The production of learning objects and the activity of facilitating learning: an hypothesis of cost quantification

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Abstract

In this paper we developed a model for better understanding the ratio between costs, production of didactic material and activity of monitoring and facilitating learning processes. The perspective adopted is that of a public body (the Autonomous Province of Trento) which is investing a great deal in e-learning. In these circumstances it has been noticed that e-learning poses a series of questions concerning the costs/compensation of the resources involved.

A traditional cost model based on the hourly pay of teachers and tutors implies two risks: on the one hand, to consider e-learning activities comparatively inexpensive to traditional training; on the other hand, to undervalue the role of the actors involved in the e-learning process, despite the continuous contribution they must give to support effective learning.

In fact, in the learning process it is necessary to alternate individual assignments with other activities to favour reflection, in depth-examination, clarification and also personalized feedback. This is possible thanks to e-learning tools.

1 Introduction

In order to choose the most suitable training approach to be employed, organizations calculate a series of factors such as costs, duration, quality of learning and customer satisfaction. One of the elements resulting more difficult to define and measure is related to e-learning costs. Economies of scale are often cited as being one of the drivers of e-learning implementation (Morris, 2007). For these reasons, when the number of participants increases, it results that e-learning is less expensive compared to the residential editions of the same course (Rumble, 2001). Another phenomenon usually coexisting with economies of scale is economies of scope, which bring to cost savings because of sharing inputs, knowledge and processes of different courses (Morris, 2007).

The paper presents the activity carried out within the project "Elle3 - Life Long Learning" which continues another experiment started in 2008 with the project ESPERTO "E-learning for the development of e-procurement of the Trentino". This introduced e-learning into the local public environment sharing out technology and best practices (Casagranda *et al* 2008). The Elle 3 project running at the Department of Innovation, Research & ICT of the Autonomous Province of Trento (PAT) aims to develop an integrated environment to design, manage and broaden learning resources. As a result, the PAT needs to adopt quickly a model to evaluate the cost effectiveness and the return of investment of e-learning projects.

The paper focuses on e-learning costs; in particular it pays attention to the economic components originating from activities of didactic materials production and support/facilitating activities during the learning process. The choice to concentrate on specific phases depends on a request of PAT, which wishes to reflect critically in order to create references for future e-learning activities.

In paragraph 5 we will present a prototype with a list of factors that PAT means to examine. This prototype aims at accomplishing the requirements of simplicity in the calculation of costs, considered the wide range of training courses and the different actors involved. The model is conceived on the basis of our direct experience and in particular it has been applied to and verified with two different learning initiatives. These initiatives have been selected according to the following criteria: the creation of more than one edition of the same course; the possibility to have the same teacher in all the editions of the same course; the creation of a certain level of homogeneity among class groups for what concerns number of participants and previous knowledge.

The choice has fallen on two streams of course: the former related to computer science (Introduction to Excel), the latter about safety at work (Safety on buildings sites).

2 Comparison between the residential and the blended editions

The comparison between the residential and the blended editions emphasized the andragogic-technological mix of each type of course. This brings to the formative effectiveness of the course, taking into consideration the ratio between costs and learning.

This latter dimension is about to be defined and only at the end of Elle3 project (2011) it will be finalized.

During 2010 other training programs will be selected from the provincial catalogue and this should make it possible to verify the present model of costs with various types of training contents.

As in the case of the courses previously experimented, the course activity will be preceded by an ad hoc training session for the teachers. This will bring several advantages: first of all, the sharing within a larger community of aspects on didactics and planning linked to e-learning and especially methodologies aimed at enhancing training and continuous self-training; second, the consideration of the calculation of production costs for the didactic material.

The model here presented is, therefore, to be considered the outcome of a continuous approximation in this phase of the work. Moreover, the model is "context specific", which means, up to now, not directly applicable to different environments. But it certainly is a possible basis for discussions.

3 Didactic models of reference

Training activities have multiple variants which make to impossible to immediately comprehend the main characteristics of each. The concept of model could help us to organize and coordinate the various phases of a process for the request, offer, choice and operative planning of a training activity. For this reason, as a starting point, we have used and adopted two models:

1. model CLEAAB 16 (Boccolini e Perich, 2004) (Bacsich & Ash, 1999) (Bacsich & Ash, 2001), to describe the process of phases and activities that characterize the planning of a blended training path, considering some of the macro activities scheduled in the model (preparation of material resources and implementation);

2. the study of G. Battaglia (Battaglia *et al*., 2008), suggesting the identification of various models through a three dimensional matrix and a descriptive list of the main characteristics of the components of the training product, has been used for the selection of the four didactic models of reference. The matrix representation of the models is then developed considering three dimensions:

- type of the main didactic objectives: knowledge, knowing how to do, knowing how to decide/act;

- importance of the vertical interactions according to the principle of authority of the teacher, distinguishing the role of the moderator, facilitator and main figure of reference for the path; the model has been integrated by introducing also the figure of the tutor who generates a further vertical interaction with the role of moderator, facilitator of collaboration processes or teaching assistant;
- relevance of the horizontal interaction according to the principle of collaboration and comparison on a scale that goes from collective learning to individual learning.

The combination of the three dimensions generates a "training space" in which it is possible to identify twelve training models. Among them, four represent relatively "pure" models and are, therefore, generally applicable: the didactic model oriented toward knowledge; the didactic model focused on method; the didactic model focused on ability; the didactic model interested in guaranteeing competence.

The collocation of a specific training course within a training model supports and "justifies" the identification of the roles of teacher and tutor, as well as the choice of instruments coherent with the didactic objectives and the vertical interaction, from the planning phase to the phase of realization and it offers a starting point for the estimation of costs (in particular for the phase which aims at facilitating the learning process).

For instance, we see that the Excel course is focused on method. The training objective is indeed that of "knowing how to do", while the vertical interaction is strong since the teacher represents the main point of reference and the horizontal one is weak because the learning process is mainly individual.

The course on "Safety on the building site" follows a format focused on ability where the teacher is the main point of reference but horizontal interaction is strong and often based on exchange. Here the objective is to know how to do something, that is to know how to apply regulations learnt during the training course, and the goal is reached through both individual study and collaborative work.

4 E-learning and figures of reference

Tutors and teachers represent the main figures that are able to create an interactive and collaborative environment in an e-learning context. Therefore, the model presented aims at evaluating an appropriate economic compensation in the implementation of the didactic phase and production of learning objects (LO), in order to allow a legitimization of the competences and to contribute to the motivation toward e -learning.

To clarify the role of the tutor and the teacher here follows a list of their

key competences (Tab. 1).

TABLE 1

Roles and competences of the reference figures during the test phase

Figures involved	Key competences
Tutor	• during planning and implementation, he/she provides methodological assistance helping to evaluate learning objectives and efficiency of methodologies/ activities. He/she also promotes interaction between residential learning and e-learning; • he/she trains teachers and participants to use and explore the potential of the e-learning platform; • offers technological assistance during the whole course; • offers technological assistance to the teacher in constructing the learning objects (Bruschi and Perissinotto, 2003) (Giacomantonio, 2007); • knows the questions linked to accessibility and standardization of LO;
Teacher	• he/she uses e-learning instruments and authoring software (after ad hoc training) • he/she manages, if the objectives make it necessary, the dynamics of cooperation. He/she also facilitates in depth-examination and self-training involving the participants (Trentin, 2004).

5 Estimate of the engagement for teacher and tutor

The planning of the training activity represents the starting point to define the compensations of teachers and tutors. Training model typology, didactic objectives, various combinations of classroom and e-learning and other components of planning make it possible to fix compensations for activities of production of didactic material and activities of support/facilitation.

For each type of model and for some classroom/e-learning combinations, we have defined maximum levels (as percentages) of acknowledgement for activities of on-line support/facilitation (Tab 2). The table has been created on the basis of the two experiments cited above, making estimations and then verifying the accuracy of the model. The increase of the overall percentage is directly related to the rise of the e-learning percentage within a certain formative course. Moreover, given the importance of on-line facilitation activities, percentages are higher in formative models based on competences. It has to be noticed that the model was conceived for a context where the target had limited previous knowledge on e-learning and almost no knowledge about network cooperation.

TABLE 2

Percentage of maximum hours acknowledged per teacher and tutor for e-learning activities

% in class-room	% in e-lear-ning	Competences		Ability		Method		knowledge	
			Tutor	Teacher	Tutor	Teacher	Tutor	Teacher	Tutor
100	0	///	///	///	///	///	///	///	///
70	30	5%	4%	4%	3%	3%	3%	2%	2%
50	50	6%	5%	5%	4%	4%	4%	3%	3%
30	70	7%	6%	6%	5%	5%	5%	4%	4%
0	100	8%	7%	7%	6%	6%	6%	5%	5%

For estimating the time employed by the teacher to construct the LO, we have identified a matrix. A numeric value is assigned to each of the nine cells and this number will be the multiplier for the expected duration of material use (Fig. 1).
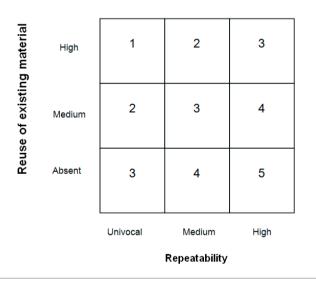

Fig. 1 Matrix for calculating the multiplying factor for the LO construction

On the vertical axis, the matrix displays the possibility to reuse existing material or material used for developing the LO; It is represented on a scale of the type of absent - medium (needs transformation or re-adaptation) – high (only slight changes or updating are needed) and, therefore, the higher the value, the less time will be needed by the teacher for the preparation of the didactic objects.

Instead, on the horizontal axis we indicate repeatability, meaning the possi-

bility to be able to reuse the same LO for other training courses or other users. Literature distinguishes between use, reuse and re-proposal of learning objects (Huddlestone & Pike, 2005). The scale is based on three parameters (univocal – medium – high) and is inversely proportional to the previous one: the higher this value, the larger the multiplier, because it will be possible to reuse the same material for more editions and participants, and, therefore costs will be amortized. In order to identify the degree of repeatability in this training context, we rely upon an estimate of the number of scheduled editions and of the number of possible users. We substantiate our hypothesis through the analysis of a large number of historical courses held at PAT, verifying the distribution of frequency of participants in similar training courses areas.

TABLE 3
Training courses in the last two years according to number of participants

	Less than 40		Between 40 and 100		More than 100		Total	
	2007	2008	2007	2008	2007	2008	2007	2008
Legal area	2	0	1	3	3	4	6	7
Economic Area	8	0	0	2	0	2	8	4
Organizational Area	1	1	0	0	3	4	4	5
Safety Area	8	9	4	5	11	8	23	22
Linguistic Area	21	21	0	0	0	0	21	21
Computer science	3	7	5	8	2	0	10	15
Technical Area	1	2	2	4	0	1	3	7
Total	44	40	12	22	19	19	75	81

The hypothesis emerging from the analysis made during the last years of training activity is the following: univocal, inferior to 40 participants; medium, from 40 to 100 participants; high, more than 100 participants.

At the moment, an experimentation and an application on various training types is being carried out in order to be able to evaluate the validity of the first hypothesis and to identify possible updating of the parameters so far identified.

6 Applicative Example

In conclusion, we introduce an extract of the experimentation carried out within the project, reporting the collocation in the model introduced, both in

terms of didactic format and as calculation of the LO production for a specific module (Tab. 4). On the basis of the didactic projection and the didactic model identified, we have defined the maximum hours acknowledged for teacher and tutor for their support activity to participants during distance training. The calculation of the hours includes the number of the course participants.

To calculate the LO production costs we used the basis of the previously described model:

- in section A, representing a brief description of the architecture of the training path, we highlight the calculation of the maximum hours acknowledged to the teacher and the tutor for managing the e-learning instruments and processes (in this case, management of forums, wikis, supervision of the group work activity in the learning community);
- in section B, we describe in detail one module of the path, with relative objectives and instruments;
- in section C, keeping in mind both the level of reuse and the repeatability of materials, we have calculated the maximum hours acknowledged to the teacher for the production of didactic material. In the LO introduced, the level of reuse has been defined medium (the teacher has developed materials starting from an existing basis) and the repeatability high (the course contemplates several editions in the same training year for a total of about two hundred participants): the result is that for 1h and 15' of online use by the participant, 5 hours have been acknowledged for the preparation of materials.

TABELLA 4

Example of part of the projection of the course Safety on building site experimented in Elle3

SECTION A	
Title of Path: SAFETY ON BUILDING SITES	
Duration of training course	35 hours
Type of didactic model	Aimed at ability
Number of participants	23 people
Type of approach	Blended: classroom hours 23 e-learning hours 12 (for each single participant)
Maximum hours acknowledged per teacher for e-learning activities	32 hours(resulting from 35*0,04*23 – see Tab. 2)
Maximum hours acknowledged per tutor for e-learning activities	24 hours (resulting from 35*0,03*23 - see Tab. 2)
SECTION B	
Title of Module: D.U.V.R.I.	
Duration	Hours: 1

Type of administration	e-learning		
Training goals in terms of objectives at the end of module): knowledge / ability / competence	Objectives: knowing the main D.U.V.R.I. elements		
Tests	Learning tests		
Instruments employed	Video-cast, discussion forum, on-line questionnaire		
SECTION C			
Material for supporting the didactics of the module			
Type of material	Reuse of existing material / Repeatability (multiplier)	Total time of employment by users	Hours acknowledged for the construction of material
Didactic material: video-cast	4 (medium reuse / high repeatability – see Fig.1)	1 hour	4 hour
Test: questionnaire	4 (see Fig. 1)	15 minutes	1 hour
Total hours acknowledged per teacher			5 hour

Conclusions

In a context like PAT, the use of learning technologies aims to make more efficient and more effective the learning environment within the public sector, objective also supported thanks to economies of scale and scope.

The learning environment that Elle 3 project aims to create, enables to obtain advantages derived from sharing knowledge, methodological innovations and reuse of didactic multimedia materials (Morris, 2007). This is particularly true in a context where the objective is to create a "cross knowledge base" (within the same area and among different areas) and the target differs in its specific features and aspects. The request to offer more personalized courses and in accordance to specific training needs of professional communities can be met thanks to the combination of existing LO or the production of new LO without having to redesign the whole learning activity. On the other hand, the collaborative training approach supported by the key figures of the process will help to stimulate the exchange and sharing of knowledge and methods.

The applied cost models, in most cases pass from the idea of remuneration for "the whole package" to a simple hourly pay for the hours provided in e-learning. However, these approaches risk to demotivate teachers and tutors in respect to those activities necessary for the final outcome of the training course, but rarely included in the retribution. The web 2.0, the social and collaborative

paradigm and its role in the e-learning world with its workload for teachers and tutors has emphasized this problem.

The core of the cost model is represented by the two main figures supporting the learning process. This model presents several advantages:

- clarity in calculating the acknowledged hours since the planning phase
- comparability of costs in respect to similar course editions or in terms of contents or didactic methodology
- estimation of costs in the yearly budget phase
- acknowledgement of the fact that learning activities and transfer of learning are facilitated.

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