Cost-effectiveness analysis applied to a blended-learning-model

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Abstract

This paper describes briefly an attempt to evaluate the cost-effectiveness of the blended-learning-model characterizing the project OpenCampus. It was not possible to follow the methodology accepted by the main literature because of a lack of accessible cost data. For this reason a perceived cost-effectiveness ratio was estimated.

Keywords: blended-learning, OpenCampus, cost, effectiveness.

1. Introduction

This study intends to examine the applicability of the cost-effectiveness analysis to the project OpenCampus implemented in 2005 by the State School of Applied Computer Sciences and Economics (SSIG), a vocational 3-year advanced school in Bellinzona, Switzerland.

The OpenCampus project aims at introducing a modality of teaching/learning centred on the Blended-Learning-Model (BL) for some subjects in the two different curricula (full-time vs *en emploi*) offered by this school[2]. The stakeholders of this project are the teachers, the school's board and the students, but this paper takes only the students' perspective.

The actors directly involved in the project are mainly 14 teachers out of 23 engaged with the BL training offer[3] and approximately 100 students from the 1st, 2nd and 3rd years.

In this paper we intend to present a preview of the methodology and main findings of our analysis. The results are based on an *ad hoc* questionnaire distributed to the students at the end of the 1st semester 2008. The results of the 2nd semester 2007 questionnaire were used only in a few cases.

2. Methodology

We assimilate the educational process to a productive one. Therefore, our analysis is characterized by three different dimensions:

1. Outcomes: perceived learning effectiveness and quality of life of the OpenCampus BL model (compared to the traditional classroom model);
2. Process: quality of teaching and of didactic materials (still under study);
3. Input: perceived time dedicated by the students to study and/or to reach the school.

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[2] Some more details about the project are available in Cattaneo (2007).

[3] All the 23 teachers are asked to reach a minimum number of objectives concerning the use of the online learning environment, even if not teaching at distance.

With regard to the outcomes, we developed a specific "effectiveness index" on the basis of the definition of the term "effectiveness", i.e. the capability to reach, trough certain activities, a given target.

In the questionnaires distributed to the students there are few questions that aim at comparing the change, and its direction, induced by the BL model used in the OpenCampus project with the traditional face-to-face model. The answers can vary from the maximum positive change ("much better", with a statistical weight of 5) to the maximum negative change ("much worse", with a statistical weight of 1) passing through the *status quo* situation ("the same", with a statistical weight of 3). Our effectiveness index considers the status quo as the starting situation and the maximum improvement as the target situation.

The index is equal to the ratio between the observed change (the answer given by the student – statistical weight equal to X – and the status quo situation – statistical weight equal to 3) and the desired change (the difference between the maximum improvement – statistical weight equal to 5 – and the status quo situation – statistical weight equal to 3):

$$E = \frac{X - 3}{5 - 3}$$

This index varies between -1, maximum ineffectiveness, and +1, maximum effectiveness; if it is equal to 0 then the BL model is as effective as the traditional classroom model.

At the end of the questionnaire there is a section which aims at collecting information about the level of satisfaction expressed by the students on this BL experience. Considering the fact that to express an opinion it is necessary to weigh the positive and the negative aspects, we believe that the level of satisfaction is a good proxy for the cost-effectiveness ratio of this BL experience as perceived by the students.

3. Results

3.1. Outcomes: perceived effectiveness

4. In comparison to the traditional face to face model, with this BL model (face to face + distance lectures)	
4.1 the teaching effectiveness is 4.2 the teaching quality is 4.3: the quality of the didactic materials is 4.4: the teachers' didactic competences are	*much better (value 5)* *better* *the same* *worse* *much worse (value 1)*

Table 1. Questions concerning the perceived effectiveness

On average, the students, independently of the year of inscription, perceive the BL model at least as effective as the traditional face-to-face model, even if the average effectiveness perceived by the 2nd and 3rd year students is lower than the one perceived by the 1st year students (Table 2).

	Question	Average	Min	Max
1st year students	4.1	3,6	2	5
	4.2	3,4	1	5
	4.3	4,9	3	5
	4.4	3,8	1	5
2nd-3rd year students	4.1	3,2	2	4
	4.2	3,1	1	5
	4.3	3,3	2	5
	4.4	3,3	2	5

Table 2. Perceived effectiveness: average, min. and max. score.

This has an impact on the effectiveness index that is higher for the 1st year students (on average equal to 20%) than for the 2nd year students (on average equal to 10%) (Table 3).

	Question	Effectiveness index
1st year students	4.1	0,28
	4.2	0,21
	4.3	0,44
	4.4	0,39
2nd-3rd year students	4.1	0,11
	4.2	0,04
	4.3	0,16
	4.4	0,11

Table 3. Perceived effectiveness: effectiveness index values

These results indicate that OpenCampus had a higher positive impact for the 1st year students than for the 2nd and 3rd year students on the aspects analyzed by questions 4.1-4.4. A *t-test* confirmed the existence of a difference in perception between 1st year students and 2nd and 3rd year students.

3.2. Outcomes: perceived quality of students' life

6.The quality of students life regarding	
6.3 the possibility to interact with the teacher and with the other students is 6.4 the workload, in comparison to the traditional classroom model, is 6.5 the digital transposition of the contents (didactic materials) is 6.6 the quality of the interactions with the teacher is	*much better (value 5)* *better* *the same* *worse* *much worse (value 1)*

Table 4. Questions concerning the quality of students' life

The students enrolled the 1st year seem to perceive an improvement, even significant, in the quality of their life compared to the one that they could have had with a traditional classroom model. Because this aspect was not present in the 2008 questionnaire (1st semester) for the 2nd and 3rd year students, we made use of the answers provided in the 2007 questionnaire (2nd semester) by the 2nd year students. The answers given are two-fold: on the one hand, there is an improvement with regard to the digital transposition of the didactic materials but also a deterioration of student-teacher interaction and workload (Table 5).

	Question	Average	Min	Max
1st year students	6.3	3,6	1	5
	6.4	3,2	2	5
	6.5	3,8	3	5
	6.6	3,5	2	5
2nd-year students (2nd sem.2007)	6.3	3,0	1	5
	6.4	2,6	1	5
	6.5	3,4	1	5
	6.6	2,9	1	5

Table 5. Perceived quality of student's life: average, min. and max. score.

Comparing the answers given by the two groups yields a more significant improvement of the life quality of 1st year students. The effectiveness index confirms this result (Table 6).

	Question	Effectiveness index
1st year students	6.3	0,30
	6.4	0,12
	6.5	0,40
	6.6	0,24
2nd-3rd year students	6.3	-0,01
	6.4	-0,22
	6.5	0,20
	6.6	-0,06

Table 6. Perceived quality of students' life: effectiveness index

The deterioration of the quality of life endured by 2nd year students is however not surprising given the fact that the 2nd year program is the toughest of the entire *cursus studiorum* offered by the SSIG.

3.3. Input: time

7. Is the time of learning required by 1 hour of lecture at a distance equivalent to the time of learning required by 1 hour of face-to-face lecture?	*Si* *No, it's lower* *No, it's higher*

Table 7. Question concerning the learning time

The project OpenCampus seems to have a different impact on the time of learning for the 1st year students than for the 2nd-3rd year students. Whereas most 1st year students state that the learning time for 1 hour of lecture at a distance is equivalent or lower to the learning time for 1 hour of face-to-face lecture (56%), almost all the students of the 2nd and 3rd year state that 1 hour of lecture at a distance requires a higher learning time than 1 hour of face-to-face lecture (84%). These answers do not allow us to conclude that the BL is more *time consuming* than the traditional face-to-face lectures.

However, the results of questions 6.1 and 6.2 also show that the BL facilitates a better management of time by the students. Almost all the students state that the they can "much better" or "better" decide when and where to study (83,7% of the 1st year students and 65% of the 2nd year students) or the time to dedicate at each lecture topic (88,4% of the 1st year student and 62,5% of the 2nd year student).

Hence, the results of the time analysis contrast when considering both the learning and study time so we can not conclude, at least with regard to the 2nd year students, that the project OpenCampus had a net positive impact on time and, as a consequence, on the costs related to this aspect.

3.4. Students' satisfaction

16. On a scale from 1 to 10:	
16.1 How much do you want this experience to continue in the future?	*1-10*
16.2 How much do you agree with the sentence "don't stop it but improve it"?	
17.What is your overall opinion about this BL experience?	*Very good (value 5)* *Good* *Not good not bad* *Bad* *Very bed (value 1)*

Table 8. Students' satisfaction questions

As announced in the introduction, the main objective of this paper is to analyze the costs and the effectiveness of the project OpenCampus taking the students' perspective. Doing that, we encountered the common cost data access problem to the application of traditional cost-

effectiveness ratios (Rice, 1997; Levin and McEwan, 2002)[4]. Hence, we make use of the students' level of satisfaction, captured by the questions in table 8, as a proxy of the cost-effectiveness ratio. Table 9 describes the average, the min. and the max. score of the answers to these questions.

		1st year students			2nd-3rd year students		
		Av.	**Min.**	**Max.**	**Av.**	**Min.**	**Max.**
16.1	On a scale from 1 to 10	8,5	5	10	8,2	1	10
16.2		9,2	5	10	9,2	1	10
17	On a scale from 1 to 5	4	1	5	3,9	2	5

Table 9. Students' satisfaction questions: average, min. and max. score.

Given the fact that the level of satisfaction expressed by the students is rather high we can conclude that this BL experience produces a perceived net benefit. In other words, the OpenCampus project has been perceived as a cost-effective experience (even if the 2nd year students state that it is still possible to improve it).

4. Conclusions

As a first conclusion reachable with the few data here reported, we can briefly summarize as follows:

- it was not possible to follow the methodology accepted by the main literature (e.g., Levin and Mc Ewan, 2001; Muenning, 2002; Rossi et al., 2004) because of a lack of accessible cost data;
- for this reason a perceived cost-effectiveness ratio was estimated;
- the use of a perceived cost-effectiveness index could help to overcome the data collection problems characterizing almost all the cost-effectiveness analyses.

Further analysis and new data collections will allow us to deepen much more the problem, and eventually to reflect on the cost-effectiveness method presented.

[4] This problem is also the consequence of a missing parameter in the questionnaire: we asked to the students if the time of study required 1 hour of BL lecture is the same/higher/lower as the one required by 1 hour of face-to-face lecture. But we did not asked them to quantify the eventual time variation.

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