BHARATI VIDYAPEETH'S

COLLEGE OF ENGINEERING FOR WOMEN, PUNE

Pune-Satara Road, Dhankawadi, Taluka – Haveli, Dist.- Pune

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Innovative Teaching-Learning Practices

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Innovative Teaching-Learning Practices

Faculty members of the Information Technology department follow innovative teaching methodologies in the classroom in addition to conventional methods such as blackboard teaching, sharing learning materials, innovative methods help students actively engage in the classroom.

The department is committed to making continuous efforts to:

Improve student learning outcomes through the adoption of innovative teaching approaches. Enhance students' understanding and proficiency by employing creative methods and strategies. Foster creative thinking, idea formulation, and active participation through a variety of engaging activities.

We kindly request you to review the document and share your valuable feedback and suggestions for further improvement. The feedback link is provided at the end of this document.

Title:- Participatory Learning

1. Student-centred, active learning pedagogy

Objectives:-

1. To actively engage students in the learning process and ensure better understanding of core concepts.
2. To enhance students' confidence, communication, and presentation skills.
3. To foster critical thinking, attentiveness, and real-time feedback in the classroom.

The Practice:-

This method enhances student engagement, reinforces learning through active recall, improves communication skills, and provides immediate feedback to both teacher and student. It also encourages attentiveness throughout the lecture and fosters a deeper understanding of the subject.
As a teacher committed to fostering holistic development in students, I have integrated an innovative approach into my teaching methodology. In every one-hour lecture, I dedicate the last ten minutes to an engaging, student-centered activity designed to enhance learning outcomes and develop essential soft skills.
During this segment, I pose a relevant and thought-provoking question based on the day's topic and invite a student to explain or present her answer in front of the class. This strategy transforms the classroom into an interactive learning environment and encourages students to take an active role in the learning process.

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Outcomes: -

This practice offers multiple benefits. Firstly, it gives me valuable insight into each student's understanding of the topic covered. It becomes immediately clear whether the core concepts have been grasped or if further clarification is needed. Secondly, it significantly boosts students' confidence and enhances their public speaking and presentation skills. Over time, it also fosters critical thinking, active listening, and effective communication.

By regularly engaging in this activity, students become more articulate, self-assured, and better prepared for real-world professional scenarios. This simple yet impactful technique makes the teaching-learning process more dynamic, participatory, and skill-oriented.

Fig.1 Students delivering a presentation for answering the given question

2. e-learning with Google Classroom:

Objectives:-

1. To provide easy and timely access to study materials and resources.
2. To promote collaborative and technology-enabled learning beyond classroom boundaries.
3. To improve student engagement, accountability, and overall academic performance.

Google Classroom Link:
https://classroom.google.com/c/NzM0MjU5MTg1OTcy?cjc=way6niq

In each semester, course study materials are uploaded on Google Classroom and made accessible to students.

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Outcomes: -

Enhances accessibility, promotes collaborative learning, and ensures timely delivery of content, thereby improving student engagement and academic performance.

Title:- Technology-Advanced Active Learning

1. Blended Learning, Collaborative Learning, Experiential Learning

Objectives:-

1. To integrate free and open-source ICT tools in teaching-learning.
2. To enhance conceptual clarity through interactive and AI-based methods.
3. To build practical skills in machine learning, chatbots, and Agile practices.
4. To strengthen collaboration, communication, and peer learning.

The Practice:-

Students engage in hands-on activities such as
- Developing chatbots using Google Dialog Flow and voice-to-text APIs.
- Practicing Agile Sprint cycles with free tools, project planning, and task tracking on Trello.
- Creating AI-based concept maps using Coggle.it.
- Building simple ML models with Teachable Machine or Google Colab (Python).
- Using blended learning via Google Classroom.
- Participating in interactive quizzes with Kahoot under the Concept Quest Challenge.

Outcomes: -

1. Course materials are uploaded on Google Classroom every semester.
2. Students gain practical exposure to ICT tools, ML, chatbots, and project management.
3. Conceptual clarity and problem-solving skills improve through AI-based tools.
4. Collaboration and communication skills are developed through team activities.

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Fig. 2 TE IT Students developing a chatbot using Google Dialog flow as part of active learning

2. **ICT-based teaching using Google Classroom:**

Objectives:-

1. To integrate ICT tools into the teaching–learning process for improved accessibility and efficiency.
2. To provide a digital platform for sharing learning materials, assignments, and assessments in an organized manner.
3. To enhance student engagement and participation through interactive and collaborative online activities.
4. To promote independent, self-paced, and continuous learning beyond the classroom.

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https://classroom.google.com/c/NTIzMTM5Nzk1NDE1?cjc=v5lsjah

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Outcomes: -

Facilitates easy access to learning materials and ensures timely content delivery, which enhances student engagement and supports academic success. Course-related videos are also made available to further enrich the learning experience.

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Title:- Math's Culture: Active Learning

1. Math's Activity in real life problems

Objectives:-

1. To Encourages logical thinking and the ability to apply math in daily life situations.
2. To Increase Engagement and Interest
3. To encourage Critical Thinking – Promotes analysis, reasoning, and decision-making in realistic scenarios.

The Practice:-

To enhance students' understanding of mathematical concepts, a classroom activity was conducted using real-life examples. The objective of this activity was to bridge the gap between theoretical knowledge and practical application, enabling students to relate mathematics to their daily lives. Through solving additional examples based on real-world situations, students were encouraged to actively participate and apply their learning in meaningful contexts. This activity not only improved their problem-solving skills but also developed logical reasoning, critical thinking, and confidence in handling practical challenges. Overall, the activity fostered interest in the subject and highlighted the importance of mathematics as an essential life skill.

Outcomes: -

1. **Better Conceptual Clarity** – Students can understand abstract concepts more clearly when linked with real situations.
2. **Improved Academic Performance** – Application-based learning strengthens problem-solving skills, leading to higher achievement in exams.
3. **Increased Interest in Mathematics** – Learners develop curiosity and a positive attitude towards math.

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Fig. 3 Course Teacher explaining Math's activity to students during tutorial sessions

2. ICT based teaching using Google Classroom with Real World Applications

Objectives:-

1. To integrate ICT tools into the teaching–learning process for improved accessibility and efficiency.
2. To provide a digital platform for sharing learning materials, assignments, and assessments in an organized manner.
3. To enhance student engagement and participation through interactive and collaborative online activities.
4. To promote independent, self-paced, and continuous learning beyond the classroom.

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Title:- Participatory Simulation Activity: Understanding Microcontroller Architecture Through Role-Play

Objectives:-

The objective of this activity was to help students understand the internal working of a PIC microcontroller, specifically focusing on instruction execution, data flow, and module coordination using an interactive role-play method.

Concepts Covered

1. Instruction Execution Cycle
2. Role of CPU Core
3. Working of Ports (PORTA, PORTB)
4. ADC (Analog to Digital Conversion)
5. Timer Module Operation
6. Interrupt Handling
7. Sensor and Actuator Interfacing

The Practice:-

In this interactive session, students were assigned roles representing different components of a microcontroller:

Role	Description
CPU Core	Central control unit making decisions
PORTA / PORTB	Handles digital input/output
ADC Module	Converts analog sensor values to digital
Timer Module	Manages time delays or periodic tasks
Interrupt Controller	Handles priority-based events
Sensor	Sends real-time input (e.g., temperature)
Actuator	Responds to commands (e.g., Fan/LED ON)

The selected scenario was a temperature monitoring system. Here's how the activity unfolded:

1. The Sensor (student) simulated sending a temperature value.
2. The CPU Core (student) requested data from the ADC Module.

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3. ADC converted the input and sent the digital value back to the CPU.
4. Based on a condition (e.g., temp > threshold), the CPU instructed PORTB to activate the Actuator (Fan).
5. The Timer and Interrupt Controller roles were also demonstrated in variations where the system needed to handle time-based alerts or sudden external events.

Student Involvement

- Students actively participated by acting out data flow and control logic.
- They communicated in "instruction format" (e.g., READ_ADC, IF TEMP > 30 THEN TURN ON FAN).
- Each module had a printed badge or label for clarity.

Outcomes: -

1. Students gained a visual and physical understanding of how different PIC modules interact.
2. They understood how the CPU controls peripherals based on sensor input.
3. It clarified abstract concepts like data flow, I/O control, ADC operation, and interrupts.
4. The session promoted teamwork, communication, and system-level thinking.

Conclusion

The role-play method proved to be an innovative and impactful approach to teaching microcontroller concepts. It provided a practical learning experience without the need for physical hardware, making complex topics easy to grasp.

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Title:- Active and Collaborative Learning Through Blended Approaches

1. Flipped Classroom, Blended Learning

Objectives:-

Promote active and independent learning through a blend of classroom instruction and digital resources.

The Practice:-

Blended Learning was implemented by integrating traditional face-to-face teaching with online resources to create a more engaging and accessible learning experience. Core concepts were explained using classroom discussions and board teaching, while supplementary materials such as PowerPoint presentations, topic-specific websites, and online tools were used to reinforce learning and provide extended exposure to real-world examples. Alongside this, the Flipped Classroom method was adopted through platforms like Google Classroom, where students were given pre-lecture content such as videos, reading materials, and concept notes. The combination of these methods promoted active learning and improved concept clarity of students.

Outcomes: -

By using different pedagogy learning is made more engaging, flexible, and effective. Enhances the understanding of theoretical concepts connected with practical application.

2. Collaborative Learning, Peer Teaching

Objectives:-

1. To enhance conceptual understanding and practical application through hands-on assignments and mini projects.
2. To develop critical thinking, teamwork, and communication skills through peer presentations and collaborative activities.

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The Practice:-

Peer teaching was encouraged through a mini-project assignment in which students were asked to create a working model or solution by combining the technologies and concepts they had studied throughout the course. This hands-on task allowed them to apply their theoretical knowledge to a practical outcome, enhancing their problem-solving and integration skills. Once the mini-projects were completed, each group presented their work to the class, explaining their approach, challenges faced, and the application of concepts—thereby helping their peers understand different perspectives and methods. This process not only reinforced the presenters' understanding but also facilitated knowledge sharing among students, making learning more student-driven. Through this, students developed teamwork, communication, and leadership skills while gaining a deeper understanding of the subject. This approach transformed the classroom into an interactive environment where students learned with and from each other.

Outcomes: -

Fosters a collaborative classroom environment where students learn from each other's perspectives. Builds confidence and improves communication skills through peer explanations and presentations.

Fig. 4 Active Learning and Peer Learning

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3.ICT based teaching using Google Classroom

Objectives:-

1. To integrate ICT tools into the teaching–learning process for improved accessibility and efficiency.
2. To provide a digital platform for sharing learning materials, assignments, and assessments in an organized manner.
3. To enhance student engagement and participation through interactive and collaborative online activities.
4. To promote independent, self-paced, and continuous learning beyond the classroom.

YouTube channel link: https://www.youtube.com/@seema__hadke

Google Classroom link:
https://classroom.google.com/c/NjQ3ODQwMTc1ODc1?cjc=szrjurc

In each semester, course study materials are uploaded on Google Classroom and made accessible to students.

Outcomes: -

Facilitates easy access to learning materials and ensures timely content delivery, which enhances student engagement and supports academic success. Course-related videos are also made available to further enrich the learning experience

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Title:- "Meet the Normalizers!" – A Game-Based Roleplay Activity for Understanding Normal Forms

1. Roleplay Activity

Objectives:-

Students will understand and apply the concepts of 1NF, 2NF, and 3NF through a game-based roleplay activity and group participation, using a real relation and functional dependencies.

The Practice:-

In this game-based interactive classroom activity, three students are assigned roles to represent 1NF, 2NF, and 3NF. Each student, acting as a specific normal form, introduces themselves to the class and clearly explains the rules and conditions they enforce on a relational database table.

The teacher presents a relation to the class along with its functional dependencies, and the rest of the class is encouraged to work step-by-step to analyze whether the relation satisfies each normal form. At each stage, the corresponding "normal form" student listens to the class discussion and either agrees with or corrects their interpretation, reinforcing the correct understanding.

One Example Used in this Activity:

Given Relation:
Supplier(supplier_id, status, city, part_id, qty, price)

Functional Dependencies (FDs):
- supplier_id → status
- supplier_id → city
- part_id → qty
- part_id → price

Composite Primary Key:
supplier_id, part_id

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Outcomes: -

By the end of this activity, students will be able to:

1. Understand and explain the rules of 1NF, 2NF, and 3NF
2. Identify primary and composite keys
3. Detect partial and transitive dependencies
4. Normalize relations step-by-step up to 3NF
5. Analyze database relations, discuss normalization steps with peers, and validate their reasoning through collaborative learning and critical thinking.

Why This Activity Works:

This activity transforms normalization from a static lecture into an interactive, student-led discovery process. By making students responsible for explaining and verifying normal forms, it deepens conceptual understanding and retention. The class participation ensures engagement, collaborative learning, and critical thinking.

Fig. 5 Students representing 1NF, 2NF, and 3NF explaining their rules during the game-based normalization activity

2. ICT based teaching using Google Classroom

Objectives:-

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Title:- Action-Based Requirement Transmission Activity

1. Experiential Learning

In software engineering, miscommunication or lack of documentation in requirement gathering often leads to project failures. This experiential activity highlights the importance of proper requirement transmission through a fun, interactive method that stimulates critical thinking and reflection.

Objectives:-

1. To make students realize the impact of undocumented or misinterpreted requirements.
2. To promote experiential learning through active participation.
3. To develop critical thinking about communication challenges in software projects.
4. To simulate real-world challenges in requirement gathering and transmission.

During Class:
Activity: Requirement Transmission Game
Students form a line or circle (8–10 participants).
The first student is given an action (requirement) in private — e.g., "clap twice, jump, and spin around."
Each student passes the action to the next through demonstration only, without verbal communication.
The last student performs the final version of the action.
The original and final actions are compared and discussed.

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Reflection:
- Analyze what changes occurred and why.
- Discuss how this relates to real-world software requirement miscommunication.
- Connect the activity to the importance of requirement validation and documentation in software projects.

Benefits:
- Encourages active and experiential learning.
- Highlights the real-world consequences of vague or undocumented requirements.
- Fosters communication, observation, and reflection skills.

Outcomes: -

1. Students understand the critical role of clear and validated software requirements.
2. Recognize how easily messages (requirements) can be distorted without proper documentation.
3. Learn through firsthand experience, leading to deeper retention.
4. Become more conscious of communication clarity in their future software engineering work.

Fig. 6 Requirement Transmission Game

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Title:- Flipped Classroom Approach with Collaborative Network Problem-Solving Activities

1. Flipped Classroom

Student-driven, concept-first learning outside the classroom
The flipped classroom approach shifts the traditional lecture-homework model. Students first explore learning material at home (through reading materials, or presentations), and then use classroom time for discussions, problem-solving, and hands-on activities. This method empowers students to learn at their own pace and use in-class time more productively.
Students are expected to view and reflect on the content. During the next class, we engage in quizzes, group discussions, or application-based exercises based on the pre-learned material.

Objectives:-

1. To promote active learning and deeper understanding.
2. To shift the role of the teacher from a lecturer to a facilitator.
3. To enhance student engagement, retention, and problem-solving skills.

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The Practice:-

- Before Class: Students watch pre-recorded videos, read articles, or complete short online quizzes at home.
- During Class: Teachers guide activities such as coding exercises, lab tasks, case studies, group discussions, or Q&A sessions.

Outcomes: -

This method promotes self-directed learning, better classroom interaction, and deeper conceptual understanding. It also helps identify and address learning gaps in real time. As students arrive better prepared, class sessions become more engaging and productive.

Fig. 7 Students discussing a presentation for answering the given question

2. Collaborative Learning

Team-based, peer-to-peer interaction for academic development

Collaborative learning places students in small groups to work on assignments, case studies, or problem-solving tasks. This approach not only helps students understand diverse perspectives but also enhances communication, coordination, and teamwork.

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Outcomes: -

This strategy encourages mutual learning, improves interpersonal skills, and nurtures leadership qualities. It fosters a sense of responsibility and belonging among learners. By working together, students build empathy and a cooperative spirit while achieving academic goals.

3. ICT-based Teaching using Google Classroom

Blending traditional teaching with digital platforms

To bridge the gap between in-person learning and online accessibility, I use **Google Classroom** as a learning management system. Course materials, videos, assignments, announcements, and quizzes are shared regularly. Students can access the platform anytime to review content, submit work, or interact with peers.

Objectives:-

1. To provide easy and timely access to study materials and resources.
2. To promote collaborative and technology-enabled learning beyond classroom boundaries.
3. To improve student engagement, accountability, and overall academic performance.

Google Classroom Link:

https://classroom.google.com/u/2/c/NjkxODE5ODIyMzc1

Outcomes: -

This ICT-enabled approach improves learning continuity, especially for revision and self-paced study. It promotes paperless sharing, and simplifies academic tracking.

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Title:- Active Engagement

1. Flipped Classroom

Objectives:-

A flipped classroom is a teaching method where students learn new content at home (through videos or readings) and use class time for interactive, hands-on activities. This approach promotes active learning, better engagement, and deeper understanding by shifting lectures outside the classroom and making class time more collaborative and practical.

The Practice:-

A flipped classroom is a teaching approach where the traditional order of learning is reversed.

In a traditional classroom, the teacher usually delivers lectures during class time, and students then go home to practice or do homework.

In a flipped classroom, students first learn the new material before class, usually by watching videos, reading materials, or completing short online lessons. Then, during class time, they apply what they learned through discussions, problem-solving, group work, or projects, with the teacher available to guide and support them. Some features of flipped classroom given below are:

- **Pre-class learning**: Students engage with instructional content (videos, readings, podcasts, slides, etc.) at home.
- **In-class activities**: Class time is used for interactive, hands-on learning, like solving problems, debates, experiments, or collaborative projects.
- **Teacher's role**: The teacher becomes more of a facilitator or coach rather than just a lecturer.
- **Student's role**: Students take more responsibility for their own learning.

Outcomes: -

In a flipped classroom, students understand topics better because they get to practice and apply what they've learned during class time. They can study at their own pace by watching videos or reading materials at home, which makes learning more flexible. Class sessions are more interactive, allowing students to ask questions, join discussions, and work in groups. This helps them improve their problem-solving and critical thinking skills. By taking charge of their own learning, students become more responsible and engaged. Overall, the

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flipped classroom approach helps connect theory with real-life applications, making learning more effective and meaningful.

Fig. 8 Students actively presenting their understanding of the topic

2. ICT based teaching using Google Classroom

Objectives:-

1. **Enhance Accessibility and Flexibility:** Provide students with anytime, anywhere access to learning materials, assignments, and feedback.
2. **Promote Collaborative Learning :** Encourage discussions, group activities, and peer-to-peer interaction through Google Classroom tools (comments, sharing, etc.).
3. **Facilitate Efficient Communication:** Create a platform for seamless communication between teachers and students.

Google Classroom Link:
https://classroom.google.com/c/NzAxOTgyNzY1ODUy?cjc=stbxs4j

Each semester, study materials are shared with students through Google Classroom for easy access and learning.

Outcomes: -

Using Google Classroom helps students access materials easily, stay organized, and learn at their own pace. The flipped classroom lets students learn theory at home and practice in class, boosting participation, critical thinking, and teamwork. Together, they make students more engaged and responsible learners.

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Title:- Learning Hike through Brainstorming: A Strategy to Stimulate Critical Thinking and

Introduction

The Flipped Classroom is a modern, student-centered teaching method that reverses the traditional lecture based model. In this approach, students first learn new concepts before class through videos, readings, or online modules, while in-class time is used for discussions, practical applications, and collaborative learning.

Objectives:-

1. To promote active learning and deeper understanding.
2. To shift the role of the teacher from a lecturer to a facilitator.
3. To enhance student engagement, retention, and problem-solving skills.

The Practice:-

- Before Class: Students watch pre-recorded videos, read articles, or complete short online quizzes at home.
- During Class: Teachers guide activities such as coding exercises, lab tasks, case studies, group discussions, or Q&A sessions.

Example:
- Pre-class Activity: Watch a video on sorting algorithms.
- In-class Activity: Write code, analyze time complexity, and compare performance with peers.

Benefits:
- Encourages independent learning and accountability.
- Improves interaction and participation in class.
- Allows more time for hands-on practice and addressing individual doubts.
- Supports diverse learning speeds through flexible pre-class resources.

Outcomes: -

Students take responsibility for learning content before class, Students can review pre-class material at their own pace and revisit as needed and Group activities during class promote collaboration and shared learning.

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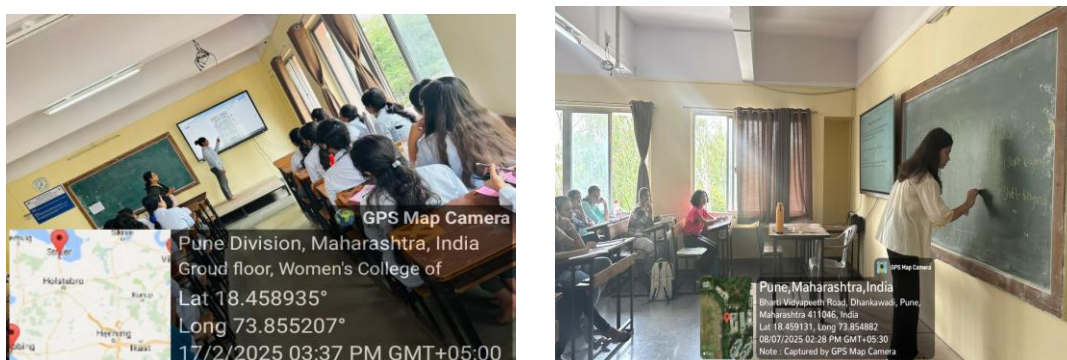E-mail: -coewpune@bharatividyapeeth.edu   Website: - http://coewpune.bharatividyapeeth.edu

Fig. 9 Pre-class activity promoting student-centered learning through digital resources

2. ICT based teaching using Google Classroom:

Objectives:-

1. To make teaching more interactive and engaging using ICT tools.
2. To enable easy communication and collaboration between teachers and students.
3. To provide flexible, anytime-anywhere access to study materials.
4. To simplify assignment distribution, submission, and evaluation.

Google Classroom Link:
https://classroom.google.com/c/NzM2NTAwMTM2MDAz?cjc=bgtsyyy

Google Classroom Link:
https://classroom.google.com/c/NzgwMTEwMDQxMjE4?cjc=6wi77dkc

In each semester, course study materials are uploaded on Google Classroom and made accessible to students.

Outcomes: -

Enhances accessibility, promotes collaborative learning, and ensures timely delivery of content, thereby improving student engagement and academic performance.

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Title:- Think-Pair-Share

1. Collaborative Thinking through Think-Pair-Share

Think-Pair-Share is a collaborative learning strategy that encourages individual thinking, peer discussion, and sharing ideas in a structured way. It helps students develop critical thinking and communication skills. Students explained basic need of Big Data and Data science to handle huge amount of data before starting new Unit of DSBDA Subject.

Three Steps of Think-Pair-Share
1. **Think**
   o The teacher poses a question or problem.
   o Students take time to **think silently** and reflect on their response.
2. **Pair**
   o Students then **pair up** with a partner.
   o They discuss their thoughts and compare ideas.
3. **Share**
   o Pairs **share their discussion** with the whole class.
   o The teacher may ask for volunteers or call on pairs to present.

Objectives:-

1. To promote active learning by engaging students in reflective thinking, peer discussion, and collective sharing of ideas.
2. To develop critical thinking, communication, and problem-solving skills among learners.

The Practice:-

- **Think** – Students are given a question/problem and allowed some time to think individually.
- **Pair** – Students then pair up with a partner to discuss their thoughts and exchange ideas.
- **Share** – Finally, pairs share their responses with the larger group or class, leading to a collaborative discussion.

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Outcomes: -

1. Students actively participate and take ownership of their learning.
2. Improves comprehension and retention of concepts through peer interaction.
3. Enhances confidence in expressing ideas and encourages collaborative problem-solving.
4. Creates an inclusive classroom environment where every student's voice is valued.

Fig.10 Think pair share Teaching Methodology

2. **ICT based teaching using Google Classroom**

Objectives:-

1. To make teaching and learning more effective by using digital tools for better access and efficiency.
2. To use a single online platform where teachers can share study materials, assignments, and tests in a systematic way.
3. To increase student involvement and participation through interactive and collaborative online tasks.
4. To encourage students to learn independently, at their own pace, and continue learning outside the classroom.

Google Classroom link:
https://classroom.google.com/c/NzU5NzQ0OTY3MTY3?cjc=66mzbg3

In each semester, course study materials are uploaded on Google Classroom and made accessible to Students.

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Outcomes: -

1. Students get easy and quick access to study materials anytime and anywhere.
2. Teaching–learning becomes more organized and systematic.
3. Better communication and collaboration between teachers and students.

Feedback link for Innovative Teaching-Learning Practices:

https://portal.vmedulife.com/institute/feedback/external/MzE1MjIw/coew-pune