Innovation in Teaching Learning Process

Research Based Learning

Name of the Innovation : Research Based Learning

Course Code and Name : Analyzing of Aircraft Structures using FEA

Class and Semester : TY & V

Academic Year and Term : 2024-2025 Term-I

Faculty Name and Designation : Mr. Basithrahman A & Assistant Professor

Introduction:

Finite Element Analysis (FEA) is a critical tool in engineering, enabling students to analyze complex structural problems with computational methods. Traditional teaching methods often focus on theoretical concepts with limited hands-on experience in real-world applications. To bridge this gap, Research-Based Learning (RBL) has been introduced as an innovative pedagogical approach in the "Analyzing of Aircraft Structures Using FEA" laboratory. This approach encourages students to explore, analyze, and validate engineering problems using research articles as primary references, fostering a deeper understanding of the subject.

Motivation/Purpose of Innovative Technique:

The primary motivation behind implementing RBL in the FEA laboratory is to enhance students' analytical and problem-solving skills by engaging them in independent research. The key objectives include:

- Encouraging students to critically analyze published research and apply concepts to real-world scenarios.
- Developing self-learning abilities and technical competency in FEA tools.
- Strengthening their ability to validate simulation results by comparing them with existing research outcomes.
- Preparing students for industry and academic research by exposing them to professional methodologies and best practices.

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Procedure Followed:

The implementation of Research-Based Learning in the FEA laboratory follows a structured process:

- **Selection of Research Articles:** Students are required to choose journal or research articles from reputed publishers related to aircraft structural analysis using FEA.
- **Problem Definition:** Based on the selected research, students define a simulation problem that aligns with their article's findings.
- **Simulation Setup:** Students perform FEA simulations using industry-standard tools, following the methodologies detailed in the selected research.
- **Result Analysis:** The results obtained are compared with those presented in the reference article to analyze deviations, validate findings, and draw meaningful conclusions.
- **Report and Presentation:** Students compile their findings in a detailed report and present their work, showcasing their understanding and critical evaluation of the research study.

Outcome:

The integration of Research-Based Learning in the FEA laboratory has resulted in several positive outcomes:

- Improved student engagement and interest in computational analysis and research methodologies.
- Enhanced ability to interpret, replicate published research findings.
- Strengthened technical skills in using FEA software for solving practical engineering problems.
- Better preparation for academic research and industrial applications.
- Encouragement of innovation and critical thinking in solving engineering challenges.
- Reports generated by students for each experiment were highly constructive, reflecting their in-depth analysis and understanding of the subject.
- The instructor's mentorship played a crucial role in guiding students through the research process, helping them refine their methodologies, and ensuring their work met academic and industry standards
- Some students published research articles based on their laboratory work, demonstrating their enthusiasm for research and technical writing. While AI tools assisted in drafting, their ability to

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conduct simulations, analyze results, and document findings showcases their growing expertise. This initiative reflects their proactive approach to research dissemination and provides a foundation for further academic growth and refinement in scholarly writing.

References:

1. Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, *95*(2), 123-138.
2. Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn?. *Educational psychology review*, *16*(3), 235-266.
3. J.N. Reddy, "An Introduction to the Finite Element Method," McGraw Hill, 2019.
4. ANSYS/ABAQUS documentation and user guides for FEA simulation methodologies.