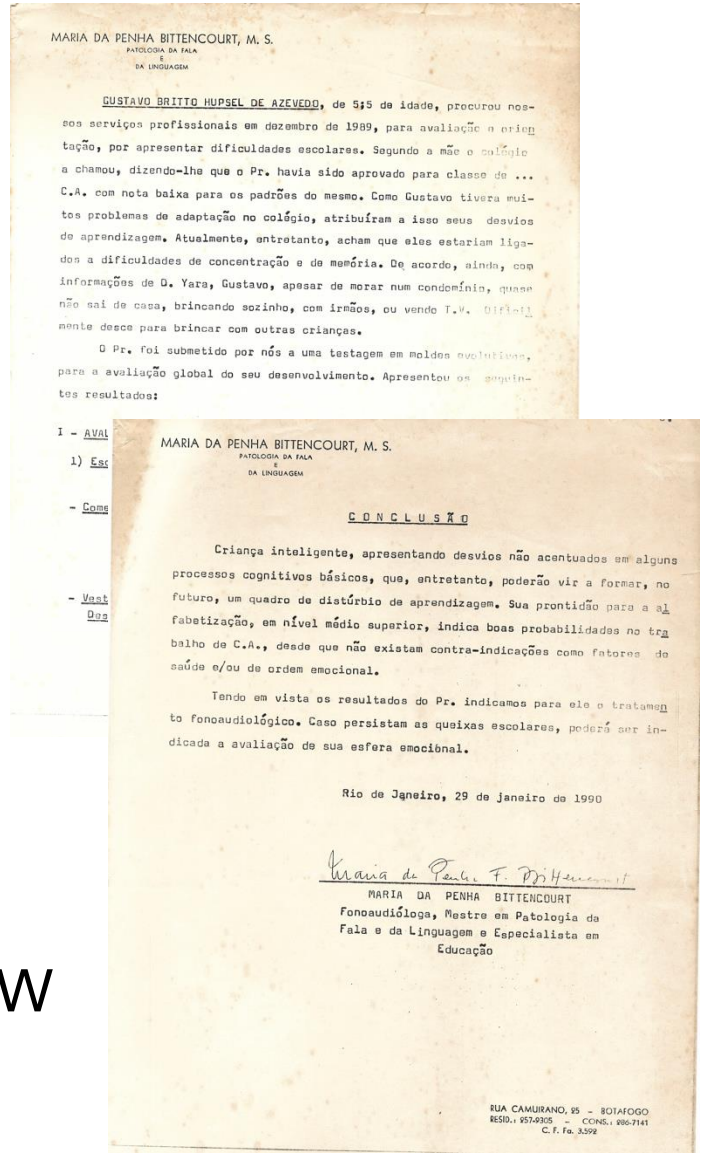
First a little story

- 1989 – 1st grade
  - Poor academic performance
  - School requests medical evaluation
- 1993 – 5th grade
  - Failed and held back

  (...)
- 2025 – 2x BSc., 2x MSc., and a PhD.
  - Invited to talk about cross-disciplinary teaching at FPAW while being neither an aviator nor a meteorologist.



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GUSTAVO BRITTO HUPSEL DE AZEVEDO, de 5;5 de idade, procurou nossos serviços profissionais em dezembro de 1989, para avaliação e orientação, por apresentar dificuldades escolares. Segundo a mãe o colégio a chamou, dizendo-lhe que o Pr. havia sido aprovado para classe de ... C.A. com nota baixa para os padrões do mesmo. Como Gustavo tivera muitos problemas de adaptação no colégio, atribuíram a isso seus desvios de aprendizagem. Atualmente, entretanto, acham que eles estariam ligados a dificuldades de concentração e de memória. De acordo, ainda, com informações de D. Yara, Gustavo, apesar de morar num condomínio, quase não sai de casa, brincando sozinho, com irmãos, ou vendo T.V. Dificilmente desce para brincar com outras crianças.

O Pr. foi submetido por nós a uma testagem em moldes ecléticos, para a avaliação global do seu desenvolvimento. Apresentou os seguintes resultados:

I - AVAL

1) Esc

- Comp

- Vast
Dos

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CONCLUSÃO

Criança inteligente, apresentando desvios não acentuados em alguns processos cognitivos básicos, que, entretanto, poderão vir a formar, no futuro, um quadro de distúrbio de aprendizagem. Sua prontidão para a alfabetização, em nível médio superior, indica boas probabilidades no trabalho de C.A., desde que não existam contra-indicações como fatores de saúde e/ou de ordem emocional.

Tendo em vista os resultados do Pr. indicamos para ele o tratamento fonoaudiológico. Caso persistam as queixas escolares, poderá ser indicada a avaliação de sua esfera emocional.

Rio de Janeiro, 29 de janeiro de 1990

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Challenge

- Dopamine-rich environment.
- Reduced attention span.
- Growing body of knowledge.
- Self-imposed barriers and anxiety associated with learning materials out of preferred areas of knowledge.

Problem-based learning - Origin

- Students perceived the **vast amount of material** presented in the first three years of medical school as having **little relevance** to the practice of medicine and clinically based medicine.
  - Similar problems exist for any field that requires proficiency within a large body of knowledge from **seemingly unconnected disciplines**.

- The PBL curriculum was developed to stimulate learning by allowing students to see the relevance and application to future roles.
  - It maintains a higher level of motivation towards learning

Problem-based learning - Paradigm

- PBL is a student-centered approach to learning that involves groups of students working to solve a real-world problem, quite different from the direct teaching method of a teacher presenting facts and concepts about a specific subject to a classroom of students.

Problem-based **teaching**

- With PBL, the teacher acts as a facilitator; the learning is student-driven, with the goal of solving the given problem.
- Concepts and subjects are presented to students as tools for problem-solving.

Complementary approaches

- Learn to fail:
  - Fast.
  - Gracefully.
  - Learn to recover.
- Competence-building :
  - Complex skills are presented
- Learn to learn
  - Guiding students through developing the necessary skills to break down challenges into manageable problems, search for analogous solutions, and propose extensions and modifications that lead to new solutions.

Implementation

- Determine desired learning outcome.
- Associate learning outcomes with students' primary activity.
- Create a problem based on association.
  - In cases where a new skill, language, or technique is needed, build competence through increasingly complex versions of the same problem.

PBL and aviation weather - WxUAS

- Desired outcome: understanding the risks of variable wind profiles, particularly the low-level jet.
- Students' primary activity: Safely pilot the UAS from the surface to 5000 ft and back (VLOS)
- Problem: You are performing a WxUAS profile with a fixed wing through a spiral ascent pattern in support of an atmospheric sampling mission when suddenly, at 4000 ft. AGL, on the upwind leg, you notice the WxUAS is losing ground. After a systems check, you conclude that the aircraft is fine, but you continue to lose ground; the aircraft is becoming smaller, and a loss of control link may soon become an issue. **What is happening? What change? Why the sudden change? What should you do?**

Summary

- Different people have different thought “languages”.
- Dedicated educators have the power to change lives.
- Problems can pique curiosity and motivate students.
- Problems create a relatable and common language.
- New knowledge is acquired gradually as a tool for problem-solving.