



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

A GOVT. AIDED UGC AUTONOMOUS & NAAC ACCREDITED INSTITUTE, AFFILIATED TO R.G.P.V BHOPAL (M.P)

OUTCOME BASED EDUCATION (OBE)

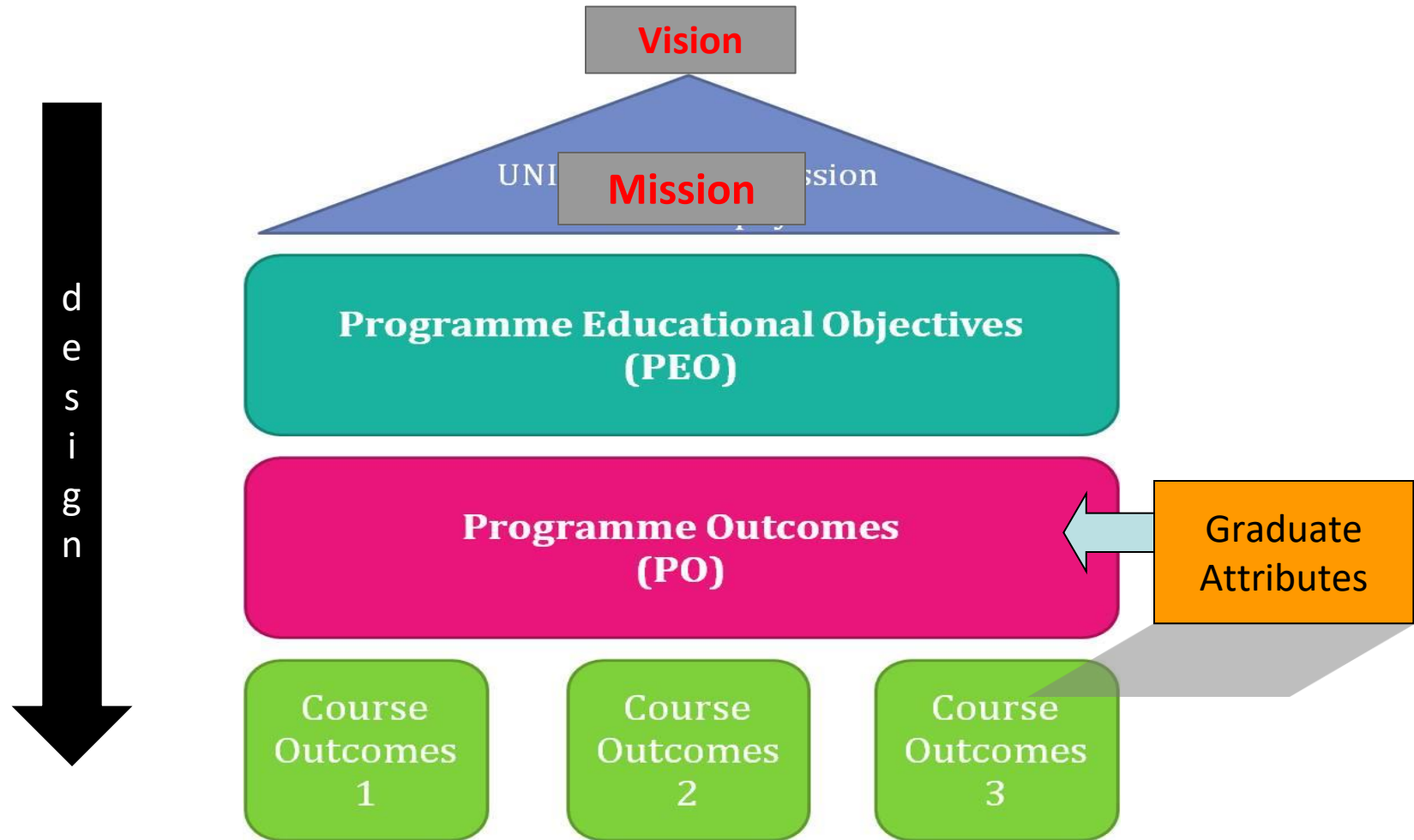
DEPARTMENT OF MATHEMATICS & COMPUTING

Traditional Education	Outcome Based Education
Teacher Centric	Learner Centric
Stress is on Output (Quantity)	Stress is on Outcome (Quality)
One way Traffic: Normally teacher is engrossed in content delivery and completing syllabus Student is most of the time passive listener	Interactive Sessions: Where both teacher and student learn together. Student is an active participant
Ownership of education is with teacher	Ownership of education is with learner

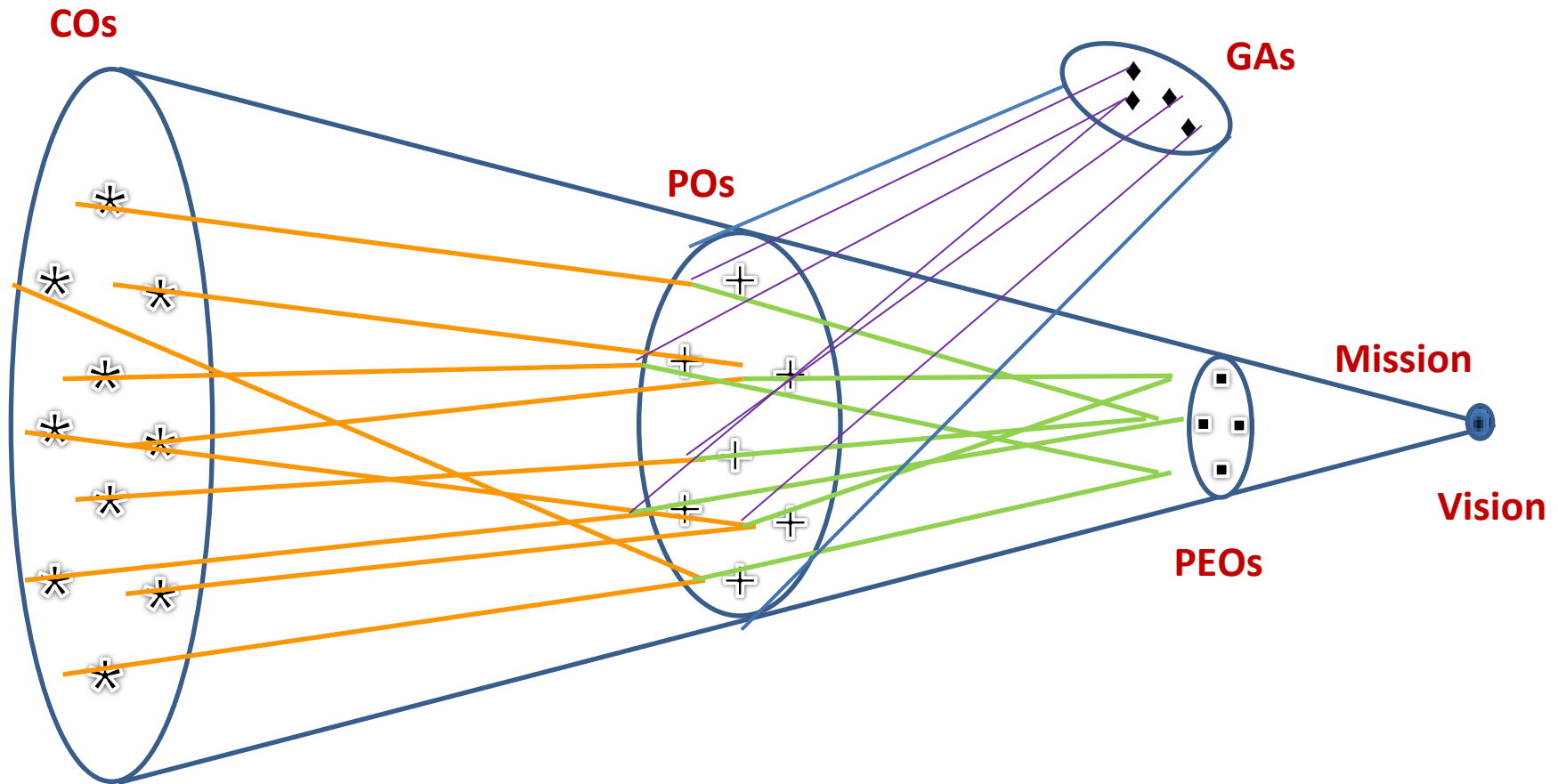
Key Components of OBE

1. Vision and Mission of the Institute
2. Vision and Mission of the Department
3. Programme Educational Objectives (PEOs)
4. Graduate Attributes (GAs)
5. Programme Outcomes (POs)
6. Course Outcomes (COs)

OBE Design



Mapping between PEOs, POs and COs



Main Concepts

- **Washington Accord:** The Genesis of NBA Accreditation
- **OBE:** Top down design, Bottom up implementation
(First the goal is set/decided then steps for achievement are decided or rather the output/end objective is decided first, then inputs are decided)
- **Vision :** Reflects the Target/ purpose of existence
- **Mission:** Steps to achieve the vision
- **PEO:** Marketing statement of the programme
- **PO:** Student ability after he/she passes out
- **CO:** Student ability after he/she completes a course

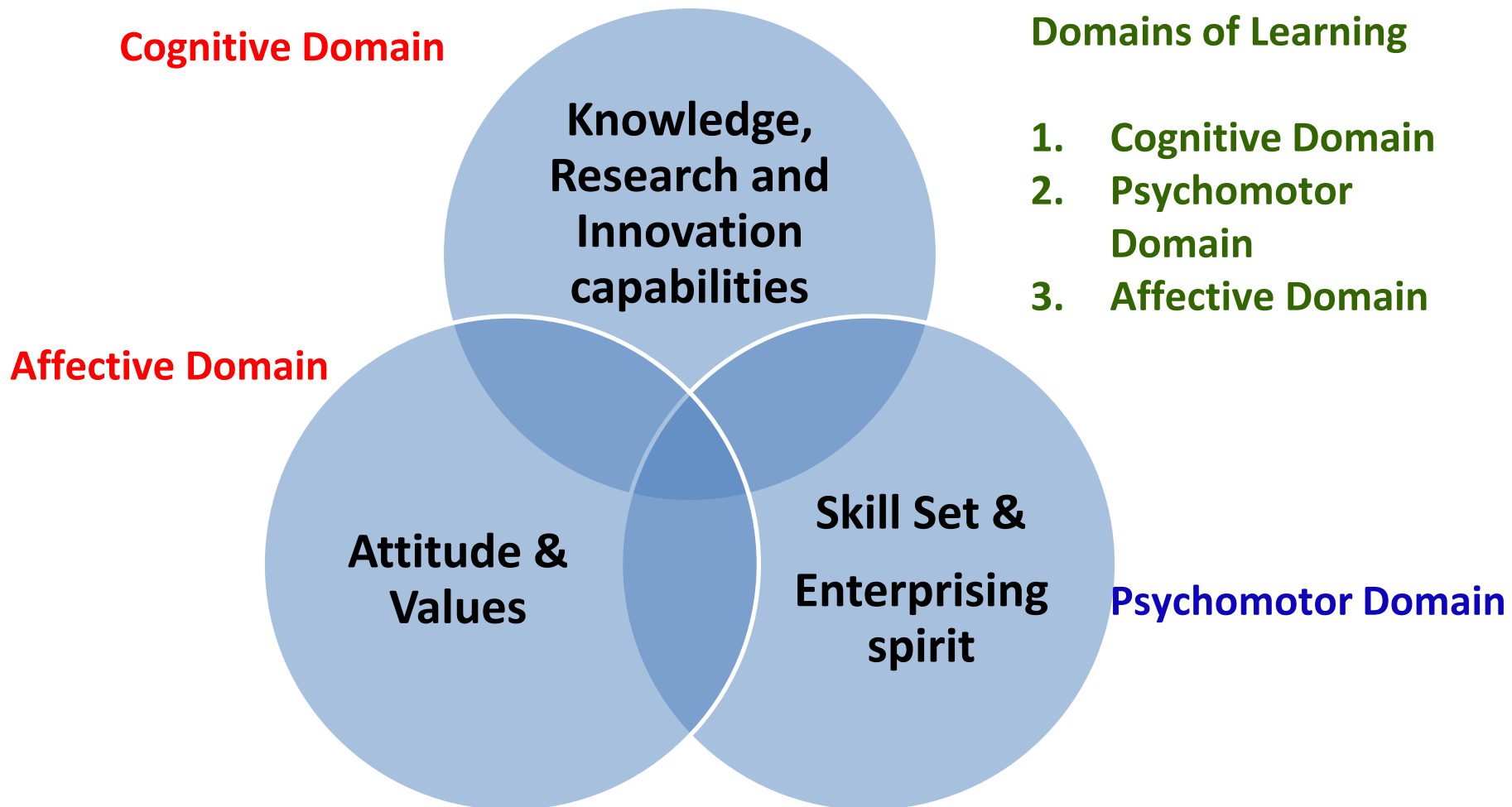
Salient points

- MILEY report (One way to motivate students)
- (Most Interesting Learning Experience Yesterday)
- Do everything with full hearted dedication: Give 100%
- Active Learning Environment : Not passive
- COs: Why a course is being taught, must be told on the very first day, also relate to COs time and again
- Record keeping, analysis, planning for future improvement
- Role of a teacher now is that of a facilitator

Programme Educational Objectives (PEOs)

- PEOs are **broad marketing statements**
- PEOs describe the **career and professional accomplishments** that the programme is preparing graduates to accomplish after **3 to 5 years** of graduation.
- PEOs are **promises** made by the institute to the stake holders (Employers, students etc)
- PEOs should be **measurable, appropriate, realistic, and achievable.**

The ASK Principle: Tripod Ensuring Employability



Graduate Attributes(GAs)

- The GAs are exemplars of the **qualities and attributes expected of a graduate from an accredited programme.**
- Graduate attributes are the **academic abilities, personal *qualities* and transferable skills** which all students will have the opportunity to develop during the programme

NBA's Universal Graduate Attributes

- **Engineering knowledge**
- **Problem analysis**
- **Design & Development of Solutions**
- **Investigation of Complex Problem**
- **Modern tool usage**
- **Engineer and society**
- **Environment & sustainability**
- **Ethics**
- **Individual & team work**
- **Communication**
- **Lifelong learning**
- **Project management & finance**
- **PSO1: Specific to the programme being accredited**
- **PSO2: Specific to the programme being accredited**

Create

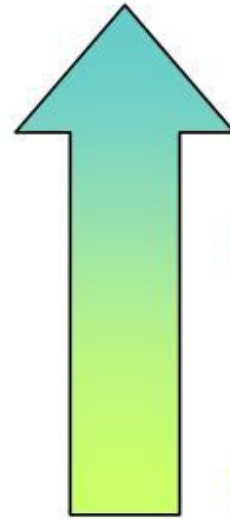
Evaluate

Analyze

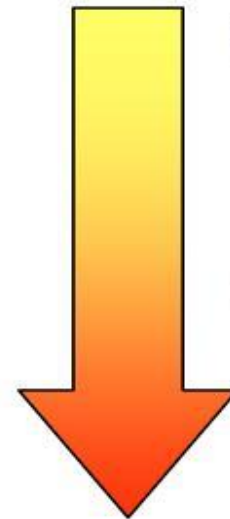
Apply

Understand

Remember



HOTS



LOTS

Blooms Knowledge Levels (Cognitive Domain)

We must **remember** a concept before we can **understand** it.

We must **understand** a concept before we can **apply** it.

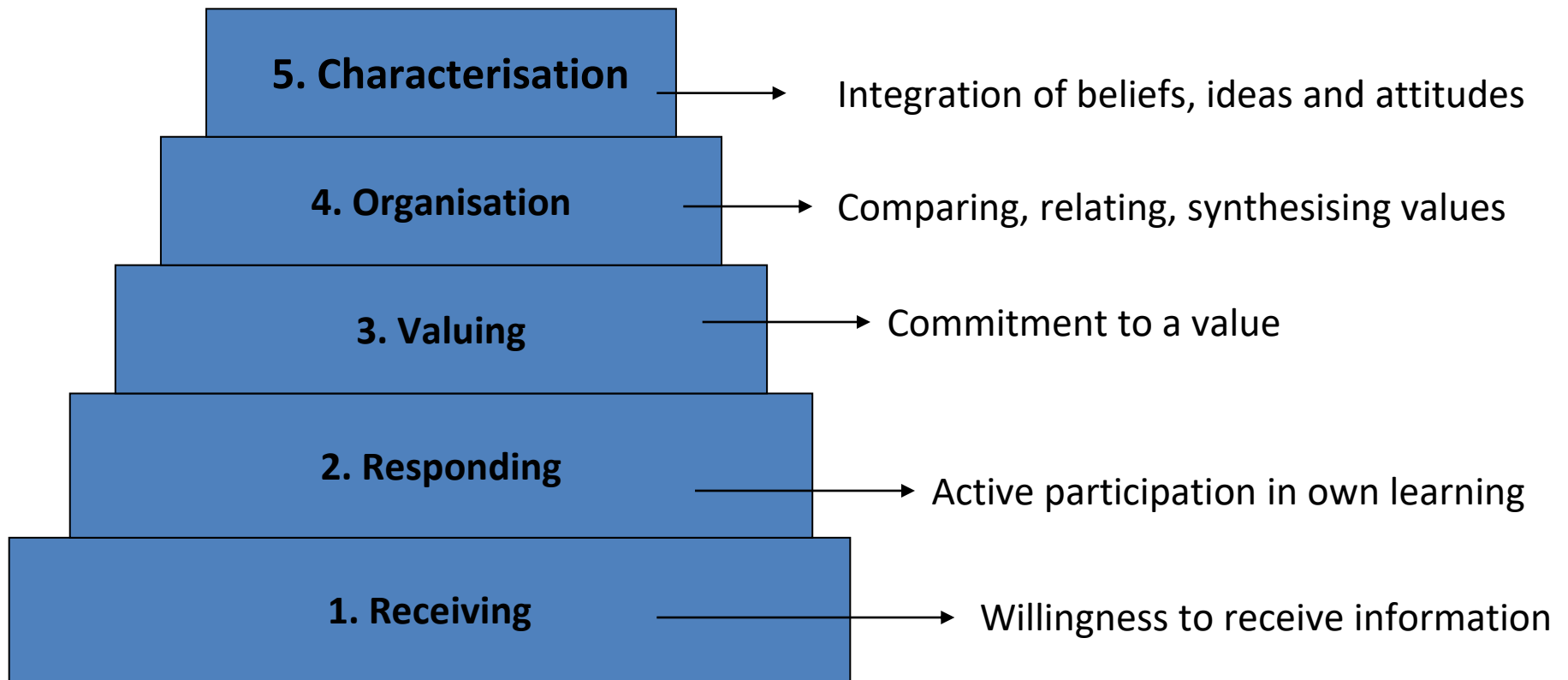
We must be able to **apply** a concept before we **analyze** it.

We must have **analyzed** a concept before we can **evaluate** it.

We must have **remembered, understood, applied, analyzed,** and **evaluated** a concept before we can **create**.

AFFECTIVE DOMAIN

(“Feeling”) concerned with value issues : involves attitudes.



AFFECTIVE DOMAIN

The separation of the head from the heart has contributed to a fractured education system that produces minds that do not know how to feel and hearts that do not know how to think.

~Parker Palmer

Motivations

Moods

Feelings

Emotions

Attitudes

Beliefs / Values

The Affective Domain and Categories of Affective Behavior

- Affective domain: Domain of student behaviors that addresses **attitudes, emotions, values, interests, feelings, etc.**
- Affective characteristics are **constructs (they are unobservable, internal characteristics)** that can only be inferred from actions in situations or responses to carefully designed questions.

➤ Affective domain (continued)

• **Reasons for assessing affective behaviors:**

- ✓ **Affect may have equal importance to cognitive ability (with respect to motivation, etc.).**
- ✓ Assessment of affect can guide future inclusion of affective instruction.
- ✓ Can be used to monitor interests or attitudes during instruction.

• **Reasons why assessing affective behaviors can be difficult:**

- ✓ Difficult to measure constructs (tends to have low reliability).
- ✓ Tendency for students to give *socially acceptable responses*.
- ✓ At secondary level, focus is on attainment of cognitive outcomes, not affective ones.

The Affective Domain and Categories of Affective Behavior

➤ Affective domain (continued)

- Categories:

- ✓ Social adjustment: Adaptive behavior and social development as indicated by responses to rules, responsibility, and interpersonal relationships with teachers and students.
 - ❖ Includes assertiveness, friendliness, cooperation, collaboration, empathy, etc.
- ✓ Attitudes: Relatively stable internal tendencies that influence what students are likely to do
 - ❖ Attitudes have objects (“attitudes toward something”).

Developing Measures of Affective Behaviors

- **Measures must be relatively easy to establish or teachers will not address the task.**
- **Important considerations when assessing affect:**
 - **Must realize that feelings and emotions can change quickly.**
 - **Try to use as many different types of measures as possible.**
 - **Decisions about interest in individual or group results should be made at initial stages.**
 - **Anonymity (necessary in order for students to respond honestly).**

Developing Measures of Affective Behaviors

- Two methods of assessing affective outcomes:
 - **Teacher observations:** Watching or listening to students.
 - ✓ Recall considerations and limitations of observations.
 - ✓ Observations may be *unstructured* (open-ended) or *structured* (predetermined checklists or rating scales).
 - ❖ Rating scales may be *Likert scales* or *Likert-type scales*.
 - **Student self-reports:** Students rather than teachers complete the instrument.
 - ✓ Published instruments exist; but not very practical for classroom use.
 - ✓ Students may not take them seriously and must be motivated to respond honestly.
 - ✓ Typical structure consists of statements; students are directed to circle or check their preferred responses.

Developing Measures of Affective Behaviors

- **Teacher observation forms:**

*Observation Form:
"Following Directions"*

1. Follows directions first time given.
2. Follows directions after second verbal prompt.
3. Follows directions after nonverbal prompt.
4. Follows directions with individualized teacher intervention.

Affective Domain

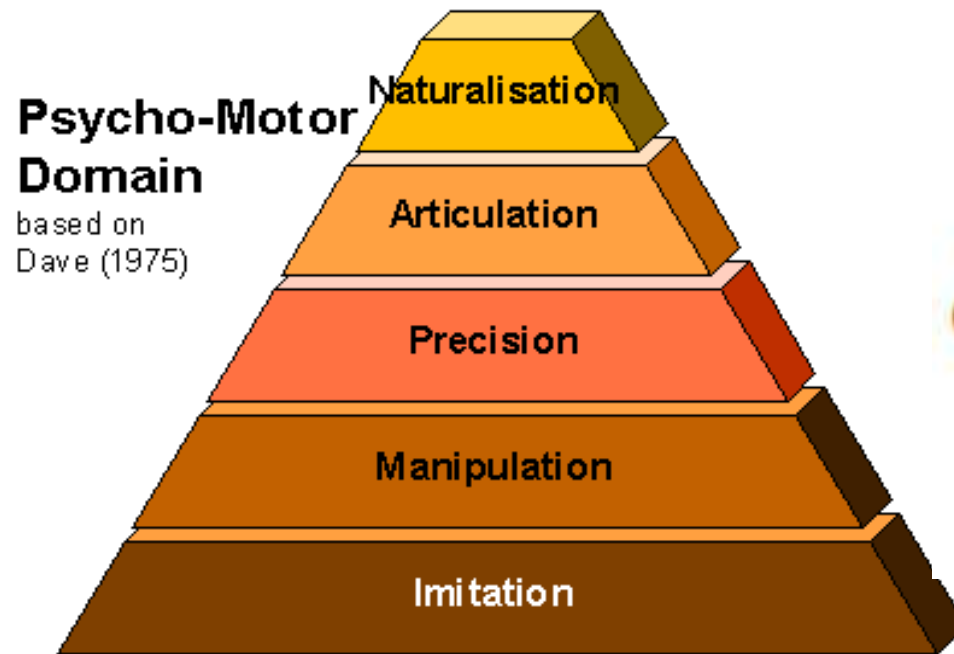
Receiving	Responding	Valuing	Organizing	Characterizing
Students become aware of an attitude, behavior, or value.	Students exhibit a reaction or change as a result of exposure to an attitude, behavior, or value.	Students recognize value and display this through involvement or commitment.	Students determine a new value or behavior as important or a priority.	Students integrate consistent behavior as a naturalized value in spite of discomfort or cost. The value is recognized as a part of the person's character.
Accept Attend Describe Explain Locate Observe Realize Receive Recognize	Behave Comply Cooperate Discuss Examine Follow Model Present Respond Show Studies	Accept Adapt Balance Choose Differentiate Defend Influence Prefer Recognize Seek Value	Adapt Adjust Alter Change Customize Develop Improve Manipulate Modify Practice Revise	Authenticate Characterize Defend Display Embody Habituate Internalize Produce Represent Validate Verify

Examples of Course Outcomes in Affective Domain

- **Accept** the need for professional ethical standards.
- **Appreciate** the need for confidentiality in the professional client relationship.
- **Display** a willingness to communicate well with clients .
- **Relate** to participants in an ethical and humane manner.
- **Resolve** conflicting issues between personal beliefs and ethical considerations.
- **Embrace** a responsibility for the welfare of children taken into care.
- **Participate** in class discussions with colleagues and with teachers.

PSYCHOMOTOR (“Doing”) DOMAIN:

- Involves co-ordination of brain and muscular activity.
- **Active verbs for this domain:** bend, grasp, handle, operate, perform, reach, relax, shorten, stretch, differentiate (by touch), perform (skilfully).



Psychomotor domain- Hierarchy

1. **Imitation:** Observing the behaviour of another person and copying this behaviour.
2. **Manipulation:** Ability to perform certain actions by following instructions and practicing skills.
3. **Precision:** Ability to carry out a task with few errors and become more precise without the presence of the original source.
4. **Articulation:** Ability to co-ordinate a series of actions by combining two or more skills.
5. **Naturalisation:** Displays a high level of performance naturally (“without thinking”).

Psychomotor Skills

Observe	Model	Recognize Standards	Correct	Apply	Coach
Students translate sensory input into physical tasks or activities.	Students are able to replicate a fundamental skill or task.	Students recognize standards or criteria important to perform a skill or task correctly.	Students use standards to evaluate their own performances and make corrections.	Students apply this skill to real life situations.	Students are able to instruct or train others to perform this skill in other situations.
Hear Identify Observe See Smell Taste Touch Watch *Usually no outcomes or objectives written at this level.	Attempt Copy Follow Imitate Mimic Model Reenact Repeat Reproduce Show Try	Check Detect Discriminate Differentiate Distinguish Notice Perceive Recognize Select	Adapt Adjust Alter Change Correct Customize Develop Improve Manipulate Modify Practice Revise	Build Compose Construct Create Design Originate Produce	Demonstrate Exhibit Illustrate Instruct Teach Train

Laboratory skills

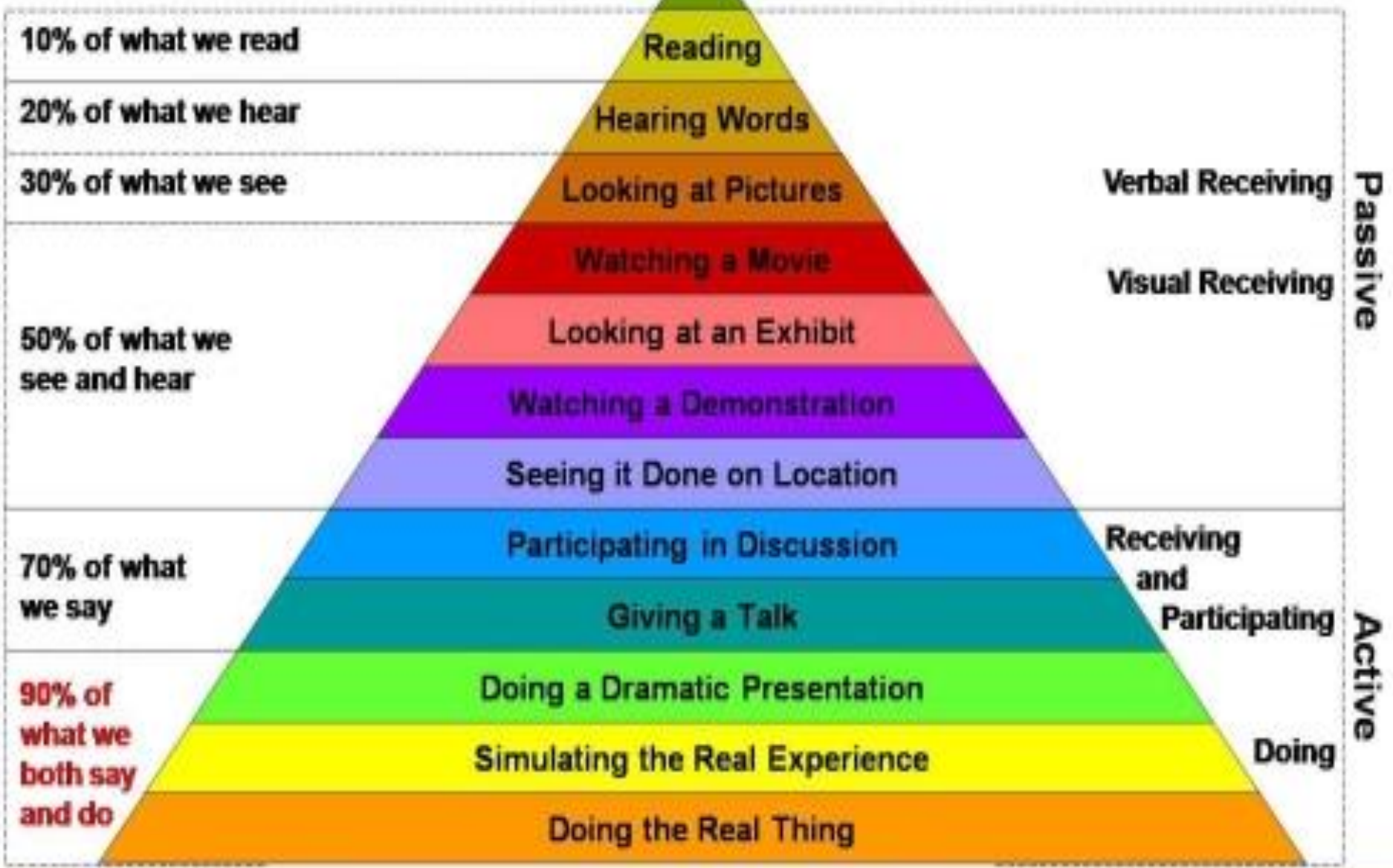
- *Operate* the range of instrumentation specified in the module safely and efficiently in the electronics laboratory.
- *Perform* load test of an electrical machine accurately and safely in the laboratory.
- *Construct* simple hardware interfacing diagram for a microprocessor based system.

Presentation skills

- *Deliver* an effective presentation.
- *Demonstrate* a range of graphic and CAD communication techniques.

We Tend to Remember

Our Level of Involvement



Research shows that:

70% of information learned during training is forgotten by the time it is needed

REVISED Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	<ul style="list-style-type: none"> • Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why 	<ul style="list-style-type: none"> • Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate 	<ul style="list-style-type: none"> • Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize 	<ul style="list-style-type: none"> • Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme 	<ul style="list-style-type: none"> • Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support 	<ul style="list-style-type: none"> • Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test

Course Outcomes (COs) Example

Do not begin with “understand”

- After successful completion of the BE program in Electrical engineering the graduates will be able to
 - Bloom’s keywords (which are underlined) are used to write Cos
1. **Describe** the constructional features of different AC and DC machines
 2. **Differentiate** between torque production in single and three phase machines
 3. **Develop** the equivalent circuit model for AC and DC machines under different operating conditions
 4. **Evaluate** the performance parameters (such as efficiency, regulation etc) of machines under various loading conditions

Attainment of COs, POs and PEOs

- The attainment of COs, POs and PEOs is computed using
- **Direct methods** : tests, end-semester examinations, Quizes, presentations, and classroom assignments etc.
- **Indirect methods**: Observation, surveys, interviews of stakeholders

PEOs Assessment: Indirect Assessment

PEO #1: Graduates will have successful professional or technical career

- **Level of technical or professional contribution according to employer**
 - **Goal: 95% or more of graduates meet or exceed expectations**
- **Percentage of graduates working in technical or professional careers or enrolled in graduate or professional school**
 - **Goal: 95% or more of graduates meet or exceed expectations**
- **Percentage who are working towards another degree since graduation**
 - **Goal: 30% or more of graduates meet or exceed expectations**
- **Percentage who have published a conference or journal article since graduation**
 - **Goal: 10% or more of graduates meet or exceed expectations**
- **Percentage who have filed for a patent since graduation**
 - **Goal: 5% or more of graduates meet or exceed expectations**
- **Percentage who have had a patent granted since graduation**
 - **Goal: 3% or more of graduates meet or exceed expectations**

PEOs Assessment: Indirect Assessment

PEO#2: Graduates of the programme will continue to learn and to adapt in a world of constantly evolving technology.

- **Level of success in learning new areas, engaging in professional development, and adapting to technological change according to employer.**
Measurement: Employer survey. Goal: 95% or more of graduates meet or exceed expectations.
- **Percentage of graduates who consulted a journal or conference article to solve a problem since graduation.**
Measurement: Alumni survey. Goal: 25% or more.
- **Percentage who have taken a class or attended a seminar since graduation.**
Measurement: Alumni survey. Goal: 50% or more.
- **Percentage who attended a conference or professional meeting since graduation.**
Measurement: Alumni survey. Goal: 50% or more.
- **Percentage who obtained another degree since graduation.**
Measurement: Alumni survey. Goal: 25% or more.

Actions for Preparing Self Assessment Report(SAR)

- Write Course Outcomes (COs) for each course of the program
- Write about 5-6 COs for each course for knowledge levels 2-6
- Mapping of question papers with COs
- Mapping of COs with POs to find the attainment level
- Finally, mapping of POs with PEOs to find out the extent to which the graduates are satisfying the PEOs
- PEOs were written to satisfy the vision and mission of the institute, hence PEO (Measurable) attainment means vision & mission has been achieved.
- For weakly supported POs find the gaps, write additional COs, improve content delivery, modify curriculum, change evaluation methods etc.
- **Process followed for assessment of each criteria should be very well documented**
- **Departmental Committees to finalize COs (Not individual faculty members)**
- **Discussions should be held with stakeholders to finalize POs and PEOs**

Actions for Preparing Self Assessment SAR continued..

- Formation of an Internal Quality assessment Cell (IQAC) for academic audit
- **Committee should decide the weightages and targets to be fixed for direct/indirect assessment**
- Design formats for collecting feed back/information from all stakeholders
 1. Alumni
 2. Employers
 3. Placement records, Higher studies records
 4. Exit survey (Passing out students)
 5. Parents & Society in general

Example of CO attainment through internal assessment



Course: 505EEL	TEST1 (10)	TEST2 (10)	Assignment (5)	Total	Attainment %
CO1	2.3/4	0.6/1	0	2.9/5	58%
CO2	2.1/3	0.8/1	1.5/2	4.4/6	73%
CO3	2.3/3	2.3/3	0.7/1	5.3/7	76%
CO4	0	1.2/2	1.7/2	2.9/4	72.5%
CO5	0	1.2/2	0	1.1/2	55%
CO6	0	0.7/1	0	0.7/1	70%

Sample pattern for designing test/assignment

Knowledge Level	Pattern of Assignments	Pattern of tests
Remember	0	20
Understand	0	60
Apply	60	20
Analyze	20	0
Evaluate	10	0
Create	10	0

Total CO attainment through (internal+External) direct assessment

CO	IE 30 Cl. Ave	EE 70 Cl. Ave	Direct CO Attainment 0.3 IE Cl. Ave +0.7 EE Cl. Ave
CO1	2.9/5= 58%	63%	60.5
CO2	4.4/6 = 76%	63%	65.9
CO3	5.3/7= 76%	63%	65.9
CO4	2.9/4= 72%	63%	64.7
CO5	1.1/2= 55%	63%	59.6
CO6	0.7/1= 70%	63%	64.1

CO Attainment and Attainment Gap

Weightage: 90% direct+10% indirect assessment

CO	Direct CO Attainment IE Cl. Ave +0.7 EE Cl. Ave 0.3	Indirect CO Attainment (Exit Survey)	CO Attainment	CO Target	CO Gap Attainment %ge
CO1	60.5	78	62.3	60	-2.3%
CO2	65.9	85	67.8	75%	7.3%
CO3	65.9	76	66.9	70%	3.1%
CO4	64.7	89	67.1	70%	2.9%
CO5	59.6	78	61.4	80%	18.6%
CO6	64.1	85	66.2	70%	3.8%

Mapping COs, POs and PEOs

	CO1	CO2	CO3	CO4	CO5	CO6
PO1						
PO2						
PO3						
PO4						
PO5						
PO12						

Similarly, mapping of PO with PEO will also be carried out