Integrating Weighted Learning Outcomes in Assignment Design: Does It Help Students?

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ABSTRACT

This paper discusses the importance of designing well structured assignments that are based on Intended Learning Outcomes (ILOs). Through the researcher experience as an assistant professor in the department of Architectural Engineering, it is found that the quality of students' response to required assignments in the course of "Construction Management" together with their output was affected by the structure and design of the assignment itself.

The researcher designed an assignment about an important topic "Trade-off in Construction Projects Management" without writing the relative weight of tested ILOs in the assignment. After receiving students output of the assignment and marking it, the researcher modified the assignment in order to incorporate certain ILOs (Knowledge and Understanding skills, subject-specific skills, intellectual skills and transferable skills) with a relative weight assigned to each. The updated assignment was re-submitted to students. While re-marking students' output, it was found that the students' response and quality of their output was significantly improved.

Keywords: Learner-centered education, rubric-based assessment, assignment design, Intended Learning Outcomes (ILOs), generic skills, decision taking, Trade-off

INTRODUCTION

Context and Background

After the shift from teaching to learning approach, and the emergence of student-centered approach in the mission and vision of higher education institutes, it was important to integrate learning outcomes in the design and specifications of academic programs and courses. Various assessment methods were re-designed in order to test students' Intended Learning Outcomes (ILOs). Assignments are examples of such assessment methods. The study focuses on the effect of integrating ILOs with relative weight in the design of assignments on students' submittals.

In this paper, the researcher conducted an experimental study in the course "Introduction to construction project management" to depict the importance of integrating course ILOs with relative weight in assignment design. An important topic in construction management is chosen for the assignment. The topic is "Trade-off in construction management". Trade-off is favouring one factor in expense of other factors. According to (Gould, 2002), the three project pillars (time, cost and quality) are subject to trade-off process during the life cycle of construction projects. The Project Manager (PM) is responsible for managing the trade-off process and taking timely decisions in that regard so that the construction project stages run smoothly without any delay.

Motivation and Importance

The significance of this research is motivated by the continuous quality assurance reviews for academic programs in the author's university. The reviews are conducted by National Authority for Qualifications and Quality Assurance of Education and Training (NAQQAET) in Bahrain. The continuous development of academic programs, course facts and descriptions, and assessment policy led to the necessity of accurately defining ILOs for the academic program as well as for courses under each program. It was advised to link assessment methods to ILOs by indicating tested ILOs in each method. In order to follow NAQQAET recommendations, the author designed a template for assignments that incorporates tested ILOs with a relative weight of importance for each ILO.

Accreditation Board for Engineering and Technology (ABET) made it mandatory for universities to follow the outcome-based assessment and evaluation process for accreditation purposes (Pallapu, n.d.). The importance of this research stems from the continuous trials of educational institutions to assure the quality in teaching, learning and

assessment methods. The education currently is shifting from teaching approach to learning approach; that means it is important to measure students' learning outcomes by all possible means and through all possible assessments methods in order to assure the effectiveness of teaching process.

Research Question

The paper tries to answer the question: Is it feasible to incorporate weighted ILOs in the design of course assessment?. Moreover, the paper tries to test whether the response of students to such assessments is affected positively or negatively. A hypothesis is designed to answer research question. The hypothesis is "average of students' marks increases if the assignment incorporates tested ILOs with their relative weight". Experimental steps taken to test research hypothesis are explained in detail later.

Research Objectives

The research aims at:

1. Highlighting recent conceptual shifts in higher education system

2. Highlighting the importance of ILOs in education.

3. Testing the feasibility of integrating tested ILOs with relative importance weight in the design of assignments.

Research Structure

The research is structured on four sections. The first section introduces the topic's context and background as well as the motivation behind conducting the research and its importance. The research question and hypothesis are also highlighted. The second section highlights the recent shift from teaching to learning approach in education, and the origin and evolution of ILOs concept in education and its reflection on assessment process. The third section explains experimental study methodology, steps of assignment design, experiment procedures and the results of experimental study. The fourth section comes up with the conclusion, limitations, recommendations and directions for further research.

ASSESSMENT AND EDUCATIONAL SHIFT

This part of the study surfs through different topics related to experimental study context. First, the conceptual shift from teacher-centered approach to learner-centered approach is highlighted with its reflection on the assessment process. Second, the role of assessment in education and the transparency in assessment design is emphasized. Finally, the link between Learning Outcomes and assessment is tackled.

Student-Centered Approach and Assessment in Education

During last decade, some research studied the shift from teacher-centered approach to learner-centered approach (Weimer, 2002; Wright, 2011). Weimer (2002) revealed that classrooms at the college/university level are extremely instructor-centered and that this situation affects negatively students' success and maturity. Wright (2011) pointed out that when students face an unmanageable amount of course content, they resort to memorization rather than conceptualization. In fact, this is reflected clearly on their response to some modes of assessment such as written assignments. In her book, Learner-centered teaching, Weimer (2002) pointed out five areas in education that can be affected by the conceptual shift from teacher-centered approach to learner-centered approach. Those areas are: the balance of power in the classroom, the function of the course content, the role of the teacher versus the role of the student, the responsibility of learning and the purpose and the process of evaluation.

Wright (2011) predicts some features about students' evaluation in student-centered approach. She predicts that "course objectives and learning will be clearly stated, and students will be taught to assess their own work and that of their peers by asking critical questions in a constructive manner". Wright's prediction reveals that learner-centered approach enhances both teaching and learning process and improves students' generic skills.

Transparency and Assessment in Education

According to (Parkes, 2010), assessment provides a critical link in the teaching and learning process. Fu & Kwok (n.d.) highlight the purpose of assessment in applied learning context as "it involves generating and collecting evidence of students' attainment of knowledge, skills, values and attitudes, and judging that evidence against defined standards". Fu & Kwok (n. d.) recommend that the assessment design should consist of a representative set of tasks which can measure a wide spectrum of knowledge, skills and attributes. They mentioned certain dimensions that have to be considered when designing an assessment task. These dimensions are: assessment mode; assessment method; assessment criteria; assessment task weighting; weighting of individual and group assessment; weighting of in-class and outside-class assessment and weighting of written and practical assessment.

It is important to put a lot of effort in designing and standardizing assessment. Many countries started to establish centralized authorities that are responsible for assuring the standardization of assessment in all educational stages. Fu & Kwok (n.d.) shed the light on the role of Hong Kong Examination and Assessment Authority (HKEAA) which is: the setting of performance standards; the guiding of assessment design; and the moderating of assessment results.

Few studies focused on the importance of using rubrics in assignment design. Keefer (2010) conducted a survey to test students' opinion about using rubric. She designed an open –ended questionnaire that is structured around previous study by Andrade and Du (2005). Students indicated that rubrics were: helpful in completing assignments and giving insight into teacher expectations. Moreover, students noticed that, for teacher, grading was easier using rubrics and resulted in consistent feedback. Additionally, several students commented that their anxiety increased when instructors used rubrics because of the pressure to produce very specific high quality work (Keefer, 2010).

Learning Outcomes Based Assessment

The emergence of Outcome Based Education (OBE) was inspired by Bloom's categorization of the skill levels achieved by students in 1956 into six categories: knowledge; comprehension; application; analysis; synthesis and evaluation (Bloom, 1984). According to (Pallapu, n.d.), design and developing of outcome-based course is a three step process: (i) Identify the outcomes; (ii) Decide the contents and teaching strategies; and (iii) Developing assessment based on the outcomes. Fu & Kwok (n.d.) state that "alignment of curriculum, learning and assessment plays a key role for the implementation of a coherent course". They add that "the Intended Learning Outcomes (ILOs) of the curriculum lead the assessment design as well as the relevant learning activities required" and "since the development of assessment tasks, criteria and rubrics are started with the ILOs, coherent assessment is expected".

Taylor & Harlow (2010) point out that learning outcome-based assessment can help identify how learning occurs within and across time. They add that ILOs and corresponding aligned assessment tasks and teaching activities are increasingly being used in order for students to achieve deeper levels of learning and understanding. Fu & Kwok (n.d.) link between assessment in applied learning and learning outcomes (knowledge, skills, values and attitudes). They highlight the challenge of Hong Kong Examination and Assessment Authority (HKEAA) in devising appropriate assessment instruments to measure the performance of students taking different Applied Learning (ApL) subjects. HKEAA developed a set of written descriptors for the 'attained' level that describes what a typical student of a particular ApL subject performing at this level is able to do. Performance descriptors drafted by HKEAA was linked to Learning Outcomes (LOs) through covering seven dimensions: knowledge and understanding; application of knowledge; generic skills; communication skills; subject-specific performance related to the context; values and attributes towards the related industry and self-understanding for further studies and career development (Fu & Kwok, n.d.). In his description of assignments and projects as assessment tools, Pallapu (n.d.) mentioned that assignments and projects can help in assessing student's ability to apply the knowledge acquired; analyze and solve problems; design, develop, and implement solutions. The assignment that is presented in the next experimental study complies typically with Pallapu's description.

EXPERIMENTAL STUDY

Experimental Study Methodology

In order to answer the research question and to achieve research objectives, an experimental assignment was designed in a way that assures covering at least three categories of the course ILOs. These ILOs were not mentioned to the students in the first version submitted to them. However, the structure of assessment tasks reflected those ILOs. The students Output of the first version were evaluated according to pre-weighted ILOs. The assignment was re-written after incorporating those ILOs with their relative weight of importance. The students were asked to re-submit the assignment again according to its second version. Inferential statistics methods were used to compare between the two results and to test research hypothesis.

The Assignment

The assignment that was used to test research hypothesis is structured around '*Trade-off*' in construction projects. As was clarified before, trade-off is an important decision making situation that faces Project Manger (PM) during the life cycle of construction projects. The first version of the assignment was designed in a form of systematic steps/tasks for students to follow. Following those steps properly assures achieving certain learning outcomes. Following is the first version of the assignment:

The three project factors (Performance/Quality – cost – time) are subject to a trade-off process.

1. *Explain the previous fact*

2. *Apply this fact to a selected real project in which a trade-off decision was made.*

3. *Criticize the decision that was made and suggest your own alternative trade-off decision*

4. *Present your assignment in a research format (size A4) containing (text – photos of the project – diagrams if applicable)*

Students were asked to demonstrate their understanding of "Trade-off" in construction project management, and to select a case study in which a clear trade-off decision was taken by the management team. Moreover, students were asked to conduct a critical analysis on the taken trade-off decision and suggest an alternative trade-off decision that can be taken.

After receiving students' submittals for the first version of the assignment, the tested course ILOs, with their relative weight was added to that version. The result was the second version which included the following ILOs. Table (1)

Table (1): Tested ILOs with their relative weight

ILO Category	ILO Code	ILO	Relative Weight (%)
Knowledge and Understanding Skills	A2	Understanding Trade-off in Construction Project Management	5
Thinking skills	C1	Decision Making	40
General and Transferable Skills	D1	Critical Thinking – Problem Solving	30
	D2	Analytical skills	15
	D3	Management skills	10
Total			100

The Experiment

The first version of the assignment was presented to 14 students. They were given 3 weeks to submit the assignment. During the first week of submission period, there was a follow-up for students' works in order to make sure that they have selected proper case studies. After receiving students' submittals, they were evaluated according to the weighted ILOs in table (1). The result was as shown in table (2)

The second version of the assignment was presented to the same 14 students with further two weeks period for submission. Students were asked to re-submit the assignment after putting into consideration the weighed tested ILOs shown in table (1). Students' second submittals were marked again. Two students didn't submit the assignment in the second round; those students were excluded from the experiment. The result are shown in table (3)

Table (2): Assignment's first version marking results

	Tested ILOs with their Relative Weight (%)					
	A2	C1	D1	D2	D3	Total
Student Number	**5 %**	**40%**	**30%**	**15%**	**10%**	**100%**
1	3	20	20	10	0	53
2	5	40	25	15	8	93
3	3	20	20	10	0	53
4	3	25	20	10	0	53

5	5	20	15	10	0	50
6	5	25	20	10	5	65
7	5	20	15	10	0	50
8	5	20	20	8	5	58
9	4	25	15	15	5	64
10	5	40	30	15	0	90
11	4	25	15	15	5	64
12	5	40	25	15	8	93
13	5	20	15	10	0	50
14	5	25	20	10	5	65

Table (3): Assignment's second version marking results

	Tested ILOs with their Relative Weight (%)					
	A2	C1	D1	D2	D3	Total
Student Number	5 %	40%	30%	15%	10%	100%
1	5	35	25	12	5	82
2	5	40	25	15	10	95
3	5	35	25	12	5	82
4	5	35	25	12	5	82
5	5	30	20	10	8	73
6	5	30	20	10	10	75
7	5	30	20	10	8	73
8	5	20	20	8	5	58
9	5	25	15	15	10	70
10	--	--	--	--	--	--
11	5	25	15	15	10	70
12	5	40	25	15	10	95
13	5	35	25	15	10	90
14	--	--	--	--	--	--

In order to test research hypothesis, the results shown in tables (2) and (3) need to be compared. The null hypothesis (H_0) will demonstrate that average of student's marks was not affected by adding weighted ILOs to the assignment (with a significance level $\alpha = 0.05$) i.e.

$H_0: \mu_1 = \mu_2$ (1)

Where: μ_1 is the average of students' marks in the first version; μ_2 is the average of students' marks in the second version

Because it is required to test whether students' submittals were affected positively in the assignment's second version or not, the alternative hypothesis (H_1) is a positive directional hypothesis i.e.

$H_1: \mu_2 > \mu_1$ (2)

The statistical parameter (t) is used to test the hypothesis. It is given by the equation:

$$t = \frac{\bar{D}}{S_D / \sqrt{n}} \quad (3)$$

Where: $\bar{D}$ is the average of differences between students' mark in the second version and their mark in the first version, S_D is the standard deviation of differences, n is the sample size.

Table (4) shows the difference between students' mark in both versions of the assignment. Variables of equation (3) are then calculated from the table as follows:

$$\bar{D} = \frac{199}{12} = 16.58 \text{ and } S_D = 13.11$$

From equation (3): $t = \frac{16.58}{13.11 / \sqrt{12}} = 4.38$

Table (4): Difference between students' mark in both assignment versions

Student Number	Marks (1st Version)	Marks (2nd Version)	Difference (D)
1	53	82	29
2	93	95	2
3	53	82	29
4	53	82	29
5	50	73	23
6	65	75	10
7	50	73	23
8	58	58	0
9	64	70	6
10	90	--	excluded
11	64	70	6
12	93	95	2
13	50	90	40

14	65	--	excluded
Total			199

Results, Discussion and Implications

As mentioned before, the alternative hypothesis (H_1) will be positive directional hypothesis and the test will be one-tailed test (right tail). In this case, from standard statistical tables, the critical value of "t" (with degrees of freedom = n-1=12-1=11 and a significance level α = 0.05) will be 1.790.

As the calculated "t" is greater than critical "t", the decision will be rejecting (H_0) and accepting (H_1) which yields that students' submittals were significantly affected positively in the assignment's second version. Fig. 1
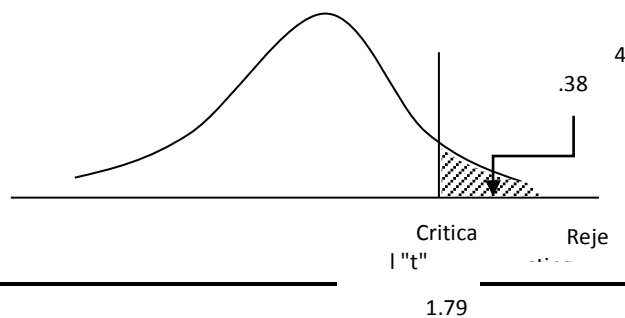

Fig. 1

Critical and calculated values of (t)

The experiment proved that students' marks in the second version of the assignment were significantly improved. It seems that adding ILOs with their relative weight helped students to tune their submittals by putting more emphasis on achieving Learning Outcomes (LOs) with higher weight. All students achieved higher marks in the second version of the assignment except one student whose mark remains the same. When investigating the GPA of that student, it was found that it is very low. It seems that he didn't care about improving his mark.

By comparing breakdown of students' marks in both versions of the assignment, it is easily found that knowledge and understanding skills mark was not affected significantly. However, both marks of thinking skills and general and transferable skills were improved significantly in students' submittals for the second version of the assignment.

The results of marking both versions of the assignment helped the instructor both in re-considering the relative importance of course ILOs, and in fine tuning some ILOs. Moreover, it helped the instructor in balancing tested ILOs in further assignments.

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

Conclusion

The educational shift from teaching approach to learning approach resulted in structuring academic programs and courses on pre-defined ILOs that cover wide range of skills such as: knowledge and understanding skills; subject-specific skills; intellectual skills and general and transferable skills. Assessment tools needed to be re-examined in order to test those ILOs effectively. It is found that transparency is an important factor in designing assessment instruments. Integrating tested course ILOs with their relative weight of importance improved students' response to the experimental study assignment. Students tuned their response to various assessment tasks in the assignment according to the weight of corresponding LOs.

Limitations

The experimental study covered by this paper has some limitations. Communication skills, which are normally tested through student's presentation of his submittals, were not included in the assignment. Instructor's feedback on the two versions of the assignment was given to students in a written form. Moreover, the feedback process was not highlighted in the paper in order to focus on the comparative analysis of students' final results in both versions of the assignment. Obviously, those areas of limitations can be covered in further experimental studies.

Recommendations and Future Studies

The following recommendations and directions for future studies are emerged from both theoretical background and practical part of the study:

−   Establishing central examinations and assessment authority that is responsible for the setting of performance standards, the guiding of assessment design, and the moderating of assessment results.

−   The instructor has to guide students to use the course concepts to acquire skills of critical thinking and problem-solving.

−   It is important to map assessment tasks with ILOs. The relative importance of ILOs is revealed by frequency and weighting of the assessment tasks concerned.

−   Devising instruments and indices that can be used to assess the quality of assessment design by testing the balanced coverage of cognitive requirements and generic skills through assessment tasks.

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