

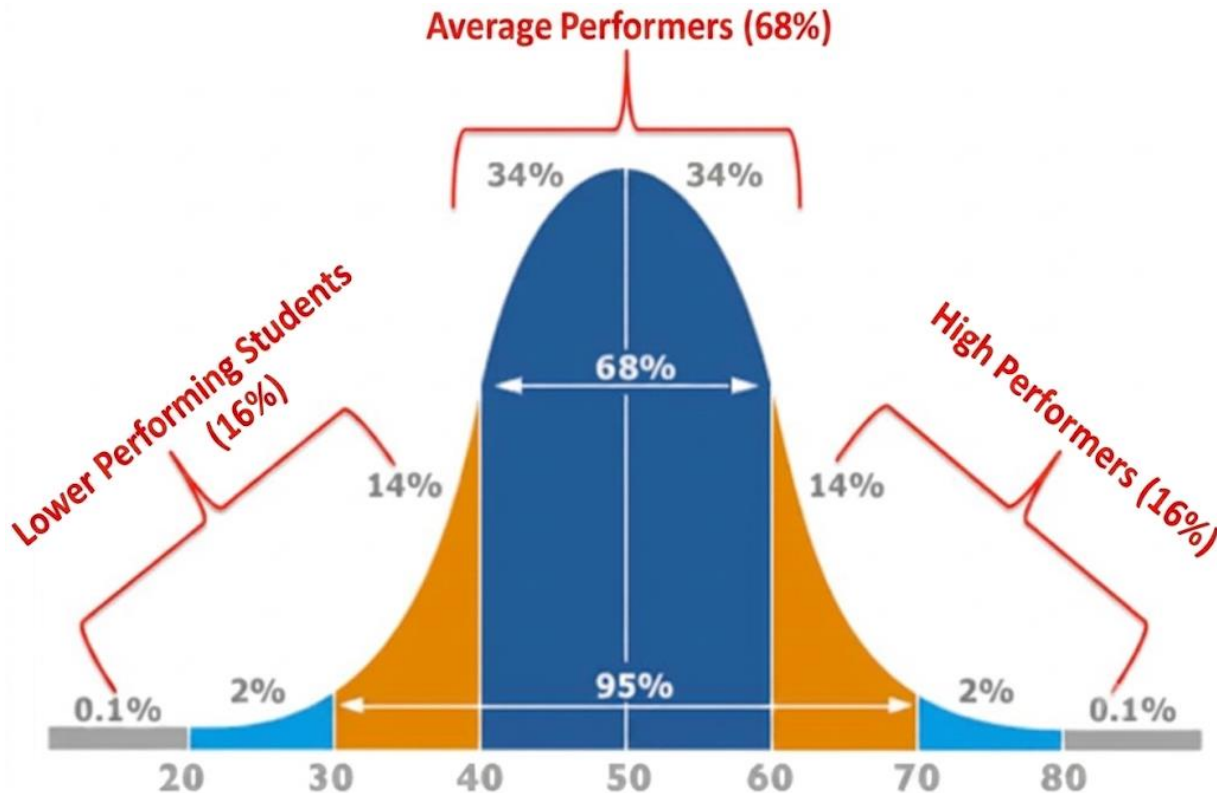
Teaching Methods for PHD students

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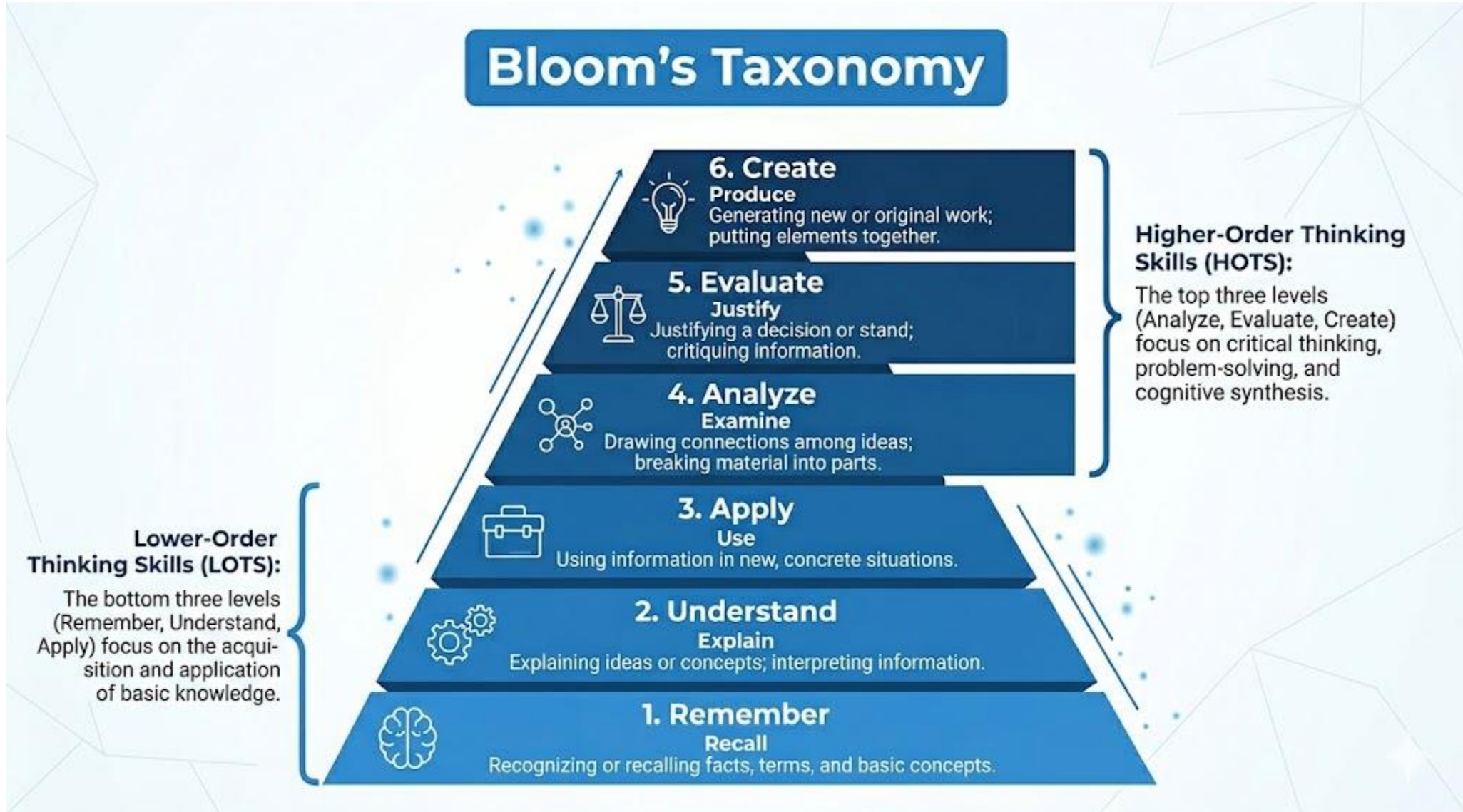
Three types of students in the classroom according to Gaussian curve



A classic, strict bell curve grading distribution operates as follows:

Top 10%: A grades
Next 20%: B grades
Middle 40%: C grades
Next 20%: D grades
Bottom 10%: F grades

Bloom's Taxonomy is a hierarchical framework used to classify educational learning objectives into levels of complexity and specificity. It is widely used by educators to design curricula, assessments, and teaching methods that promote higher-order thinking rather than just **rote memorization**.



Victorian education

- Long benches
- Big black board
- Lecturing, instructions
- Memorizing



Teaching methodology



- Lecturing, instructions
- Flipped Classroom
- Individual learning
 - Individualized learning
 - Differentiated instructions
 - Personalized instructions
- Summative assessment
- Formative assessment
- Conceptual teaching
- Project-Based Learning



The **lecturing methodology** is a traditional, teacher-centered instructional approach where the teacher stands before a group of students to verbally deliver information, explain concepts, and structure a specific topic.

Advantage: Allows a single instructor to deliver a massive amount of organized data to hundreds of students.

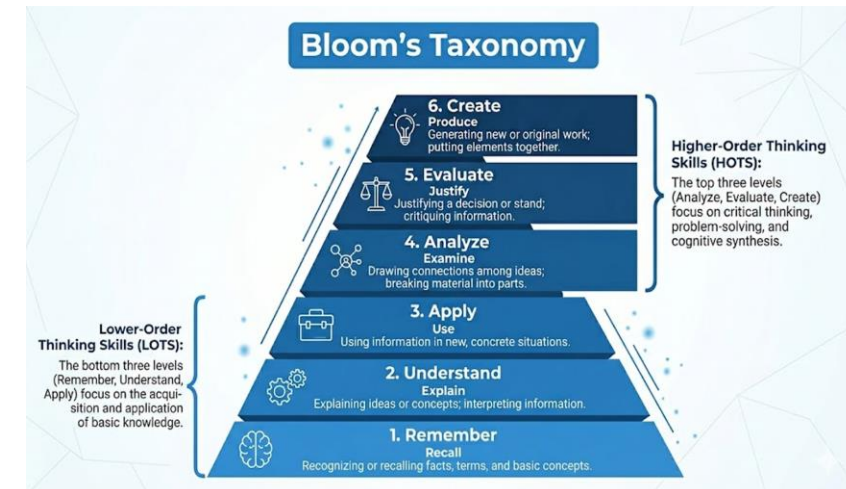
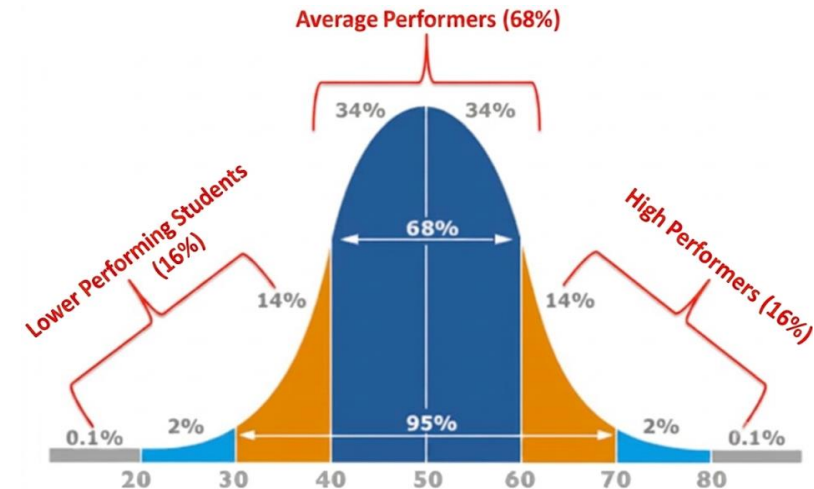
Disadvantage: The lecture moves at one speed.

Students who get confused are left behind, while advanced students may lose focus.

Bloom Taxonomy: Remember, Understand

Avareage performer benefit

from this kind of organized teaching session.



Flipped Classroom

At Home: Learning foundational concepts via recorded videos, podcasts, or reading assignments at your own pace.

In Class: Collaborative problem-solving, debates, lab work, or deep-dive discussions where peers and instructors provide immediate feedback.

Advantages:

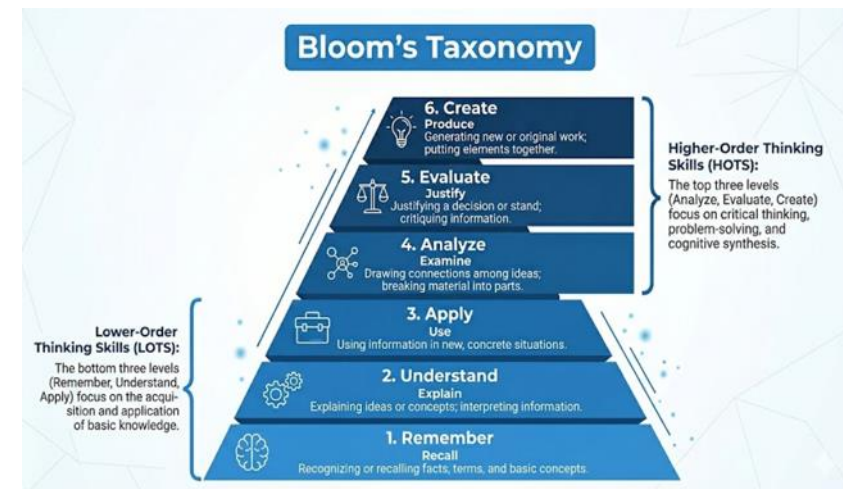
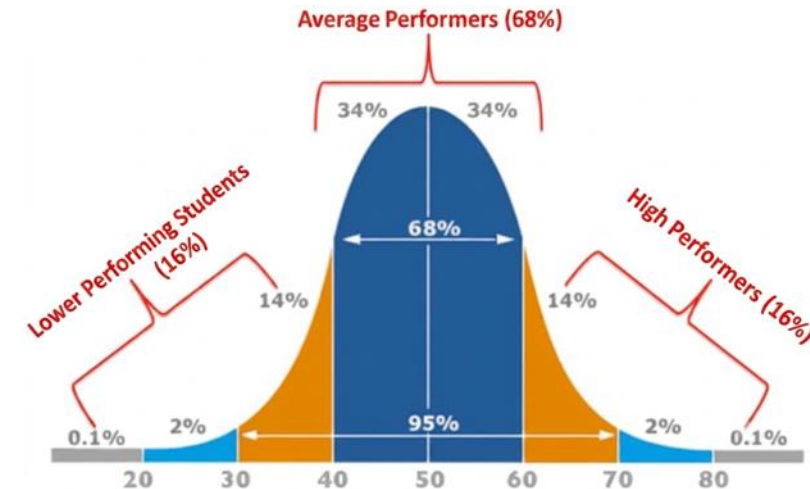
- The hardest part of learning isn't hearing the information; it's applying it. Flipping ensures that when a student gets stuck on a tough calculus problem or chemistry equation, the teacher is standing next to them to guide them through it.
- Class time becomes energetic and social. Students work in groups, teaching each other and building critical teamwork skills.

Disadvantages:

- The system completely breaks down if students don't do the pre-work

All students benefit

The flipped classroom aligns perfectly with Bloom's Taxonomy. It moves from LOTS to HOTS.



Individual teaching is an approach where the **pace** of learning is customized for each student in the classroom

- **Individual teaching** is an approach where the **pace** of learning is customized for each student in the classroom.
- **Individiulized teaching**

The learning goals remain the same for the whole class, but students can progress through the material at different speeds.

- **Differentiated instructions**

Students learns the same thing, but through different activities based on their learning style or level.

- **Personalized**

The learning is completely tailored to the student's unique interests, choices, and goals.

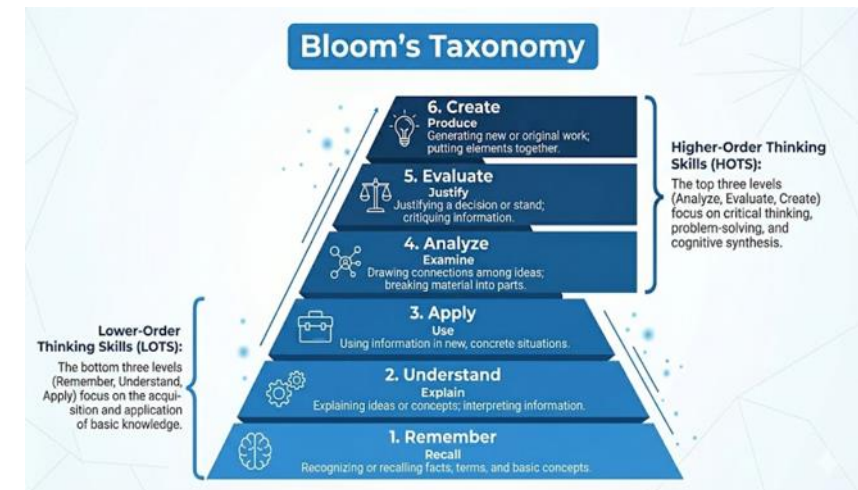
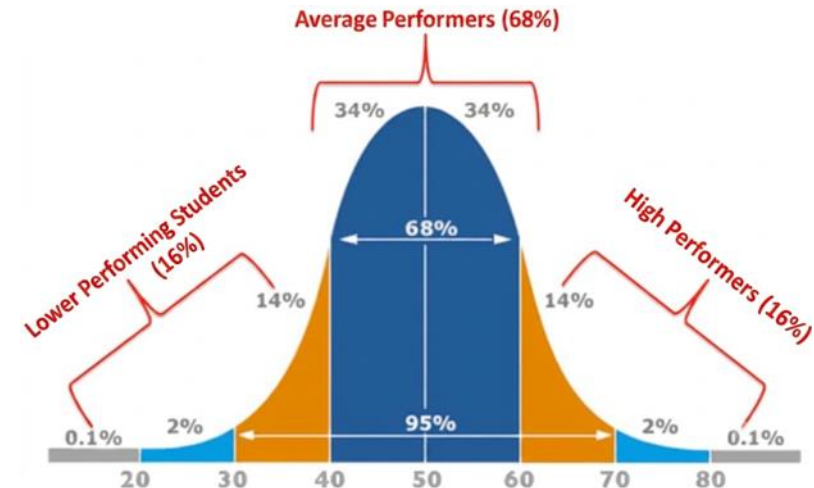
Advantage: Advanced students don't get bored waiting for the class to catch up and struggling students don't experience the chronic anxiety of being left behind.

Disadvantage: Creating thirty separate learning paths instead of one is an incredible logistical burden on teachers.

All Students benefit

Individual teaching (1-on-1) aligns perfectly with Bloom's Taxonomy. It moves from LOTS to HOTS.

Educational psychologist Benjamin Bloom found that the average student tutored 1-on-1 (the ultimate form of individual teaching) performed two standard deviations better than students in traditional classroom



In education, an **assessment** is the evaluation used to measure what a student has learned.

- **Summative assessment**

This type of **assessment**—like a **final exam** or project—is used at the end of an instructional cycle to measure ultimate student achievement.

Examples: Chapter tests given at the end of a specific curriculum section, GCSE, A-level, SAT, ACT, Mature exam,

Role of the Teacher: guard, clerk

- **Formative assessment**

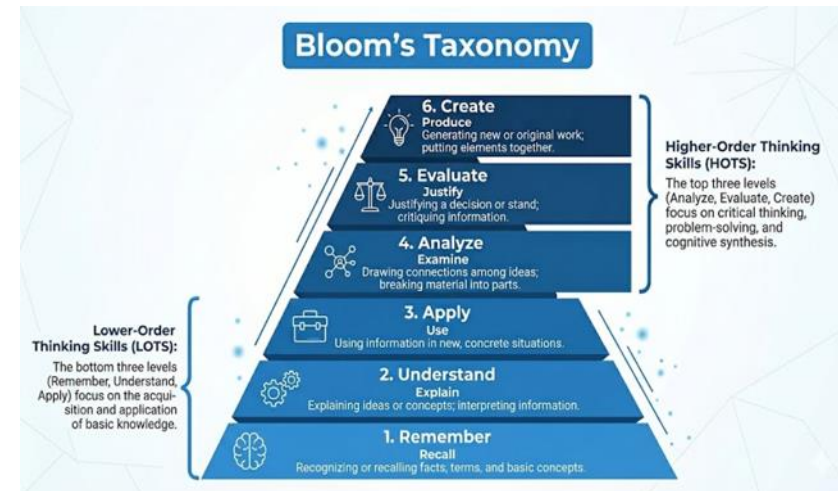
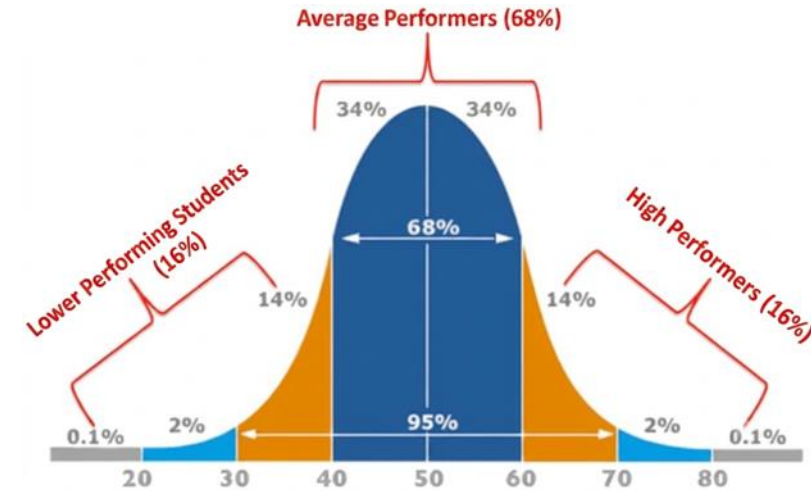
This type of **assessment** is used by Teacher **during learning process to find the weakness of the student and apply improvement.**

Examples: Quizzes, homework, and class discussions

Role of the Teacher: guide, mentor

All students benefit

Both types of assessment can target any level of Bloom's Taxonomy.



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Conceptual teaching: This approach focuses on teaching students big, transferable ideas and organizing principles rather than forcing them to memorize isolated facts, rules, or formulas. The goal is to help students understand the why and how behind a topic so they can apply that knowledge to completely unfamiliar situations.

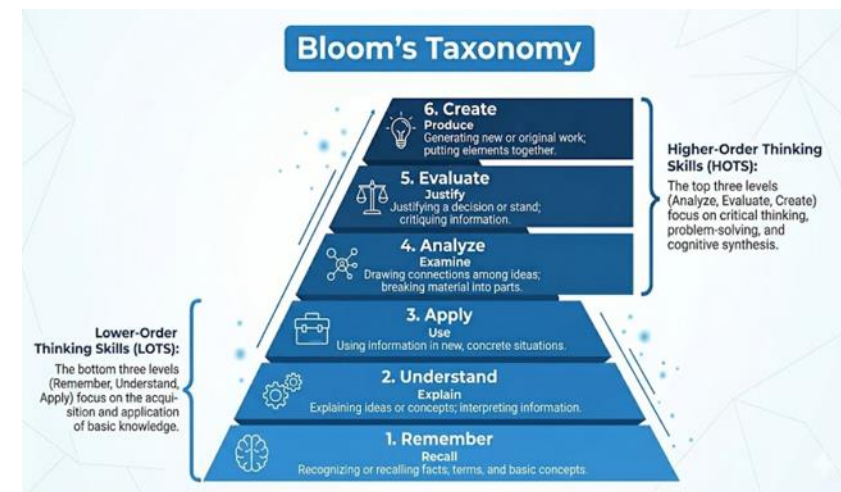
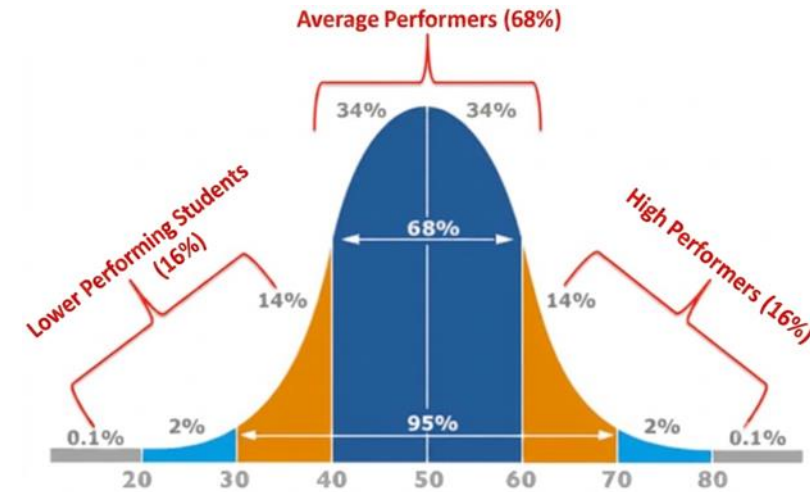
When students learn conceptually, their knowledge stays with them long after the test is over. It offers three major benefits:

- **Transferability:** If a student understands the concept of *Symmetry* in math, they can easily recognize it in art, biology, and architecture.
- **Critical Thinking:** It moves students up **Bloom's Taxonomy**—away from simple recall and toward analyzing, evaluating, and creating.
- **Future-Proofing:** Facts are easily looked up online. The ability to connect concepts, see patterns, and solve novel problems is what makes deep thinking valuable.

Disadvantage:

Students who have learning differences, lower working-memory capacity can feel completely overwhelmed. Without a strong scaffolding system, these students can easily get lost in abstract discussions.

It is usually for high performers



Project-Based Learning (PBL) is an instructional methodology where students learn by actively engaging in real-world, personally meaningful projects.



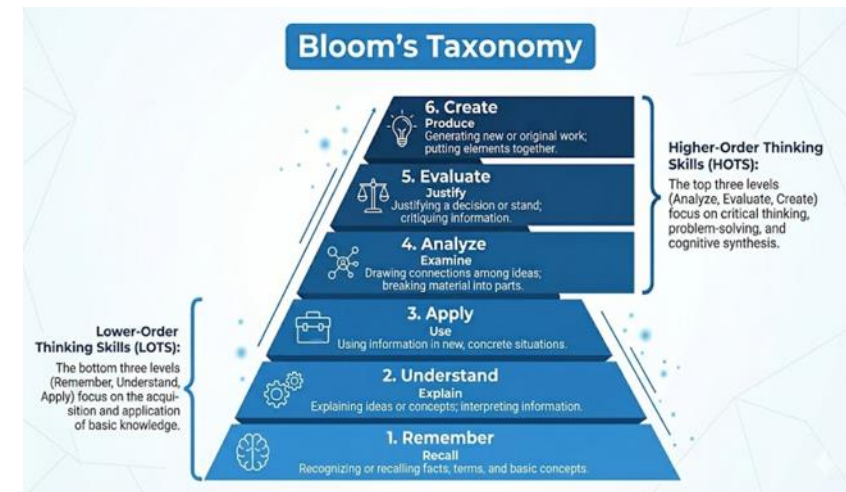
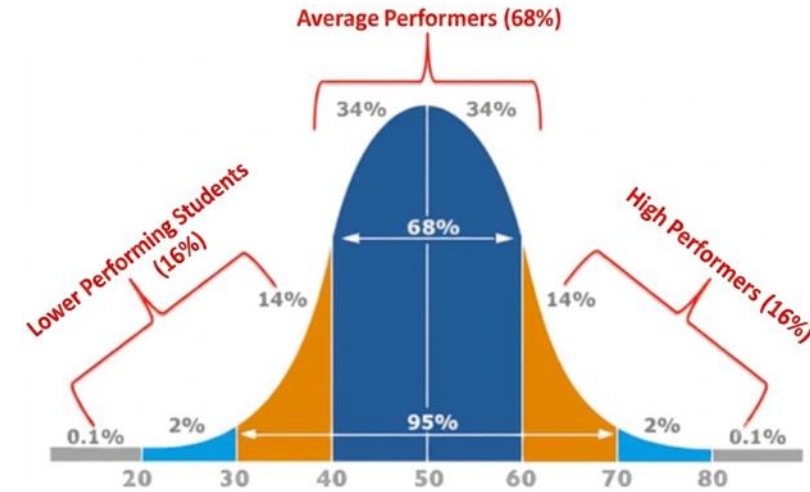
Main Advantages:

- The "main course." The project is the vehicle for learning the material
- Critical thinking, collaboration, and problem-solving
- The "Guide on the Side" coaching and facilitating
- Evaluation of the final product, the process, and self-reflection.

All students benefit

The Project - Based Learning (PBL) aligns perfectly with Bloom's Taxonomy. It moves from LOTS to HOTS.

Brain science shows that we retain information significantly better when we apply it immediately to solve a concrete problem. PBL builds "soft skills" like teamwork, time management, and resilience that tests simply cannot measure.





For a lesson to qualify as true Project-Based Learning (and not just a "doing a poster presentation" day), it must contain several key ingredients:

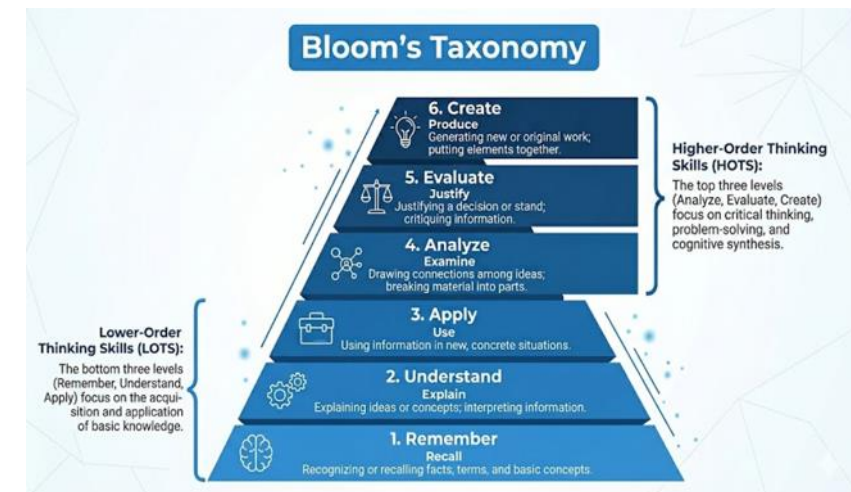
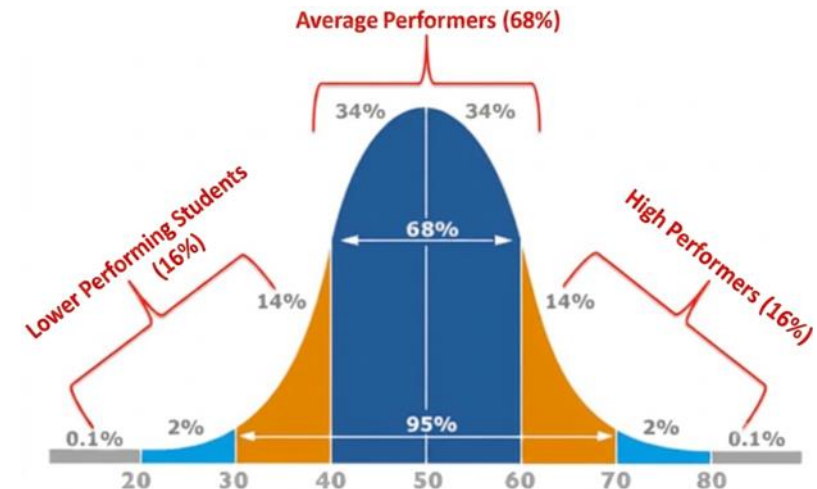
A Challenging Problem or Question: The project must be framed by a meaningful, open-ended question that drives everything the student does (e.g., "How can we reduce the carbon footprint of our school cafeteria?").

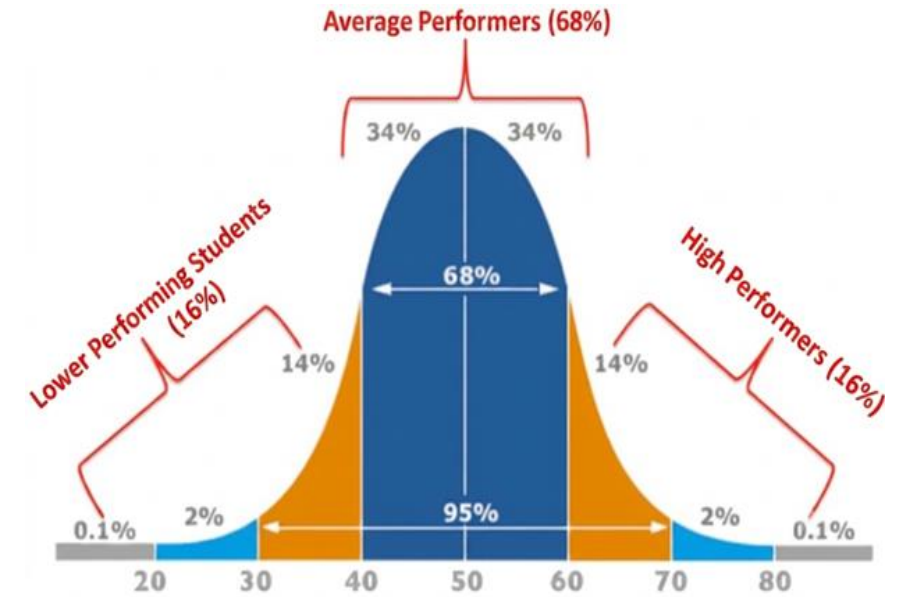
Sustained Inquiry: Students don't find the answer in a single Google search. They must ask questions, find resources, gather data, and iteratively build their solution over time.

Authenticity: The project must involve real-world contexts, tasks, or tools. They aren't just writing an essay for their teacher; they might be designing an app, creating a business proposal, or constructing a physical prototype.

Student Voice & Choice: Students make crucial decisions about how they work, what they create, and how they manage their time. This builds immense ownership over the learning process.

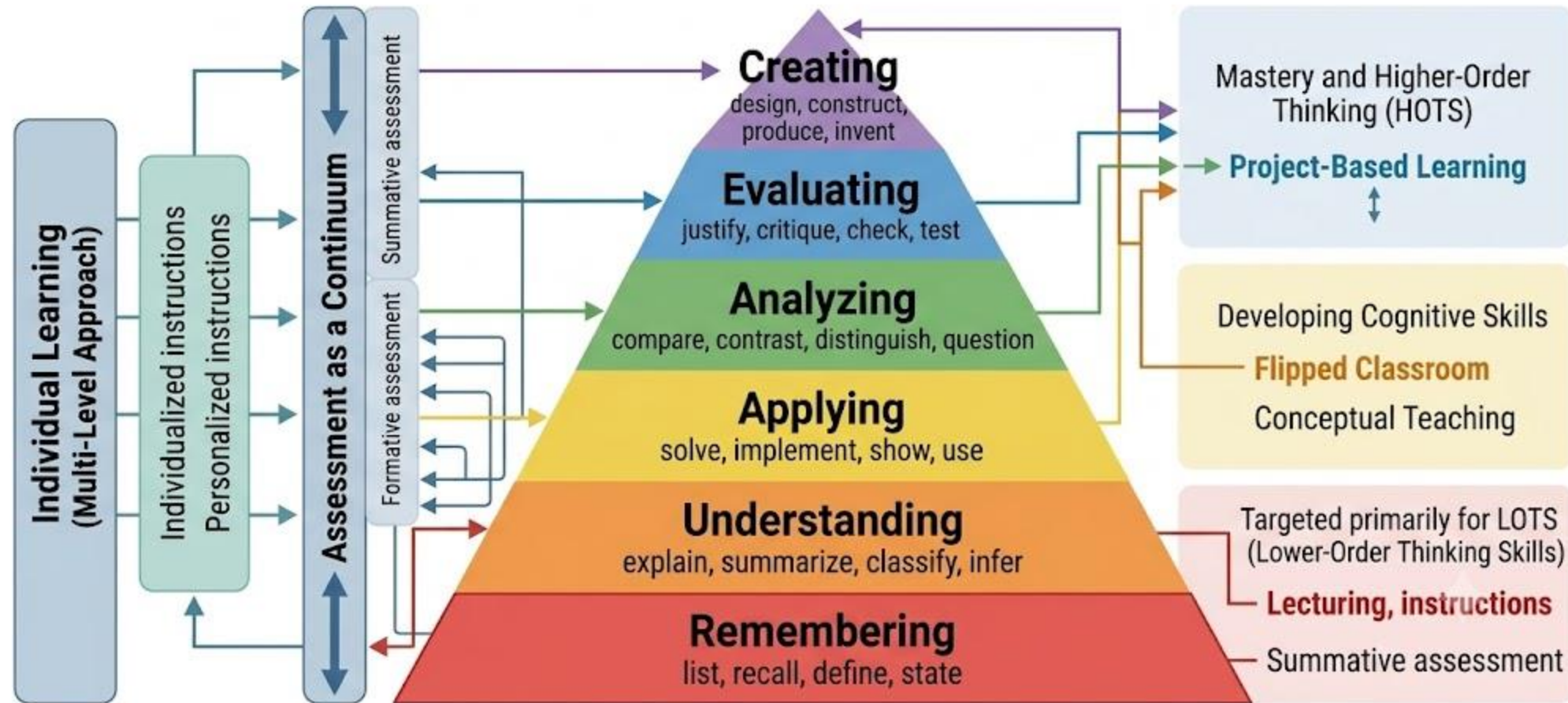
A Public Product: The project does not end when it gets handed to the teacher. Students must present their work, findings, or designs to a real audience—such as classmates, parents, or community members.





Flipped Classroom ➡ Project-Based Learning (PBL) ➡ Assessment

Integrating Teaching Methodologies (from image_175962.png) with Bloom's Revised Taxonomy





1. Create the teaching session by using following teaching methodology or formulate an engineering mini-project that moves students all the way up to **"Creating"**.
2. Identify your core educational learning objectives by using Bloom's Taxonomy Baseline?
 - LOTS: What basic formulas, definitions, or code syntax must they Remember, Apply and Understand?
 - HOTS: What must they Analyze, Evaluate, or Create to think like actual professional engineers?

a) The Flipped Classroom Model

At Home (LOTS): Outline article, video or reading assignment targeting basic knowledge acquisition (e.g., how to use a specific circuit analysis formula).

In Class (HOTS): Outline a collaborative problem-solving activity or lab work where students solve tough engineering equations in teams while you act as the guide.

b) Project-Based Learning (PBL) (Conceptual Teaching)

Ensure it features: **A Challenging Question:** (e.g., "How can we optimize a drone prototype to maximize payload capacity while minimizing battery drainage?"). **Authenticity & Public Product:** What real-world tools will they use, and how will they present their physical prototype or app code to a real audience (classmates, industry peers)?

3. Assessments:

Formative Assessment: Detail at least one active feedback mechanism you will use during the learning process (e.g., a mid-class quiz, a live simulation test, or a peer-review checklist, **verbal guiding**)

Summative Assessment Design the final evaluation (a capstone presentation, a graded project product, or a final exam cycle) to measure ultimate student achievement.

