Implementation of Outcome-Based Education (Curriculum Design, Teaching/Learning and Assessment)

Prof.B.V. Appa Rao

bva.nitw@gmail.com

Learning Outcomes based Curriculum Framework(LOCF): Curriculum Design in Higher Education

What exactly are Learning outcomes?

- Learning Outcomes are clear learning results that the teachers want students to demonstrate at the end of significant learning experiences.

- Learning Outcomes are what learners can actually do with what they have learned. They are the tangible applications of what has been learned.

- Learning outcomes are performances that embody and reflect learner's competence in using content, information, ideas, and tools successfully.

Traditional System	Outcomes-based Education System
• Content based	Learning Outcomes Based
• Teacher-centered	Student-centered
• Mostly lecture method	Active learning methods
• End result is Marks or Grades	Graduate Attributes are End Result
• Choice Based Credit System	Choice based Credit System (more electives)
• Heavy syllabus, more credits	Relatively less syllabus, less credits
• Partial external evaluation	Total Internal evaluation by Teacher
• Affiliation system can function	Demands Autonomous system

Learning Outcomes-based Curriculum Framework (LOCF) of UGC

- In the year 2019, UGC has formulated Graduate attributes for Programs in Science. Arts, Commerce & Humanities and has brought out Learning Outcomes-based Framework(LOCF) for these Programs

- NEP 2020 made it mandatory to implement outcome-based Education in every discipline in all colleges and universities in the country.

- Therefore, Curriculum design for academic programs in Sciences, Social Sciences, Arts, Commerce and Humanities has to be done within the 'Learning Outcomes-based Framework'

Objectives of the learning outcomes-based curriculum framework:

(Ref: https://www.ugc.ac.in/pdfnews/4598476_LOCF-UG.pdf

1. To help formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes that are expected to be demonstrated by the holder of a qualification.

2. To enable prospective students, parents, employers and others to understand the nature and level of learning outcomes (knowledge, skills, attitudes and values) or attributes that a graduate of a programme should be capable of demonstrating on successful completion of the programme of study.

Objectives of LOCF(contd.)

3. To maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility.

4. To provide higher education institutions an important point of reference for designing teaching/learning strategies, assessing student learning levels, and periodic review of programmes and academic standards

Graduate Attributes according to LOCF of UGC

- The **quality, depth and breadth of the learning experiences** made available to the students while at the higher education institutions help develop their **characteristic attributes by the time, they graduate.** These are called **Graduate Attributes**

- The graduate attributes reflect both **disciplinary knowledge and understanding, generic skills including global competencies**, that all students in different academic fields of study should attain and demonstrate.

Graduate Attributes in a simplified form :

1. **Disciplinary Knowledge**: Demonstrate comprehensive knowledge and skills of the disciplines that constitute a programme of study.

2. **Communication Skills**: Express thoughts and ideas effectively in writing and orally, communicate with others using appropriate media, confidently share one's views in a clear and concise manner to different groups.

3. **Critical Thinking and Problem solving**: Evaluate critically practices, policies and theories on the basis of empirical evidence, by following scientific approach to knowledge development.

4. **Analytical Reasoning**: Demonstrate the ability to evaluate the reliability and relevance of evidence, identify logical flaws in the arguments of others, analyse and synthesize data from a variety of sources, and draw valid conclusions.

5. **Research related skills**: Demonstrate a sense of inquiry and capability for asking relevant questions; the ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data; plan, execute and report the results of an experiment or investigation.

6. **Collaboration/Cooperation/Team work**: Demonstrate ability to work effectively with diverse teams, facilitate cooperative and coordinated effort on the part of a group in the interests of a common cause.

7. **Information/Digital Literacy**: Demonstrate capability to use ICT in a variety of learning situations, and ability to access, evaluate, and use a variety of relevant information sources and appropriate software .

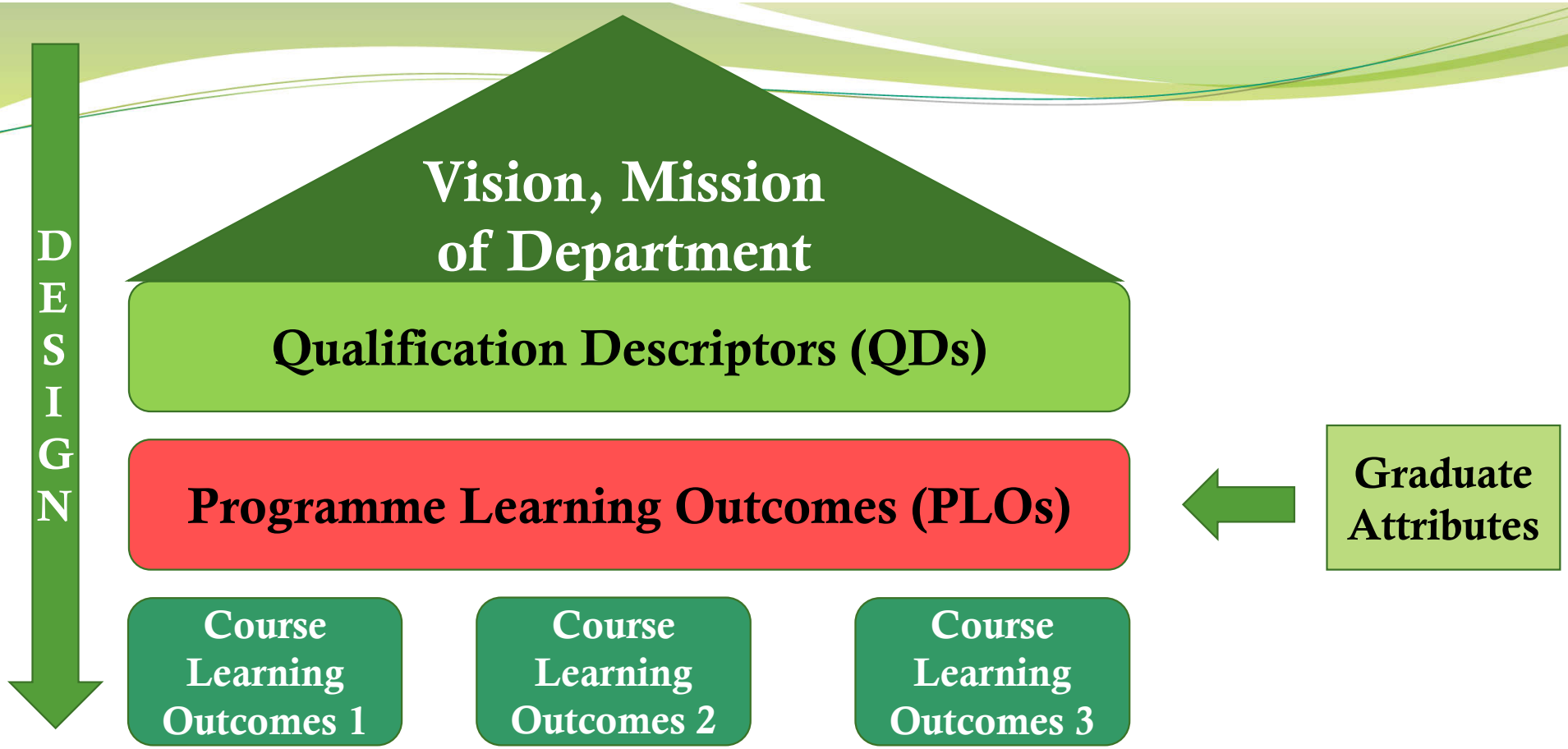
8. **Multicultural Competence**: Demonstrate knowledge of the values and beliefs of multiple cultures and a global perspective, and engage in a multicultural society by interacting respectfully with diverse groups.

9. **Moral and Ethical Awareness/Reasoning**: Demonstrate ability to identify ethical ssues related to one's work, avoid unethical behaviour such as fabrication or falsification of data or committing plagiarism, and adopt objective, unbiased and truthful actions in all aspects of work.

10. **Community Engagement**: Demonstrate responsible behaviour and ability to engage in the intellectual life of the educational institution, and participate in community and civic affairs for sustainable development and environmental protection

11. **Leadership Readiness/Qualities**: Demonstrate capability to formulate an inspiring vision, build a team who can help achieve the vision, motivate and inspire team to engage with that vision, and use management skills to guide the team to the right destination.

12. **Self Learning and Lifelong Learning**: Demonstrate ability to acquire knowledge and skills, necessary for participating in learning activities throughout life, through self-paced and self-directed learning, for personal development and to meet the changing trades and demands of work place.



Curriculum design in Learning Outcomes-based Curriculum Framework (LOCF)



Curriculum design in Outcome Based Education (NBA curriculum Framework)

Vision and Mission Statements of the Department

- **Vision** is a futuristic statement that the department would like to achieve over a long period of time (**generally written in a single sentence**)

- **Mission statements of the Department** are essentially the means to achieve the vision(3 to 4)

MS1: related to human resource development through teaching programs offered by the Department or centre

MS2: related to research

MS3: related to extension programs, sponsored res. Projects, Training programs etc.(as applicable)

MS4: Collaboration with other International / National organizations

Vision and Mission (Ref: Chemistry Department, Central University of Karnataka)

(Attribution: Chemistry Dept., Central University of Karnataka)

Vision:

To be one of the well-recognized Departments of Chemistry for higher learning in India and the world in terms of producing skilled and employable chemists, researchers, teachers and entrepreneurs, who are go-getters in meeting the challenges in chemistry and society.

Mission Statements:

MS1: To impart quality education at postgraduate and doctoral levels through well-designed curriculum to meet the demands of academia, research labs and industry.

MS2: To provide the state-of-art research facilities to carry out pioneering research in the cutting-edge areas of Chemistry.

MS3: To become a hub for human resource development and sponsored research projects with funding from national and global agencies.

MS4: To associate with national and international reputed institutions for academic excellence and collaborative research.

Qualification descriptors (QDs)

- **A qualification descriptor indicates the generic outcomes and attributes expected for the award of a particular type of qualification (for eg. a bachelors degree or a bachelors degree with honors or a Masters degree).**

- **The qualification descriptors also describe the academic standard for a specific qualification in terms of the levels of knowledge, skills, competencies, attitudes and values that the holders of the qualification are expected to demonstrate.**

- **The qualification descriptors reflect disciplinary knowledge and understanding as well as generic skills, including global competencies, that all students in different academic fields of study should demonstrate.**

How to write Qualification Descriptors (6 nos)
General format applicable for all disciplines

After completion of this academic program, the graduates will be able to-

QD1: Demonstrate comprehensive knowledge and skills in areas related to …(mention different important areas of the academic program)…….

QD2: Use knowledge and skills required for identifying problems and issues, collection of relevant quantitative and/or qualitative data, analysis and evaluation using methodologies as appropriate to the subject(s) for formulating evidence-based solutions and arguments.

QD3: Apply disciplinary knowledge and transferable skills in areas related to …(mention different important areas of the academic program) to new/unfamiliar contexts in order to solve complex problems with well-defined solutions.

QD4: Communicate the results of studies undertaken in the field(s) of (mention a few important fields of the academic program) accurately in a range of different contexts using the main concepts, constructs and techniques of the subject(s)

QD5: Demonstrate skills of self-learning and lifelong-learning to meet one's learning needs using research and development work and professional materials.

QD6: Demonstrate knowledge and transferable skills in the fields of (mention important fields of academic program) relevant in employment opportunities like ……in organizations like…… etc.

Name of the Academic Program: M.Sc in Chemistry

Qualification Descriptors (QDs): *(Attribution: Central University of Karnataka, Chemistry Department)*

After completion of this academic program, the postgraduates will be able to-

QD1: Demonstrate comprehensive knowledge and skills in Organic, Inorganic, Physical, analytical, Materials Chemistry and other modern areas of Chemistry.

QD2: Employ advanced tools, techniques, and methodologies to achieve the evidence-based solutions for local and global problems related to Chemistry

QD3: Apply disciplinary knowledge and transferable skills in the interdisciplinary areas of chemistry to solve problems with well-defined solutions.

Qualification Descriptors (Continued)

QD4: Develop benchmark standards in writing, oral communication, team-work, and ethics to disseminate results of studies undertaken in Chemistry.

QD5: Prepare for self-learning and lifelong-learning to meet one's learning needs using research and development work and professional materials.

QD6: Demonstrate knowledge and transferable skills in cutting-edge-areas of chemistry that empower them for employment opportunities in academia, research laboratories, chemical and allied industries

Mapping Qualification Descriptors (QDs) with Mission Statements (MS)

	MS-1	MS-2	MS-3	MS-4
QD-1	3	3	1	1
QD-2	1	3	3	3
QD-3	2	3	1	2
QD-4	2	3	3	1
QD-5	3	3	3	2
QD-6	2	3	3	1

Note: '3' in the box indicates 'High-level' mapping, '2', 'Medium-level' mapping, and 1 for 'Low-level' mapping

Program Learning Outcomes(P.L.Os)

The learning outcomes described in qualification descriptors are attained by students through learning acquired on completion of a programme of study. These are called Program Learning Outcomes

- **Programme learning outcomes include subject-specific skills and generic skills, and competencies, which the students of a specific academic programme should be able to demonstrate for the award of the certificate/Diploma/Degree qualification.**

- **The programme learning outcomes would also focus on knowledge and skills that prepare students for further study, employment, and citizenship. They help ensure comparability of learning levels and academic standards across colleges/universities.**

- **P.L.Os may be drafted in accordance with Graduate Attributes. P.L.Os must be aligned with relevant Q.Ds.**

- **A programme of study may be monodisciplinary, multi-disciplinary or inter-disciplinary.**

Program Specific Outcomes(2 to 3)

If the curriculum of an academic program has a few specialized courses, then it may include 2 to 3 Program Specific Outcomes related to the subject content (knowledge and skills) of those specialized courses.

Program Learning Outcomes (PLOs) (*attribution-Central University of Karnataka, Chemistry Department)*

After the completion of the M.Sc Chemistry program, the postgraduates will be able to:

PLO-1: Demonstrate comprehensive knowledge and skills in different areas of Chemistry, viz; Organic, Inorganic, Physical, Analytical and Materials Chemistry

PLO-2: Apply knowledge and experimental skills to synthesize and analyze chemicals/ materials of immediate need for the society and relevance to chemical and allied industries

PLO-3: Develop eco-friendly protocols/procedures for chemical processes in the industry.

PLO-4: Critically evaluate practices, rules, and theories based on empirical evidence, by following the scientific approach to knowledge development in Chemistry

Program Learning Outcomes (PLOs)-Continued

PLO-5: Demonstrate effective communication skills both orally and in writing using appropriate media in all the aspects related to Chemistry and one's profession

PLO-6: Demonstrate a sense of inquiry and ability to define problems; use research methods, analyze, interpret and draw conclusions from data; plan, execute and report the results of an experiment or investigation in intra/interdisciplinary areas of chemistry.

PLO-7: Apply the knowledge of chemistry associated with critical thinking to achieve sustainable solutions for energy and environment and other problems in day-today life.

PLO-8: Demonstrate ability to work effectively with diverse teams, facilitate cooperative effort as a member or leader of a team to achieve the deliverables of any project

Program Learning Outcomes (PLOs)-Continued

PLO-9: Demonstrate the capability to use computational tools, software, and databases relevant to different fields of Chemistry

PLO-10: Demonstrate the ability to identify ethical issues related to one's work, avoid unethical behavior such as committing plagiarism, not adhering to intellectual property rights, and adopt objective and truthful actions in all aspects of work.

PLO-11: Demonstrate knowledge of the values of multiple cultures and a global perspective and effectively engage in a multicultural society for employment or further studies

PLO-12: Demonstrate the ability of self-learning and lifelong-learning using ICT and Open Education Resources

Mapping of Program Learning Outcomes (PLOs) with Qualification Descriptors(QDs)

	QD-1	QD-2	QD-3	QD-4	QD-5	QD-6
PLO-1	3	3	2	2	2	3
PLO-2	3	2	3	1	3	3
PLO-3	3	2	3	3	1	3
PLO-4	3	3	2	1	3	1
PLO-5	1	2	1	3	2	3
PLO-6	3	3	2	2	2	3
PLO-7	3	3	3	1	3	3
PLO-8	2	1	3	2	1	3
PLO-9	3	3	3	3	3	2
PLO-10	1	3	3	3	2	3
PLO-11	1	2	2	1	3	3
PLO-12	2	3	2	3	2	1

3 in the box=high mapping
2= medium level mapping
1= low mapping

Course Learning Outcomes (CLOs)

The programme learning outcomes are attained by learners through the course learning outcomes acquired on completion of selected courses of study within an academic programme.

- **Course learning outcomes (C.L.Os) are specific to the learning for a given course of study related to a disciplinary or interdisciplinary/multi-disciplinary area.**

- **Some programmes of study are highly structured, with a closely laid down progression of compulsory/core courses to be taken at particular phases/stages of learning.**

- **Some programmes allow learners more freedom to take a combination of courses of study according to the preferences of individual student that may be very different from the courses of study pursued by another student of the same programme.**

- **C.L.Os must be aligned with the relevant P.L.Os**

Design of each course in the Curriculum (Course design):

A good course design consists of the following components

1. Prerequisite knowledge
2. Course Learning Outcomes (5 to 6 for a 3 0r 4 credit course)
3. Mapping of CLOs with one or more of the PLOs in the form of a table
4. Detailed Syllabus including references
5. Teaching/Learning Strategies in brief
6. Assessment Methods and weightages in brief

How to formulate the Course Learning Outcomes: Guidelines

Watch my video on youtube:

https://www.youtube.com/watch?v=Cdf2cY4D8Oo&t=336s

Mapping of Course Learning Outcomes (CLOs) with Program Learning Outcomes (PLOs) and Program Specific Outcomes (PSOs)- Course Articulation Matrix

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PSO 1	PSO 2	PSO 3
CLO1															
CLO2															
CLO3															
CLO4															
CLO5															
CLO 6															

Detailed Syllabus:

Unit 1: ……

Unit 2: ……

Unit 3: ……

Unit 4: ……

Unit 5: ……

……..

(Number of Units (in a range) may be decided by the School / Department / Centre). It may vary from one course to the other.

Reference Books: Authors, (year), *Title of the Book*, Edition, Publishers, Place of Publication, Page Nos.

any number of relevant references, for which at least 1 copy is available in the library.

Drafting the syllabus: Salient points

1. It must be student-centred syllabus. It should be of great relevance for the needs of the students by the time they graduate.

2. The course learning outcomes and the syllabus must be discussed in the faculty meeting, with external experts from Academia, Industry, other employing organizations, and Alumni.

3. The current and future trends in the discipline must be taken into consideration.

4. The syllabus must not be heavy in outcome-based education as active learning strategies are to be implemented in classroom teaching. It must be reduced in comparison to the traditional lecture method.

- **For the purpose of calculation of credits, one lecture hour is considered as one credit. One tutorial hour is considered as one credit. Two hours of Lab work or Field work or workshop practice or community engagemnet are considered equivalent to one credit. (as per UGC guidelines)**

- **No of credits for an undergraduate(Honors Program 4 years)= 160**

- **No of credits for an integrated P.G Program (5 years)= 200**

- **No of credits for a Post Graduate Program (2 years)= 80**

(The above are followed in many universities as per the revised guidelines of U.G.C. A little deviation up to + or - 2 credits may be allowed)

Teaching-Learning Strategies in brief (4 to 5 sentences):

watch my videos on learning outcomes-based active learning strategies part 1 and part 2

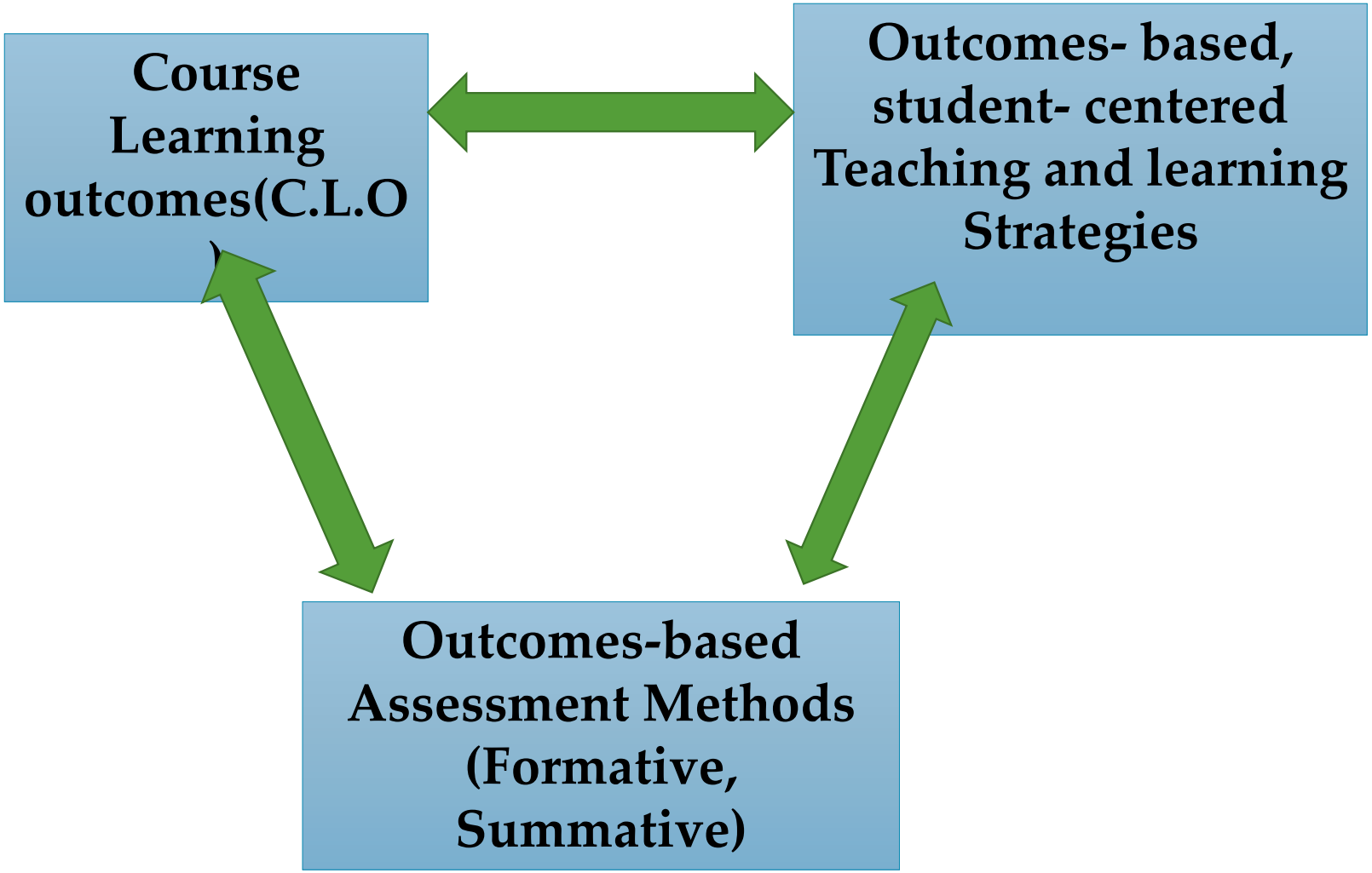
https://www.youtube.com/watch?v=DE804rxZEKU&t=180s

https://www.youtube.com/watch?v=5OYdQCLRpjg&t=137s

Assessment methods and weightages in brief (4 to 5 sentences):

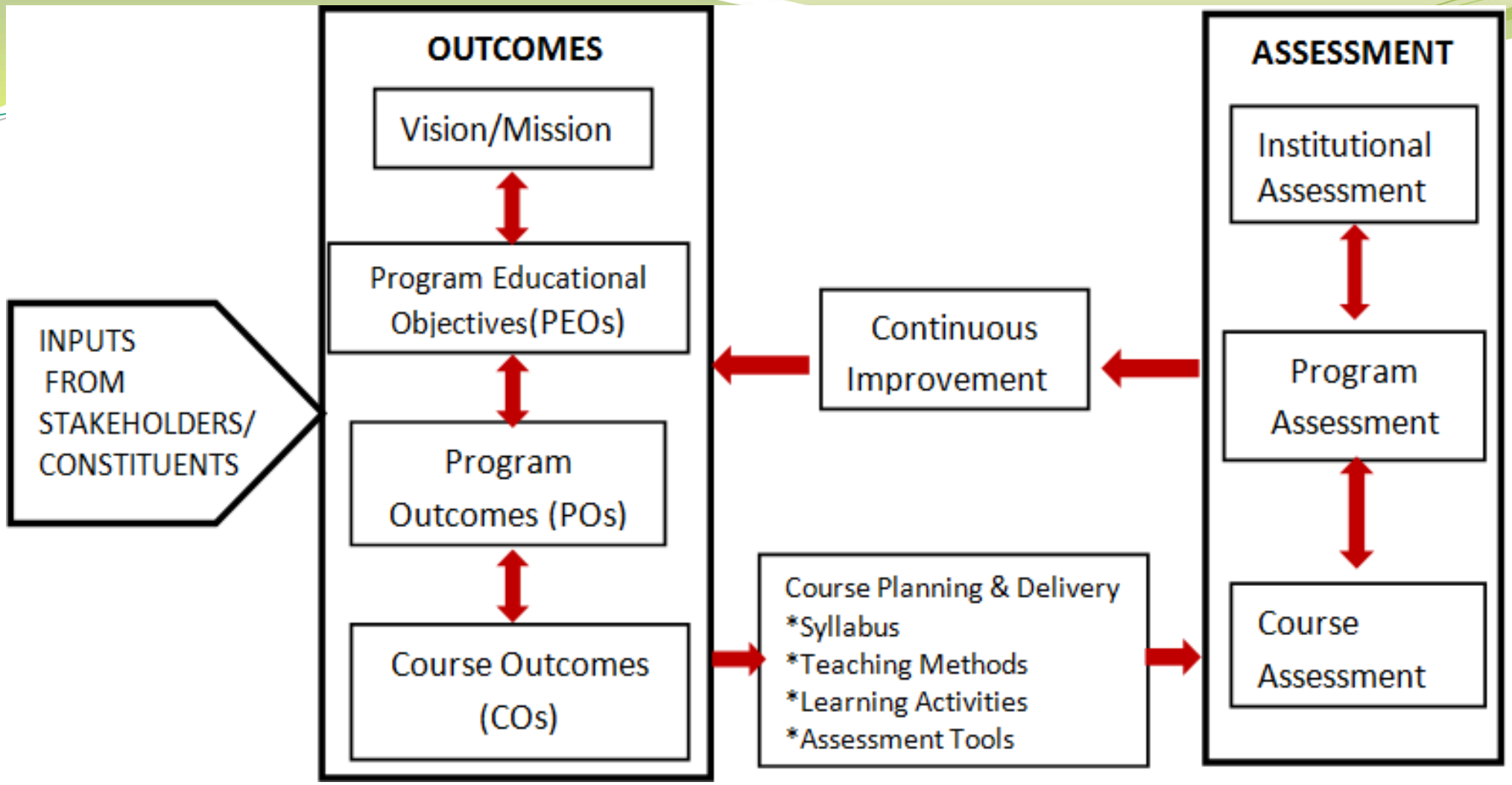
Watch my video on Learning outcomes-based assessment in Higher Education

https://www.youtube.com/watch?v=wqJagsi636c


Course Learning outcomes(C.L.O)
Outcomes- based, student- centered Teaching and learning Strategies
Outcomes-based Assessment Methods (Formative, Summative)

Assessment of Attainment of Outcomes

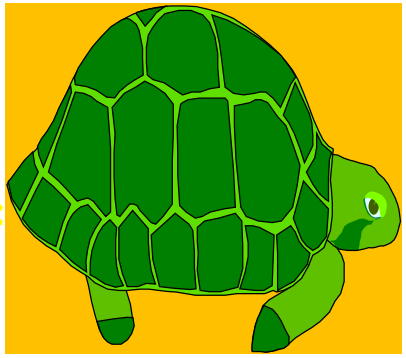
- At Course Level
- At Program Level
- At Institutional Level

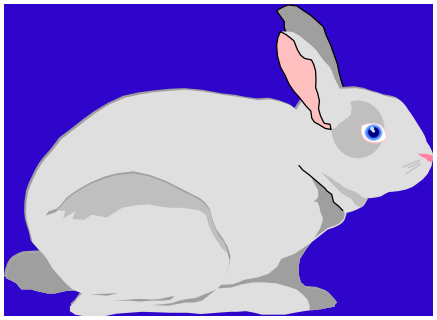


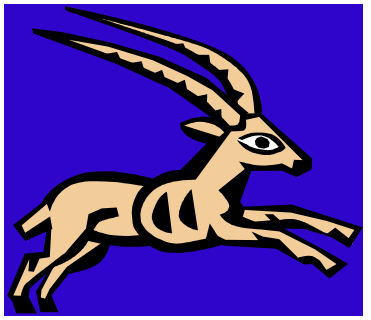
(PEOs and QDs mean the same)

Learning Outcomes based curriculum Framework

Why focus teaching on the learner?







- **Learning styles are different**
- **Sensory/ Intuitive**
- **Visual/ Auditory/ Kinaesthetic (physical activities)**
- **Inductive/Deductive**
- **Active/Reflective**
- **Sequential/Global**
- **Approaches to learning, Pace of intellectual development are different**

Ref:' Understanding Student Differences, Richard Felder & Rebecca Brent, J. Engineering Education, 94(1), 57-72, (2005).

In order to facilitate the Learning Outcomes among Students as per Course Outcomes, we must learn

- **Subject Knowledge(Mastery)**
- **Pedagogy(Appropriate teaching methods)**
- **Integrating tools of Information and Communication Technology (ICT) in Teaching & Learning Process**

Some of the active learning strategies

- Learning by doing
- Learning through discussion among the peer group
- Learning through Case Studies
- Through Group Projects
- Through Field Studies
- Experiential Learning
- Reflective Learning
- One Minute Paper during the classroom interaction
- Open ended questions by teacher
- Open ended questions from students
- Collecting questions in a Question Bowl taken around the class by the teacher or one of the students and discussion on those questions
- Preparation of question bank by students at various cognitive levels

Question Paper Format in OBE (For theory courses)

Max. Marks: **Subject:** **Time:**

Q.No	Question Description	Marks	B.T.L	Mapping	
				C.O No	P.O No
1.A					
B					
2. A					
B					
C					

Notes regarding Question Paper Format given in the previous slide

- **BTL NO means ‘ Bloom’s Taxonomy Level Number based on the hierarchy with ‘Remember Level’ as 1 and ‘Create level’ as 6.**

- **Number of questions and Choice in answering questions may be as per the model decided by a University or the Department of a University or an Autonomous College.**

- **Even for the Sessional Test, every learning outcome of a unit is the sub-outcome of a C.O. Accordingly the C.O may be mentioned while mapping.**

- **Rubrics must be used for assessment of Lab Courses, Project works, Field Studies and similar ones.**

- **Rubric must be prepared by the teacher and provided to the students at the beginning of the Course.**

- **For more details, pl. watch my video on ‘ Rubric as a tool for assessment of Lab Courses and Project Works’ Link is given below.**

  https://www.youtube.com/watch?v=NIQEJL-_CBg&t=3s

Concluding Remarks

- **Implementation of OBE may vary to some extent from University to University.**
- **Students must be educated at Departmental/School level about the advantages and benefits of OBE to students. This is very important.**
- **If teachers, students and administrators work together with all sincerity, implementation of OBE system is possible with greater attainment and achievements.**
- **I sincerely hope and wish that all the Universities of our country will make sincere efforts in designing the Curriculum in OBE Framework and implementation of the same in true spirit for producing more knowledgeable, skilled, competent, creative and ethical graduates, who can contribute to the progress of the country.**