A Tabular Approach to Outcome-Based Course Planning

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Abstract. Many educational institutions are moving towards outcome-based teaching and learning. It is a challenge to make the overworked instructors participate in the migration. We present an approach allowing them to plan outcome-based courses in a step-by-step manner. The course plan contains tables that relate the study topics, teaching, learning and assessment activities to the learning outcomes. Misalignments become obvious on the tables to facilitate correction. The approach may reduce the migration effort and improve the OBTL quality.

Keywords: outcome-based teaching and learning (OBTL), course intended learning outcomes (CILOs), course planning

1 Introduction

Outcomes are clear, observable demonstrations of student learning [1]. In outcome-based teaching and learning (OBTL), learning outcomes are used to derive teaching, learning and assessment tasks. It promises focused teaching and learning at the course level and accountability at the program level.

Constructive alignment ensures that learning outcomes, study topics, teaching, learning and assessments are consistent with each other [2]. In OBTL course plans, some instructors put two of the above components on the same table to help detect misalignments. We enhance the tables to facilitate the detection of additional misalignments.

Our framework enables an instructor, with limited knowledge in OBTL, to draft three tables. He or she can then work with a colleague knowledgeable in OBTL to revise the tables until the various activities are fully aligned with the course learning outcomes.

OBTL has different interpretations. A consensus of what is OBTL cannot be reached herein. The paper describes how OBTL course planning can be done efficiently in our chosen interpretation. Our approach is illustrated with a simple example of a software design course. We create the CILO table in section 2, the syllabus table in section 3 and the teaching, learning and assessment (TLA) table in section 4. The conclusions are presented in section 5. This paper only deals with the planning issues of OBTL courses.

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2 Course Intended Learning Outcomes (CILOs)

The course aim of our example is to develop knowledge and skills in the students on the specification, design and implementation of software systems. With this aim in mind, we author the intended learning outcomes. Each outcome is a task that students are expected to be able to perform upon successful completion of the course. An outcome starts with an action verb, for example, draw, create, select, write, transform and so on. By identifying the products of the action, we can make an outcome more precise and readily verifiable. UML diagrams are the products of the first outcome in our example.

Table 1. CILO Table.

ID	Description	Weight
1	Draw UML diagrams	15 %
2	Create requirements specifications	15 %
3	Create analysis models	20 %
4	Create system design documents	20 %
5	Select appropriate design pattern for reuse	10 %
6	Write interface specifications in OCL	10 %
7	Transform models to code and databases	10 %
		100 %

The weight of an outcome represents its relative importance. The weights guide the student assessments. Why is the first outcome worth 15 percents not 14 or 16? Some outcome-based purists fault weight assignments for being arbitrary. John Biggs has proposed several alternatives that are supposedly less arbitrary [2]. For instance, he suggested that an instructor could award a final grade of A to a student who performed six tasks at the top level, and a B for four tasks at the top level. Why three tasks at the top level are not sufficient for a B? It is tedious to determine the appropriate grades for all the possible combinations. We will have to consider many more scenarios. Biggs' approach is just as arbitrary as ours except without the assignments of numeric scores. For practical reasons, we recommend the use of the more familiar weight assignment approach.

We have seen instructors assigning values of 1, 2 and 3 as weights. It is also problematic. Which of '1' and '3' carries more weight? Do two outcomes of the same weight contribute equally to the final score? Does the weight of '1' contribute half of the weight of '2' in the final score? Weights expressed in percentages eliminate the confusions. Some instructors may not want to commit a specific percentage to a CILO. Leaving the weights unspecific gives instructors room to play with. However explicit contributions of individual outcomes to their final grades allow students to appropriately expend their effort.

In our mark-based assessments, instructors can associate a particular score with a performance level [3]. For the first outcome above, we may award 3% for the ability to choose the right kinds of UML diagrams for the given situations. If the student can also draw UML diagrams with errors, we award 6%. We award 9% for diagrams with

insignificant errors, 12% for error-free diagrams for ordinary problems and a perfect 15% for error-free diagrams for complex problems. Documenting these expectations in the course plan reduces unnecessary anxieties experienced by the students.

3 Syllabus

The learning outcomes represent one view and the syllabus represents another view. The later view is important because it is how most instructors look at their courses and how books are organized. The syllabus below helps to ensure the agreement of the two views. The rightmost columns on the syllabus table correspond to the outcomes of the CILO table. A checkmark in a cell indicates that the study topic directly supports the outcome.

Table 2. Syllabus Table.

Description	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Requirements Elicitation: problem statements, use cases and non-functional requirements	✓	✓					
Requirements Analysis: CRC, entity objects, boundary objects and control objects	✓		✓				
System design: subsystems, component diagrams, deployment diagrams and persistent data	✓			✓			
Reuse: delegation, Liskov substitution principle and design patterns					✓		
Object design: types, signatures, invariants, preconditions, postconditions and OCL						✓	
Model transformation: refactoring, optimization, mapping models to code and databases							✓

When preparing the table, the instructor wants to be sure that there is at least one checkmark on every row. Otherwise, the study topic does not contribute to any outcome. This may indicate that the study topic is irrelevant to the outcomes or an outcome has been omitted.

The instructor should also ensure that there is a checkmark on every column. Otherwise, the respective outcome is not supported by any study topic listed. If there is at least a checkmark on every row and column and the checkmarks are placed correctly, we gain confidence that the outcomes and study topics are indeed aligned.

4 Teaching, Learning and Assessments (TLA)

Teaching, learning and assessments should all contribute to the learning outcomes. Therefore we list them in the TLA table. Lecturing and reading are not part of student

assessments. All the outcome columns are checkmarked for lecturing and reading. This is not necessary the case for some courses.

Table 3. TLA Table.

Description	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Total**
Lecturing	✓	✓	✓	✓	✓	✓	✓	
Reading	✓	✓	✓	✓	✓	✓	✓	
First assignment	5	10	10					25
Second assignment	5			10		5	10	30
Examination	5	5	10	10	10	5		45
	15	15	20	20	10	10	10	100

The bottom right cell in the table shows that the three assessments add up to 100%. Each assessment covers a different set of outcomes. Two things are required to ensure alignment. First, every outcome has to be assessed at least once. For example, outcome 7 involves the creation of a computer program which is difficult to assess in an examination. Therefore we have chosen to assess it in the second assignment. Second, the subtotals on the bottom row have to agree with the weights assigned to the respective outcomes listed in the CILO table. For example, we have assigned 15% to outcome 1 in the CILO table. It is achieved in the TLA table by assigning 5 marks each to the assignments and the examination.

Many instructors would consider assessments separate from teaching and learning. However assessments are known to influence student learning. We find it appropriate to consider assessments along with teaching and learning. We have limited ourselves to a few assessments to keep the example brief. The readers are encouraged to choose additional assessment such as tutorials, case studies, group projects, student presentations, class discussions, laboratory sessions, essays, reflective journals, and portfolios.

5 Conclusions

The CILO table captures the relative importance of the course outcomes. The syllabus table relates the study topics to the course outcomes. Non-empty rows and columns ensure the alignment of the study topics with learning outcomes. The teaching, learning and assessment (TLA) table ensures that the activities are aligned with the outcomes. Some alignment checks can be performed mechanically. Our approach does not eliminate the possibility of poorly-written course outcomes but the tables unveil their shortcomings. Misaligned and nonassessable outcomes become easier to catch. A colleague knowledgeable in OBTL can help the instructor to complete an OBTL course plan in which the three tables form a significant part.

CILO tables, expressing weights in percents, clarify the priorities of the outcomes. Syllabus tables relate study topics to course outcomes bridging the gap between OBTL and the prevalent content-based teaching. Finally, we combine teaching, learning and assessment activities into a TLA table to have a holistic view of various

activities' contributions to the learning outcomes. We can verify that the assessments are consistent with the importance of the outcomes. Our approach is pragmatic for efficient migration of courses to OBTL.

References

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