Assessment Method for Course Outcomes and Program Outcome

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Abstract: One of the key aspects in Outcome-Based Education (OBE) is the assessment of the course outcomes. The Outcome based Education (OBE) has been one of the major concern of most academic institution in India, especially among the Pharmacy institution as the National Board of Accreditation (NBA) has made it compulsory towards program accreditation. COs are the attributes, that the student is expected to have or obtained at the time he or she completing the course. Each course under the bachelor programme has its own set of COs. At the end of each course, the COs needs to be assessed and evaluated to check whether it has been attained or not. This paper aims to provide an evaluation method for the attainment of course Outcomes for Pharmacy Program as defined by National Board of Accreditation (NBA). NBA requires specific evaluation techniques and assessment methods for measuring the attainment of Course Outcomes and Program Outcomes. Accordingly this paper describes the assessment method used to measure the PO via direct assessment of the Course Outcomes and indirect methods through surveys. Course Outcomes for each course were developed and surveys were conducted throughout the year to assess the level of awareness and understanding of OBE.

Keywords: OBE, NBA, Course Outcomes, Program Outcomes.

INTRODUCTION

Over the past three years, the Guru Gobind Singh College of Pharmacy in Yamuna Nagar (Haryana) India has adopted Outcome Based Education (OBE) approach in its teaching and learning process. OBE implementation is nowadays compulsory in attaining accreditation from National Board of Accreditation [1]. A formal definition of OBE can be stated as "an outcome is visible and observable demonstration of knowledge, competence and orientation at the end of a learning experience" [4]. Thus for OBE implementation, initially it is necessary that the desired or defined outcomes are determined and then according to defined outcomes, programme curriculum, teaching and learning methodology and supporting facilities are designed. During the course of the programme, various measurement methods are used to measure the attainment of outcomes.

These outcomes attributes, normally in form of knowledge, skill or attitude, which prepare the graduates for their professional practice
The outcomes are normally looked at 3 different levels, at course level (Course Outcomes), at programme level (Programme Outcomes), and at professional level (Programme Objectives). This paper describes a method that is used to analyze or evaluate the attainment of specific learning outcomes which are the Course Outcomes (CO) for a course. CO is the attribute that the students are expected to have after completing the course. The evaluation of whether CO is attained is essential in determining the student achieving in a particular course. The result of CO attainment will also be used to evaluate the attainment of Programme Outcomes (PO). The outcome of analysis will be used to improve the teaching and learning experience in the particular course.

A. OBE and NBA [3,4]
Outcome based education is an approach to education in which decisions about the curriculum are driven by the exit learning outcomes that the students should display at the end of the course. The National Board of Accreditation (NBA) has adopted OBE approach and has laid out guidelines for institutions to pursue excellence in order to get accreditation. Those guidelines are followed to define the program outcomes and the course outcomes.

Program Outcomes: Program Outcomes are narrower statements that describe what students are expected to know and be able to do upon the graduation. These relate to the skills, knowledge, and behaviour that students acquire in their enrolment through the program.

Course Outcomes: Course Outcomes are narrower statements that describe what students are expected to know, and be able to do at the end of each course. These relate to the skills, knowledge, and behaviour that students acquire in their enrolment through the course.

Assessment: Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of programme educational objectives and programme outcomes. Attainment: Attainment is the action or fact of achieving a standard result towards accomplishment of desired goals. Primarily attainment is the standard of academic attainment as observed by test or examination result.

B. Methodology
All courses under the bachelor degree programme would have their own course outcomes or also commonly known as CO. These COs are produced based on the requirement of the programme outcomes (PO). Each CO will be mapped to PO (the CO-PO) matrix. The PO will be then mapped to the programme educational objectives (PEO). Figure 1 shows an example of relationship between CO, PO and PEO. PO attainment can be done through direct attainment (student performance) method by taking average of all CO’s that corresponds to respective PO’s and through indirect attainment methods based on the student exit surveys, employer surveys, etc. To measure the attainment of POs, the COs is mapped to POs and this is done in such a way that the attainment of PO is derived through attainment of CO and Surveys.
In this paper as an example we have considered Pharmacognosy course which is one of the course in 1st year of the program.

The COs are abbreviated as C101, C102, C103, C104, C105 and C106 for Pharmaceutical Chemistry-I, Pharmaceutical Chemistry-II, Pharmaceutics-I, Pharmacognosy-I, Pharmacology-I, Pharmacognosy-II respectively for 1st year courses. Similarly C201, C202, C203, C204… for 2nd year courses and so on for 3rd & 4th year.

Course Outcomes from Pharmacognosy-I are taken to be analyzed. There are five associated course outcomes as decided by the instructor. They are as shown in Table no.1:

**Figure 1: Relationship between CO, PO and PEO**

**Table 1: Pharmacognosy-I Course Outcomes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Upon completion of this course students will be able to</th>
</tr>
</thead>
<tbody>
<tr>
<td>C104.1</td>
<td>State the historical background, modern concept and scope of Pharmacognosy.</td>
</tr>
<tr>
<td>C104.2</td>
<td>Define the botanical aspects, sources and classification of crude drugs.</td>
</tr>
<tr>
<td>C104.3</td>
<td>Describe the concept of cultivation, collection, processing of medicinal plants along with adulteration if any.</td>
</tr>
<tr>
<td>C104.4</td>
<td>Explain qualitative &amp; quantitative analysis of selected medicinal plants.</td>
</tr>
<tr>
<td>C104.5</td>
<td>Demonstrate society about natural allergens along with the utilization of pharmaceutical aids &amp; Ayurvedic preparations.</td>
</tr>
</tbody>
</table>
Program Outcomes are related to Graduate Attributes which are laid down by NBA. POs are defined by Program Coordinator and they are as follows:

1. **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.

2. **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.

3. **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.

4. **Modern Tool Usage**: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

5. **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.

6. **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).

7. **Pharmaceutical Ethics**: Honour personal values and 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.

8. **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.

9. **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.

10. **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.

11. **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.
CO-PO matrix for Pharmacognosy-I of 1st year is shown in Table 2.

**Table 2: Sample CO-PO Matrix**

<table>
<thead>
<tr>
<th>CO</th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
<th>PO 4</th>
<th>PO 5</th>
<th>PO 6</th>
<th>PO 7</th>
<th>PO 8</th>
<th>PO 9</th>
<th>PO 10</th>
<th>PO 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>C104.1</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td></td>
</tr>
<tr>
<td>C104.2</td>
<td>2</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td></td>
</tr>
<tr>
<td>C104.3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>2</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>1</td>
</tr>
<tr>
<td>C104.4</td>
<td>3</td>
<td>&quot;-&quot;</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
</tr>
<tr>
<td>C104.5</td>
<td>3</td>
<td>&quot;-&quot;</td>
<td>1</td>
<td>&quot;-&quot;</td>
<td>&quot;-&quot;</td>
<td>2</td>
<td>&quot;-&quot;</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The CO-PO mapping has been done with correlation levels 1, 2, 3 and "-" for no correlation as defined below:

1. Slightly (Low)
2. Moderately (Medium)
3. Substantially (High)

**Course Outcome Assessment:** To find Course Outcome Attainment level we conduct 3 sessional examinations, assignment and Class Test for each CO in each year for each subject on the basis of Result we find the attainment level. We also use various attainments Test Methodology such as follows.
Describe the assessment processes for calculating Attainment level of Course Outcomes by internal examination, test and assignment

Average percentage of marks obtained in test taken on the basis of Course Outcomes

Average percentage of marks obtained in assignment taken on the basis of Course Outcomes

Average percentage of marks obtained in sessional examination on the basis of Course Outcomes

Average of best two percentages from the former three evaluations.

Students having 50% or more than 50% marks are expressed by Y (Yes)
Students having less than 50% marks are expressed by N (No)

From the overall students, we have taken the percentage of those students which contains Y (Yes) because they have achieved the course outcomes

On the basis of overall percentage of course outcome, attainment level denoted by 1, 2 and 3

50% students getting 50% marks attainment level is 1
60% students getting 50% marks attainment level is 2
70% students getting 50% marks attainment level is 3
Describe the assessment processes for calculating Attainment level of Course Outcomes by external examination.

Calculation of marks obtained by the students in final examination out of 80. This can be achieved by the subtraction of the internal sessional marks from the external obtained marks.

From the same the percentage can be calculated by applying following formula:

\[
\text{Percentage (\%) = \left(\frac{\text{External marks} - \text{Internal marks}}{80}\right) \times 100}
\]

Students having 50% or more than 50% marks are expressed by Y (Yes)

Students having less than 50% marks are expressed by N (No)

From the overall students, we have taken the percentage of those students which contains Y (Yes) because they have achieved the course outcomes.

On the basis of overall percentage of passed students attainment level denoted by 1, 2 and 3

- 50% students getting 50% marks attainment level is 1
- 60% students getting 50% marks attainment level is 2
- 70% students getting 50% marks attainment level is 3
The various tools for assessing the students

a) Direct methods
- Annual Examinations
- Sessional Examination
- Class Test
- Assignments
- Minor Project work

b) Indirect methods
- Co-curricular activities
- Extra-curricular activities
- Graduate exit survey
- Alumni Survey
- GPAT & other exams

1 – Low (0 >=50%)
2 – Moderate (51% to 60%)
3 – High (61% to 100%)

CO assessment needs to be calculated as per the direct assessment method. The overall percentage distribution of marks for direct assessment methods as per examination scheme is shown in Table 3, assuming 60% weightage to university examination and 40% weightage to Internal Assessment (Sessional examination, Class test & Assignments). This measurement method is further used to calculate final CO attainment.

<table>
<thead>
<tr>
<th>COS</th>
<th>INTERNAL</th>
<th>40%</th>
<th>EXTERNAL</th>
<th>60%</th>
<th>ATTAINMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>C104.1</td>
<td>3</td>
<td>1.2</td>
<td>3</td>
<td>1.8</td>
<td>3</td>
</tr>
<tr>
<td>C104.2</td>
<td>3</td>
<td>1.2</td>
<td>3</td>
<td>1.8</td>
<td>3</td>
</tr>
<tr>
<td>C104.3</td>
<td>3</td>
<td>1.2</td>
<td>3</td>
<td>1.8</td>
<td>3</td>
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<tr>
<td>C104.4</td>
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<td>1.2</td>
<td>3</td>
<td>1.8</td>
<td>3</td>
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<tr>
<td>C104.5</td>
<td>3</td>
<td>1.2</td>
<td>3</td>
<td>1.8</td>
<td>3</td>
</tr>
</tbody>
</table>
Apart from the CO assessment methods, the overall percentage distribution for CO’s is to be considered for calculation of assessment of CO’s.

**Program Outcome Attainment:** Program Outcome attainment is done through direct attainment method and indirect attainment method. Both direct and indirect assessment tools are used for evaluation of attainment of POs. For the overall attainment, 60% and 40% weightage are given to direct and indirect assessment respectively.

PO attainment through direct assessment is depicted in Table 4; it highlights the average attainment of PO from 1st to 4th year of Pharmacy Program.

**CONCLUSIONS**

This paper provides a suitable method for assessment of course outcomes through direct and indirect assessment methods as defined by NBA. The direct assessment method implies that the course outcome attainment directly reflects the program outcome attainment and the indirect assessment method implies that each individual component in the assessment contributes to the attainment of program outcome. Outcome Based Education has made faculty to develop creative way of assessing student’s performance through their regular assessment by using different assessment tools/methods. This study can help as guidance to faculties in assessment of course outcomes and monitoring the students’ performance as well as improving teaching efficiency.
Table 4: PO Attainment (Direct Method + Indirect Method)

<table>
<thead>
<tr>
<th>Assessment tool</th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
<th>PO 4</th>
<th>PO 5</th>
<th>PO 6</th>
<th>PO 7</th>
<th>PO 8</th>
<th>PO 9</th>
<th>PO 10</th>
<th>PO 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Performance</td>
<td>2.67</td>
<td>1.91</td>
<td>1.71</td>
<td>1.62</td>
<td>1.64</td>
<td>1.35</td>
<td>1.46</td>
<td>1.25</td>
<td>1.26</td>
<td>1.35</td>
<td>1.23</td>
</tr>
<tr>
<td>Direct Attainment</td>
<td>2.67</td>
<td>1.91</td>
<td>1.71</td>
<td>1.62</td>
<td>1.64</td>
<td>1.35</td>
<td>1.46</td>
<td>1.25</td>
<td>1.26</td>
<td>1.35</td>
<td>1.23</td>
</tr>
<tr>
<td>Indirect</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Co curricular Activities</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<td>Extra-curricular activities</td>
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<td>3</td>
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<td>3</td>
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<td>1</td>
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<td>1</td>
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<td>Graduate Exit Survey</td>
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<td>3</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>GPAT and other exams</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Indirect Attainment</td>
<td>2.3</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1.66</td>
</tr>
<tr>
<td>Total Attainment 60% (Direct)+40% (Indirect)</td>
<td>2.5</td>
<td>2.15</td>
<td>2.06</td>
<td>2.17</td>
<td>2.18</td>
<td>2.01</td>
<td>2.07</td>
<td>1.15</td>
<td>1.15</td>
<td>2.01</td>
<td>1.40</td>
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<td>Target</td>
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<tr>
<td>PO Achieved</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

REFERENCES:


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