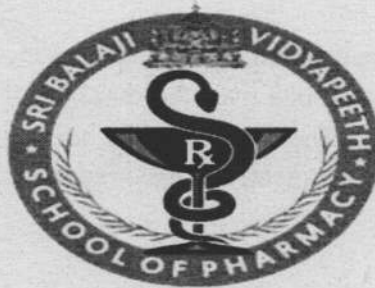# ANALYSIS OF PROGRAMME OUTCOME AND COURSE OUTCOME

SCHOOL OF PHARMACY

Program outcome and Course outcome analysis

Introduction:

Quality assurance is a key factor in education. This require analysis of Program Outcome (PO) and Course Outcome (CO) mapping. This analysis is an important steps in outcome based education. As Pharmacy education is moving from traditional teaching learning process to innovative method of teaching and learning, this need to be incorporated in to the evaluation system. Besides analysing the mapping, to make it more objective a score need to be obtained for mapping and attainment score need to be calculated for each course and program .All these analysis help to monitor not only the performance of the program but also the individual students. This type of analysis is not routine in health care education.

Terminologies

Program educational objective (PEO)

Program Educational Objectives are broad statements that describe what graduates are expected to attain within few years of completing their program. These are based on the needs of the society as analysed and outlined by the regulatory bodies.

Program Outcome (PO):

Program outcomes represent broad statements that incorporate many areas of inter-related knowledge and skills developed over the duration of the program through a wide range of courses and experiences. They represent the big picture, describe broad aspects of knowledge, skill and attitude development, and encompass multiple learning experiences.

Course Outcomes (CO):

Course outcomes describe the learning that will take place across the curriculum through concise statements, made in specific and measurable terms, of what students will know and/or be able to do as the result of having successfully completed a course.

Mapping of PEO, PO and the CO:

Mapping (program mapping) facilitates the alignment of course-level outcomes with program outcomes. It allows faculty to create a visual map of a program. It is also used to explore how students are meeting program-level outcomes at the course level. Outcomes mapping focuses on student learning also.

Attainment score or level :

Attainment score or level is defined as a measure of a student's achievement in school which compares every child to a standardised expectation for their level, regardless of individual starting points.
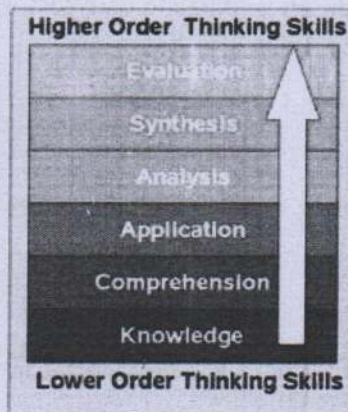
Bloom's Taxonomy:

Bloom's Taxonomy of Learning Domains was created in 1956 under the leadership of educational psychologist Dr. Benjamin Bloom in order to promote higher order of thinking in education. It is most often used when designing educational, training, and learning processes. The three Domains of Learning are (1) Cognitive: Mental Skills (Knowledge), (2) Affective: growth in feelings or emotional areas (attitude or self) and (3) Psychomotor: manual or physical skills (skills). **(Figure 1)**
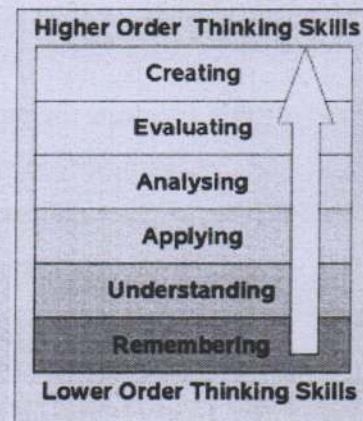
The Revised Bloom'sTaxonomy

Benjamin S. Bloom
1913-1999

1956

Higher Order Thinking Skills

| Evaluation |
| Synthesis |
| Analysis |
| Application |
| Comprehension |
| Knowledge |

Lower Order Thinking Skills

Bloom, B., Englehart, M. Furst, E., Hill, W., & Krathwohl, D. (1956). Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain. New York, Toronto: Longmans. Green.

2001

Higher Order Thinking Skills

| Creating |
| Evaluating |
| Analysing |
| Applying |
| Understanding |
| Remembering |

Lower Order Thinking Skills

Anderson, L. & Krathwohl (Eds.). (2001). A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives. New York: Longman.

Figure. 1 Bloom's taxonomy

School of Pharmacy is affiliated to Pharmacy Council of India and Sir Balaji Vidyapeeth, Puducherry. It has provided the syllabus for arious health care courses, where all courses have its own objectives and methodology to achieve the course outcomes. To attain the course outcomes and program outcome, the institutes use course wise marks of students and the pass percentage of the formative and summative assessment.

UNDER GRADUATE

Bachelor of Pharmacy (B.Pharm)

Program Educational Objectives (PEO)

The programme is designed to --

- **PEO1:** Impart basic knowledge and skills of Pharmaceutical sciences in an organized manner and graduates will compete for future by becoming expert in all disciplines of pharmacy.

- **PEO2:** Train and develop the students can acquire theoretical and practical skills which can be applied in pharmaceutical industry and health care sectors.

- **PEO3:** Inculcate the professional standards and ethics in the students.

- **PEO4:** Inspire graduates for life-long learning to work and co-ordinate with members of multidisciplinary teams and communicate effectively using modern technology.

Program Outcome (PO)

After completion of this programme, the graduate will –

- **PO1: Pharmacy Knowledge:**

Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.

- **PO2: Planning Abilities:**

Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

> **PO3: Problem analysis:**

Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

> **PO4: Modern tool usage:**

Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

> **PO5: Leadership skills:**

Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.

> **PO6: Professional Identity:**

Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

> **PO7: Pharmaceutical Ethics:**

Apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

> **PO8: Communication:**

Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

> **PO9: The Pharmacist and society:**

Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

> **PO10: Environment and sustainability:**

Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

> **PO11: Life-long learning:**

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

Course (Cs)

The course of study for B. Pharm shall include Semester Wise Theory & Practical. 1st Year B.Pharmacy-Semester I consists of Human anatomy & physiology I, Pharmaceutical Analysis I, Pharmaceutics I, Pharmaceutical Inorganic Chemistry, Communication skills, Remedial Biology/Remedial Mathematics; 1st Year B.Pharmacy-Semester II consists of Human anatomy & physiology II, Pharmaceutical Organic Chemistry I, Biochemistry, Pathophysiology, Computer Application in Pharmacy, Environmental Sciences, 2nd Year B.Pharmacy- Semester III consists of Pharmaceutical Organic Chemistry II, Physical Pharmaceutics I, Pharmaceutical Microbiology, Pharmaceutical Engineering; 2nd Year B.Pharmacy- Semester IV consists of Pharmaceutical Organic Chemistry III, Medicinal Chemistry I, Physical Pharmaceutics II, Pharmacology I, Pharmacognosy and Phytochemistry I; 3rd Year B.Pharmacy- Semester V consist of Medicinal Chemistry II, Industrial Pharmacy I, Pharmacology II, Pharmacognosy and Phytochemistry II, Pharmaceutical Jurisprudence; 3rd Year B.Pharmacy- Semester VI consist of Medicinal Chemistry III, Pharmacology III, Herbal Drug Technology, Biopharmaceutics and Pharmacokinetics, Pharmaceutical Biotechnology, Quality Assurance; 4th Year B.Pharmacy- Semester VII consist of Instrumental Methods of Analysis, Industrial Pharmacy II, Pharmacy Practice, Novel Drug Delivery System, Practice School; 4th Year B.Pharmacy- Semester VIII consist of Biostatistics and Research Methodology, Social and Preventive Pharmacy, Pharma Marketing Management, Pharmaceutical Regulatory Science, Pharmacovigilance, Quality Control and Standardization of Herbals, Computer Aided Drug Design, Cell and Molecular Biology, Cosmetic Science, Experimental Pharmacology, Advanced Instrumentation Techniques, Dietary Supplements and Nutraceuticals and Project work. Each course has its well defined course outcome mentioned in individual course book.

Mapping and analysis of Cs, POs and PEOs

The process of attainment of Cs, POs and PEOs starts from writing appropriate COs for each course in the four year degree program. As Undergraduate Pharmacy program is regulated by the Pharmacy Council of India, COs and POs are defined by it. Based on this, course outcomes are refined by the respective faculty members of the course using action verbs of

learning levels as suggested by Bloom Taxonomy. Then, a correlation is established between Cs and POs and Cs and PEOs on the scale of 0 to 3 ('0'being no correlation, 1 being the low correlation, 2 being medium correlation and 3 being high correlation) based on their perception. The average score is calculated and is correlated with the courses as a whole not individually. A 35x11 mapping matrix of COs-PEOs **(Table.1)** and 35x4 mapping matrix of Cs-POs **(Table.2)** is prepared at the institute level in this regard for all courses in the program. **Radar graph** was plotted to find out the level of correlation between PEO-Cs **(Fig.2)** and PO-Cs **(Fig.3)**.

Table 1. Cs-PEO Mapping matrix

SL. NO	COURSE	PEO1	PEO2	PEO3	PEO4
1.	Human Anatomy and Physiology I	3	3	1	3
2.	Pharmaceutical Analysis I	3	3	3	3
3.	Pharmaceutics I	3	3	2	3
4.	Phamaceutical Inorganic Chemistry	3	3	1	2
5.	Human Anatomy And Physiology II	3	3	1	3
6.	Pharmaceutical Organic Chemistry I	3	3	2	3
7.	Biochemistry	3	3	2	2
8.	Pathophysiology	3	2	2	3
9.	Pharmaceutical Organic Chemistry – II	3	3	2	3
10.	Physical Pharmaceutics I	3	3	2	3
11.	Pharmaceutical Microbiology	3	3	2	3
12.	Pharmaceutical Engineering	3	3	2	3
13.	Pharmaceutical Organic Chemistry – III	3	3	2	3
14.	Medicinal Chemistry I	3	3	2	3
15.	Physical Pharmaceutics II	3	3	2	3
16.	Pharmacology I	3	3	3	3
17.	Pharmacognosy &Phytochemistry I	3	3	3	3
18.	Medicinal Chemistry II	3	3	3	3

19.	Industrial Pharmacy I	3	3	3	3
20.	Pharmacology II	3	3	3	3
21.	Pharmacognosy &Phytochemistry II	3	3	3	3
22.	Pharmaceutical Jurisprudence	3	1	3	3
23.	Medicinal Chemistry III	3	3	3	3
24.	Pharmacology III	3	3	3	3
25.	Herbal Drug Technology	3	3	2	2
26.	Biopharmaceutics and Pharmacokinetics	3	3	2	2
27.	Pharmaceutical Biotechnology	3	3	1	2
28.	Quality Assurance	3	3	3	3
29.	Instrumental Methods of Analysis	3	3	3	3
30.	Industrial Pharmacy II	3	3	3	3
31.	Pharmacy Practice	3	3	3	3
32.	Novel Drug Delivery System	3	2	2	3
33.	Biostatistics and Research Methodology	2	2	1	3
34.	Social and Prevent Pharmacy	3	3	3	3
35.	Pharma Marketing Management/ Pharmaceutical Regulatory Science/Pharmacovigilence/Quality Control and Standardization of Herbals/ Computer Aided Drug Design/ Cell and Molecular Biology/ Cosmetic Science/ Experimental Pharmacology/ Advanced Instrumentation Techniques/ Dietary Supplements and Nutraceuticals	3	2	2	2
	Average Score	**2.97**	**2.83**	**2.29**	**2.83**

(0 - No correlation; 1 - Low correlation; 2 - Medium correlation; 3 - High correlation).
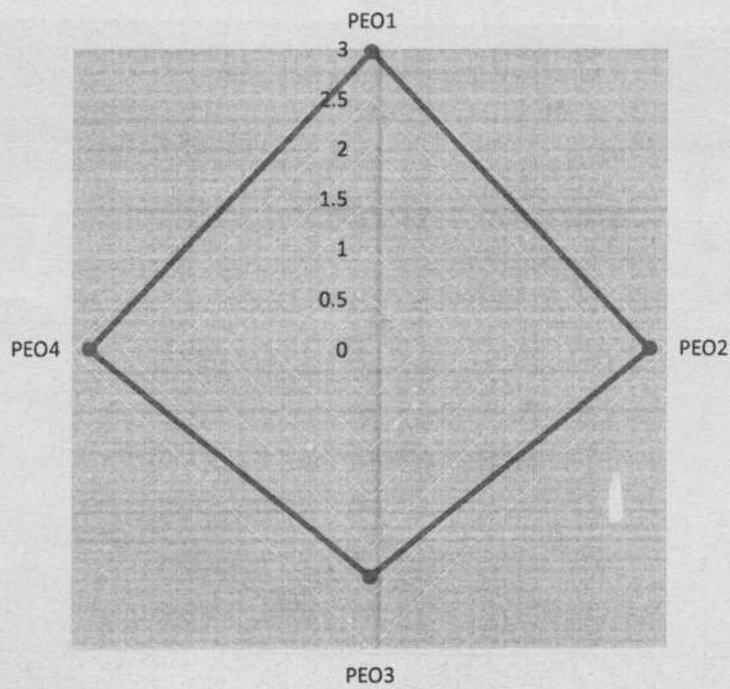
Mapping of PEO and Cs

Figure 2. Mapping of Program educational objectives & course
(0 - no correlation; 1 - Low correlation; 2 - Medium correlation; 3 - High correlation)

Table 2. Cs-PO Mapping matrix

Sl No	Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
1.	Human Anatomy and Physiology I	3	2	1	3	0	1	2	0	0	2	3
2.	Pharmaceutical Analysis I	3	3	3	3	2	3	3	1	1	1	3
3.	Pharmaceutics I	3	3	3	3	2	3	2	1	1	1	3
4.	Phamaceutical Inorganic Chemistry	3	3	3	0	0	1	3	2	3	2	3
5.	Human Anatomy And Physiology II	3	2	1	3	0	1	2	0	0	2	3
6.	Pharmaceutical Organic Chemistry I	3	3	3	2	2	3	2	0	1	0	3
7.	Biochemistry	3	2	3	3	2	2	0	0	0	1	1
8.	Pathophysiology	3	3	3	2	2	3	3	2	3	1	3
9.	Pharmaceutical Organic Chemistry – II	3	3	3	3	1	3	3	2	3	2	2
10.	Physical Pharmaceutics I	3	3	3	3	3	2	3	2	3	3	2
11.	Pharmaceutical Microbiology	3	3	3	3	2	3	1	1	1	2	3
12.	Pharmaceutical Engineering	3	3	3	3	3	3	3	1	3	3	1
13.	Pharmaceutical Organic Chemistry – III	3	3	3	3	3	3	3	1	2	3	2
14.	Medicinal Chemistry I	3	3	3	3	3	3	3	2	3	1	2
15.	Physical	3	3	2	2	1	3	3	2	3	3	3

	Pharmaceutics II											
16.	Pharmacology I	3	3	3	3	3	3	3	2	3	3	3
17.	Pharmacognosy &Phytochemistry I	3	3	3	3	3	3	3	2	3	2	3
18.	Medicinal Chemistry II	3	3	3	3	3	3	3	2	3	3	3
19.	Industrial Pharmacy I	3	3	2	3	3	3	2	2	3	3	3
20.	Pharmacology II	3	3	3	3	3	3	3	1	3	3	3
21.	Pharmacognosy &Phytochemistry II	3	3	3	3	3	3	3	1	3	3	3
22.	Pharmaceutical Jurisprudence	3	1	2	0	1	3	2	1	2	3	3
23.	Medicinal Chemistry III	3	2	2	2	2	2	3	0	3	3	2
24.	Pharmacology III	3	3	2	3	2	3	3	1	2	1	3
25.	Herbal Drug Technology	3	2	3	3	1	2	2	0	1	1	2
26.	Biopharmaceutics and Pharmacokinetics	3	3	3	3	2	2	2	1	1	1	3
27.	Pharmaceutical Biotechnology	3	3	2	2	2	3	2	1	2	2	3
28.	Quality Assurance	3	3	3	3	2	3	3	2	2	1	3
29.	Instrumental Methods of Analysis	3	3	3	3	1	3	3	1	1	2	3
30.	Industrial Pharmacy II	3	3	3	3	3	3	2	1	3	1	3
31.	Pharmacy Practice	3	3	3	3	3	3	3	3	3	3	3
32.	Novel Drug	3	3	2	3	2	3	2	2	2	1	3

	Delivery System											
33.	Biostatistics and Research Methodology	3	2	3	3	1	1	2	2	2	0	2
34.	Social and Prevent Pharmacy	3	3	3	3	3	3	3	3	3	3	3
35.	Pharma Marketing Management/ Pharmaceutical Regulatory Science/Pharmaco vigilence/Quality Control and Standardization of Herbals/ Computer Aided Drug Design/ Cell and Molecular Biology/ Cosmetic Science/ Experimental Pharmacology/ Advanced Instrumentation Techniques/ Dietary Supplements and Nutraceuticals	3	2	2	2	2	2	2	3	3	1	3
Average Score		**3.00**	**2.74**	**2.66**	**2.66**	**2.03**	**2.60**	**2.49**	**1.37**	**2.14**	**1.91**	**2.69**

Figure 3. Mapping of Program outcome & course

(0 - No correlation; 1 - Low correlation; 2 - Medium correlation; 3 - High correlation)

Analysis of Cs, POs and PEOs

On analyzing, the average score of individual program outcome ranges from 1.37 to 3.00. It shows, there exist a strong correlation of all Cs with that of PO1, PO2 & PO11, whereas medium correlation between Cs and PO3 to PO7 and PO9. Also Low correlation between Cs and PO8 and PO10 respectively. Similarly, on analyzing, the average score of individual program educational objectives ranges from 2.29 to 2.97. It shows, there exist a strong correlation of all Cs with that of PEO1, whereas medium correlation between Cs and PEO 2 to PEO 4.
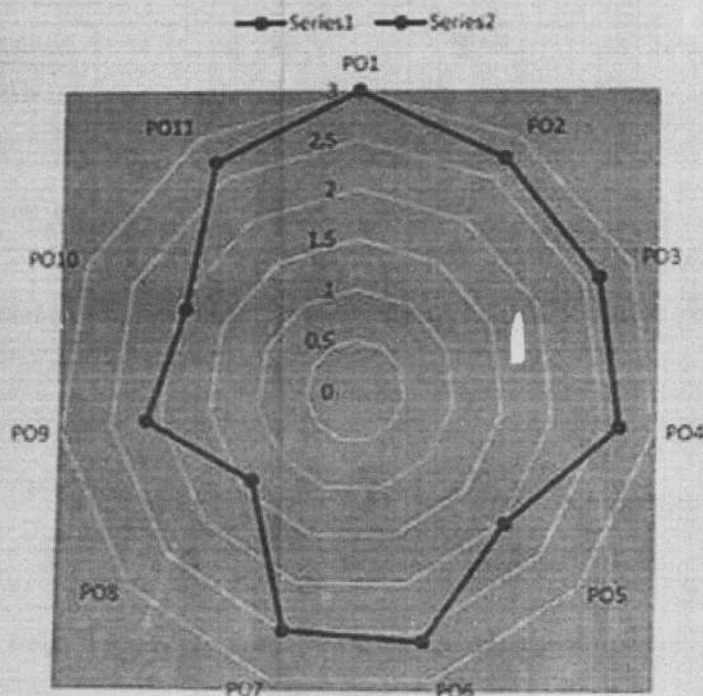
MAPPING OF CO WITH PO

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Analysis of Cs, POs and PEOs

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