The Teaching Evaluation Model: A Web Application Framework

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Abstract. The paper proposes a model for the continuous improvement of academic teaching aimed at delivering a programmed excellent learning in perspective. The proposed Teaching Evaluation Model (TEM) is a dynamic and open system based on the Deming Cycle (PLAN-DO-CHECK-ACT). The objective pursued by the model is to match the expected learning with real learning. The results of this work are intended to highlight the field application of the TEM approach. Specifically, the application consists of a web-based tool conceived and designed to allow teachers and institutions to build a continuous improvement of the teaching and learning processes. By enhancing the interior design education and hence the profession itself, the model reveals that technology-enhanced assessment may deliver tangible benefits for learners, teachers and institutions.

Keywords: Learner-centered-teaching · PDCA cycle · Graphical User Interface · Technology-enhanced assessment

1 Introduction

The Teaching Evaluation Model (TEM) is a working method developed for teachers and aimed at reducing the gap between learning objectives (quality promised, ideal learning) and learning outcomes (real quality, real learning). The method is represented by the PLAN-DO-CHECK-ACT (PDCA) cycle conceived by W. Edwards Deming [3]. Therefore, the TEM approach is proposed as an integrated system of design, implementation, evaluation/self-evaluation and improvement in order to implement a university course evaluation system. The aim is to offer the teacher the possibility to act on real learning and work toward an ideal one, right when this process is being realized on the field, giving rise to a dynamic system. The TEM model is proposed also as an open system that "learns" through classroom exams. Thus, learning which results is then fed

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back to the teacher in the form of a sort of "guidelines for improvement". These guidelines are created when one or more teachers implement the model on the field. In this sense, in order to have a concrete possibility of operating in an effective way on training progress, the TEM approach has been developed in a software application (evaluation management system). The research contents of this paper are discussed in Sects. 3 and 4. Section 3 presents the TEM framework, its operational method, and its purposes. We emphasize how the TEM model has been transformed into an evaluation management system giving rise to an enforceable application. Section 4 introduces the first results of the work that are expressed highlighting the peculiarities of this management system, the advantages and limitations that distinguish it and its numerous potential further applications.

2 Theoretical Background

The TEM is part of a context of consolidated studies with a particular tradition in the North European and Australian studies [4, 8] in which teaching and learning are considered in close relation. In this sense, Biggs distinguishes three levels of thinking about teaching where the responsibility (success/failure) can be taken by students (first level), teachers (second level) or both (teaching and learning, third level) [1]. In the latter case, the author identifies the good teacher in the one who is able to stimulate learning activities and to lead students to become independent lifelong learners. In this line, the TEM proposes a novel approach to teaching in which teaching and learning are inseparable parts of a system of continuous improvement centered on learner and directed by the teacher. The TEM approach bases its operational logic on the Biggs's theory of the constructive alignment in outcomes-based teaching and learning [1]. Ultimately, teaching modalities and strategies as well as evaluation practices are aligned to education and training objectives. Therefore, a coincidence between what is taught, learned and assessed must be realized. On this basis, the TEM takes its steps towards the continuous improvement and enhancement of the educational processes in progress. The aim is to reduce the gap between "ideal learning" and "real learning". Thus, the TEM builds its bases on a continuous process of reflection and self-assessment [2] that integrates into a specific working model and leads to teachers' professional growth by stimulating their innovative behaviors. There is a plenty of studies focusing on the opportunities arising from processes of teachers' self-evaluation in the international literature [5, 7]. However, although an extensive discussion on the topic of self-evaluation has well-founded [6, 9], the international literature related to the teachers' self-evaluation and in the perspective of the teaching quality is very limited. In that regard, the TEM is placed in this particular research area. Far from being a complete answer and without limits, the proposed model offers the teacher the opportunity to observe and evaluate its own teaching and learning path, through a self-evaluation and self-training process that leads to the inescapable virtuous horizon of the continuous improvement.

3 The TEM Methodology

The TEM approach is a system that incorporates the PDCA phases. The subdivision in phases is presented in the following sub-sections.

3.1 The PLAN Phase

The first phase of the process of continuous improvement is embodied in the design of a specific course. The teacher divides the course into several modules, defining every learning goals in a specific designing pattern. Each module, in turn, consists of a number of classes (defined by the teacher). Initially, the teacher defines only the macro objectives to be achieved within the different modules - that at a later phase will be articulated into classes and related objectives. The PLAN phase includes the organization by the teacher of an entrance exam/test to be administered to students on the first class day. The model is centered on learners and their full satisfaction tending, therefore, to an excellent learning outcome and teaching experience. To this purpose, the PLAN phase must be based on competences (knowledge and skills) that students demonstrate at the beginning of each course. The aim is to make the course design effective and efficient, adapting "the production cycle" (training) to the "technical characteristics of the raw material to be processed" (students). In this sense, the items composing the exam should be defined for a perfect adherence to the objectives of the course modules. The entrance exam/test results will highlight the level of skills possessed by the learners at the beginning of the course. Compared to these skills, the results may show a homogeneity in the class of learners (upward or downward) or a heterogeneity. This information is necessary to achieve a design which is able to lead the educational process towards a high quality learning environment. These results will then be reported in the outline design scheme (see first column under Outcomes in Fig. 1). After having become aware of the learning level, and hence the learning needs, shown by the class (entrance exam) teachers have to:

1. Articulate the objectives of each module into sub-goals defined in terms of precise actions that learners have to be able to know and carry out at the end of each lesson;
2. Define the teaching strategies most appropriate to the level of knowledge/skills shown by the class (an effective method of identification of the teaching strategies is represented by the QFD) [10];
3. Organize the exam/test at the end of each module (one for each module of the course) in which each exam/test item (one or more) contributes to verify the achievement of a specific objective. The items are addressed to test the skills possessed by learners (defined in the learning objectives) at the end of the lectures – that compose the module under evaluation. There will be as many items as many specific objectives defined in each lectures composing each module. The scores of each item have to be predefined. The main goal is to foster the DO and CHECK phases.

Lectures		Objectives	Strategies			Outcomes			
module	lecture	specific educational objective	subject	methods	tools	entrance exam	end-of-module exam	improvement	end-of-course exam
1	1								
	2								
	3								
	4								

Fig. 1. The PLAN phase - Course design scheme to be filled by the teacher. Source: our own elaboration.

3.2 The DO Phase

The PLAN phase fosters the DO phase in which the teacher conducts lectures as planned, starting with the first module. After having doing her/his job, the teacher will go down in the delicate phase of the learning check.

3.3 The CHECK 1 Phase

At this stage, the teacher administers the students' end-of-module exam, designed in the PLAN phase and given to learners in the last lecture of each module. These results merge in the designing pattern of the course in the column of outcomes (end-of-module exam) indicating whether there was an effective learning and at what level. A critical threshold establishes the acceptable level of learning beneath which the second check phase has to start, that is the CHECK 2 (teacher's self-evaluation). Ultimately, the objectives not achieved in terms of "learning-awaited" (evaluation below the critical threshold) become the subject of a critical analysis to be carried out by the teacher, who will delve into the possible causes of this unattained learning (see CHECK 2 phase). The objectives not achieved may be more than one, regardless of their number, and they may indicate a problem with a specific educational objective (skill, knowledge or expertise) not acquired by the learner. The CHECK 1 phase ends with the identification of the objectives not achieved. This identification fosters the CHECK 2 phase. If all objectives are achieved, the teacher can continue the most ideal process skipping CHECK 2 and ACT phases.

3.4 The CHECK 2 Phase

Once the objective/s not achieved are identified in the CHECK 1 phase, teachers have to reflect on the possible causes which determined the failure in achieving the learning objective/s with a self-assessment questionnaire (CHECK 2) [10]. Two types of levels are included in the questionnaire. The first level is aimed at those novice teachers in the use of the TEM approach. The second one is aimed at those teachers who have already demonstrated their ability to effectively master the model, understanding the conditions required to design a course and/or to govern a classroom. In the latter case, teachers will

use a shorter but more technical version of the questionnaire. In the first level, two areas of analysis are highlighted: "what to do" and "how to do it". The teachers begin their search for the possible causes through a gradual widening of the first area of analysis investigating the PLAN phase (thing). The first level also includes "the identification of the right things to do". The teachers are encouraged to reflect on some aspects: learners' knowledge/skills, learning objectives, topics included in each class and definition of the teaching strategies. In this kind of analysis, the teachers have to trace out the fundamentals of the course design and assessing if they were properly defined. The self-assessment questionnaire, therefore, offers the teacher a gradual analysis of the key aspects of the course design where each "point of deepening" allows the teacher to show or to discard the possible causes of the problems encountered by the learners. In the second area of analysis, the teacher proceeds in the same way, but focusing on the "how". The latter sticks to "do well the right things". Indeed, it is not enough to identify "the right thing to do", it is necessary to do them well. And how to do them well? The points highlighted in the questionnaire suggest to the teacher some critical aspects to be carefully considered during the lectures. The objectives to be achieved are at stake. The problem may lie in the ability to master the methods and/or educational tools and/or methods of presentation of a lecture. Ultimately, the teacher could have defined the best teaching strategies (combination of methods, tools and scheduling) mastering them in the best possible manner. At the same time, the teacher could have not considered how her/his communication and presentation skills and the quality of relationships may affect students' learning. Even in this case, each "in-depth study point" allows the teacher to highlight or discard the possible causes of the problems emerged during the CHECK 1 phase. The self-assessment questionnaire allows the teacher to evaluate both the aspects defined in the PLAN phase (objectives, topics, educational strategies – section titled "thing" in the questionnaire) and those that cannot be defined in that phase as relating to the teacher's skills and expressed during the DO phase – section titled "how" in the questionnaire. Subsequently, the entire CHECK phase allows the teacher to reflect on aspects that s/he may have considered irrelevant or predictable as well simply never considered and that can enrich the teacher's experience and training in a continuous virtuous improvement (self-training). In this sense, the teacher performs a process of analysis, evaluation and selection of the possible causes of the problems encountered by the students (self-assessment, CHECK 2) that boosts the significance of the next ACT phase. The second level of the questionnaire provides a much more streamlined and technical workflow mainly focused on how the teaching strategies have been implemented. In both cases, first and second level, the analysis requires that the teacher recognizes the possible cause/s (more likely occurred in the failure of one or more learning educational objectives) and highlights it/them in the designing scheme and, in particular, within the section dedicated to the improvement, in the corresponding line/s of the target/s not achieved. The ACT phase is going to start.

3.5 The ACT Phase

The teacher after having identified the possible causes of the problems encountered by the students (CHECK 2 phase) defines the actions to be taken to overcome the

problems identified so that to achieve the learning objective/s unattained. More specifically, in the line/s that show/s the objectives not achieved – in which the teacher has reported the points highlighted in the self-assessment questionnaire – the teacher writes the corrective actions to be implemented in the next course module (see column improvement under Outcomes in Fig. 1). These corrective actions are defined by the teacher on the basis of her/his reflections made in the CHECK 2 phase. Ultimately, the teacher has to redesign the modalities for pursuing the unattained objectives, to be experienced in the next module - with specific lectures. These corrective actions will, therefore, integrate one or more classes of the next course module. In this way, the ACT phase has been completed.

At this point, the PDCA cycle will be repeated again with the implementation of the lectures of the new course module (DO phase). At the end of this new module, the CHECK 1 phase will allow the teacher to check if all the educational objectives of the module have been achieved, in particular those including the "corrective actions". If one or more objectives previously not achieved still persist in the module, the teacher will proceed in the manner illustrated in the PDCA cycle. With regard to the case of objectives subject to corrective actions, if the exam shows the achievement of an acceptable level of learning (threshold exceeded), the line corresponding to these objectives will be highlighted with a specific color (green). This color highlights a best practice that will be reported in the self-assessment questionnaire (for example) if the end-of-course exam will confirm a positive outcome. The purpose is to foster the self-assessment questionnaire only by standardizing the best practices resulting from the application of the TEM in an ongoing course. The best teachers' experiences will be gathered in the self-assessment questionnaire (in terms of the example of "good practice"). The questionnaire is now taking its most important functions: to organize, manage and share knowledge and skills (best practices) with the users of the model - teachers [10]. In this sense, the self-assessment questionnaire is an instrument of self-training, a sort of "guidelines" that leads the teacher in the process of continuous teaching improvement: "ideal learning" towards "real learning". The PDCA cycle will be concluded at the end of the last module of the course. At this point, the teacher will administer a final test (end-of-course exam) to verify the achievement of the main objectives of all the modules. The results thus obtained will enable the teacher to assess their own teaching, particularly in terms of effective learning by students. From the teacher's point of view, the TEM emphasizes the difference between "ideal and real" learning, constituting a starting point not a finishing point. In this sense, a last CHECK phase, will be implemented by the teacher in order to change the overall design of the course for the new academic semester, if necessary.

4 A Web Application Framework

The structure of the TEM approach can be easily implemented by the HTML, PHP and MySQL programming languages giving teachers an user-friendly application to project their educational activity. On the one hand, as it is well known, the HTML and PHP codes are a programming languages to build dynamics web pages where users interact and make decisions. The HTML code is the standard language to create visually web

pages, while the PHP code is an object-oriented language particular useful in building Graphical User Interfaces (GUIs). The GUI allows users to interact with computer devices and are now a cornerstone in developing modern teaching methods and strengthening the learning process as a whole. On the other hand, MySQL is an open-source relational database management system that works together with the PHP code and stores knowledge (data) created by users who make their decisions in the GUI. To this end, we have built a GUI to let the TEM framework feasible and usable to any teacher (users) interested to improve the evaluation of their teaching courses. In what follow, we briefly highlights basic mechanisms on the functioning of the GUI we conceived and developed:

1. Any teacher points her/his browser to the URL http://erre.unich.it/ees/teacheval and has to fulfil the registration form before using the GUI;
2. The application is now ready to use. Figure 2 shows the possibility of managing the teaching plan according to the TEM approach. At this stage the teacher choices objectives of her/his lectures and then s/he edits the teaching plan by pressing the virtual button dedicated to this function. The teacher follows the PDCA process as shown in Sect. 3 (TEM methodology) and, therefore, s/he sets up the number of modules and lectures. S/he specifies her/his teaching strategy (topic, method and tool). Finally, s/he has to insert the outcomes. The outcomes are at the heart of the teacher self-evaluation. The teacher finds the solution to the problem/s emerged when learners do not reach the minimum threshold of learning.

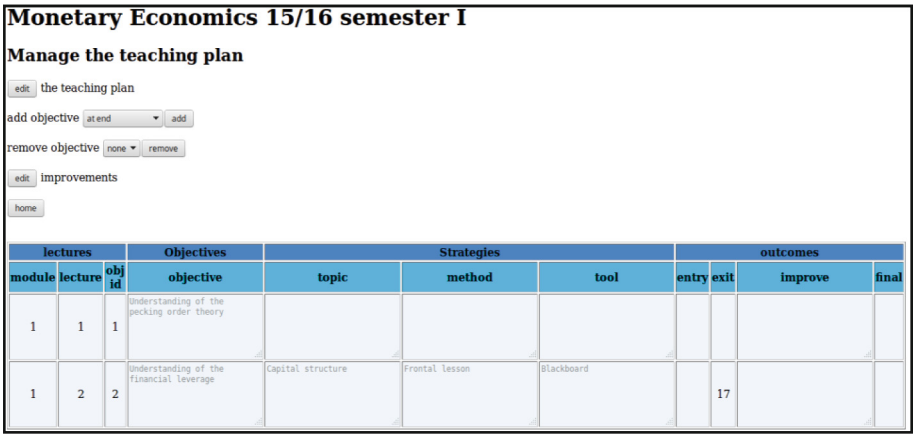

Fig. 2. The web page for managing the teaching plan (*e.g.* the course of Monetary Economics). Source: our own elaboration.

3. Suppose that the class has not reached the standard requirement: in this case, the teacher has to press the button to edit improvements, and the application goes to the improvement page as shown in Fig. 3. Here, the teacher has to press the edit button and the application jumps to the self-evaluation page where the teacher is guided by an evaluation survey list in order to check off the selected item that s/he believes can

be helpful to improve the students' performances. The self evaluation points identified by the teacher are given in the checkbox "improve" where the new teaching strategy shall be specified. The teacher will use the selected strategy in the next module in order to overcome the problem emerged.

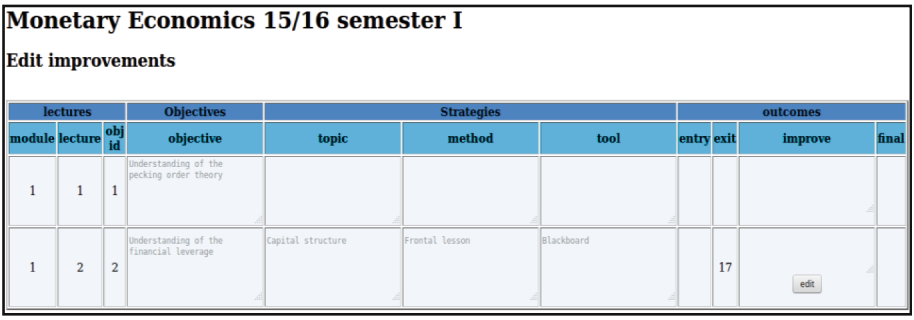

Fig. 3. The web page for improving the teaching plan (*e.g.* the course of Monetary Economics). Source: our own elaboration.

5 Concluding Remarks

The TEM approach is a novel method to think, plan, manage and evaluate the university teaching process in view of the continuous improvement of education and training. The benefits are numerous and may be more useful for more subjects: learners, teachers, and institutions. Although the TEM approach is not exempt from limitations, it may offer a new approach to raise awareness of how to work towards learner-centered practices, whilst managing major educational change. Indeed, the authors of this paper are currently administering a pilot program in the University of Chieti-Pescara (Italy) working on developing a standard and guidelines for an international accreditation procedure.

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