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**Active Learning as Source of Continuous
Innovation in Courses**

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**ACTIVE LEARNING AS SOURCE OF CONTINUOUS
INNOVATION IN COURSES**

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Abstract

This paper presents a model to expand the positive effects of active learning to the process of continuously assessing and improving a course. Main practical and theoretical foundations, as well as recent results of the model, are exposed.

Keywords

Active learning, Assessment, Innovation, Radical constructivism.

Summary of the session:

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TITLE: Active learning as source of continuous innovation in courses.

OBJECTIVE OF THE PROPOSAL: Generate a debate about the relationship between active learning and the process of continuously improving course's design.

QUESTIONS: 1) Do students get more active if the task of introducing innovations in the course is included as part of their obligations as students?

REFLECTION ON THE QUESTION: We propose that students have much more "energy" available than what teachers usually estimate and utilize. Our experience is that, if students get involved not only with learning as an individual experience but also with improving the course as a communitarian task, passion, commitment and learning all increase at the same time.

I. Introduction

A frequent mistake in introductory courses to engineering is to underestimate the willingness and capacity of students to behave as engineers from the beginning of their studies (Nesbit et al., 2005).

Most active learning approaches and techniques focus on the attempt to increase student's involvement with learning. In a sense, active learning is seen as a question of increasing "student's energy" available and applicable to learning.

In the "Introduction to Industrial Engineering" at the University of Chile, based on a Radical Constructivist Approach (RCA), a Continuous Innovation Model (CIM) has been developed, based on the premise that students can be, simultaneously, continuously and synergistically, active learners and active evaluators and designers of the course.

The thesis is that when "student's energy" is directed towards these two objectives at the same time a synergetic effect is produced. When students realize their power to actively participate in creating a better course for them, they learn more, get into an entrepreneurial mood and a virtuous circle is activated.

The above synergetic virtuous circle is especially strong if the pedagogic goals of the course are focused on increasing self-awareness and developing skills more than on cognitive issues. In the case of the course where the CIM model was developed these skills are: to communicate, to work in teams, to negotiate and several other skills related with entrepreneurship, innovation and leadership. As it is evident, learning in these domains, which means a change of attitude and behavior, produces also a change in the course the students individually and socially create.

One of the skills that best triggers the virtuous circle of learning and improving the course is assessment. When students increase both their willingness and capabilities to make grounded assessments, the impact on the continuous innovation and improvement of the course is

especially powerful. This is particularly so in cultures which are weak in the assessment domain, both in the grounding and in the communication components of it, as it is the case of Chile and other Latin cultures.

I.1 The “Introduction to Industrial Engineering” Course

The Introduction to Industrial Engineering (IN 31A) course, created 10 years ago, is the main entrance to the specialization in Industrial Engineering and to the Department of Industrial Engineering (DII) as the new academic home for students who have completed five semesters of the common core in the Engineering School of the University of Chile (Vignolo et al., 2006).

The main objectives of this course are to:

- Expand self-awareness and self-management capabilities.**
- Induce and allow the students to become designers and managers of their personal program of learning**
- Introduce them to the Industrial Engineering world.**
- Increase entrepreneurial, teamwork, leadership, communication, innovation and other related skills.**

These objectives are achieved through the following main activities:

Activation Workshop:

Normally in an all day long Saturday –to ensure a significant emotional and spiritual involvement- students are introduced to the Radical Constructivist Model and go through a sequence of individual and group exercises, mostly aimed at increasing self-awareness and becoming active designers and managers of their learning process.

Weekly Activation Sessions:

Twice a week during the fifteen weeks of the semester students are invited to practice their abilities to build up the course, by means of

observing and modifying their moods, paradigms and focus of interest and actively participating in conversations with professors, peers and special guests.

Team Projects:

Emphasis is also placed on increasing awareness and competencies related to entrepreneurship, presenting the course as a “start up” that the students must guide to a successful end (Vignolo & Celis, 2007). Learning aimed at increasing awareness of the “real” world is carried out through real projects that are made through a team project. The teaching team and the other groups, through weekly sessions and the course’s wiki page, monitor the progress of the projects⁴.

Over the ten years the course has been offered, marks in the Official Educational Survey Report have been above average, notwithstanding the fact that the formal survey does not capture the course objectives adequately. By far the main benefit of the course has been an increase in students’ willingness and ability to successfully initiate and conduct a wide variety of ambitious and relevant projects.

Among them:

- 1. The reactivation and empowerment of the Industrial Engineering Student Union.**
- 2. The creation of DesPerTAR Social (From the Spanish: Desarrollo Personal con Trabajo Aplicado a la Realidad), a students organization oriented to promote “learning in social action”.**
- 3. The “Building Up My Dreams” program that was later included in the program of the course.⁵**

Another important result of the pedagogical model used in the course was student’s contribution to improving the course. As students were asked to assess and recreate the course, minute to minute, lecture to lecture and week to week, following the constructivist pattern, not only they assessed and recreated their positions in relation to the course but

⁴ <http://in31a-ot08.wikispaces.com/>

⁵ <http://escuela2.ing.uchile.cl/vida-estudiantil/cms/construyendo-nis-suenos>

also started making significant contributions to the continuous evolution of the course.

This was the basis for the design of the Continuous Innovation Model, which also includes interacting with alumni and other actors.

The CIM operation has produced changes in the course, in the teaching team and in the CIM it self. This process can be seen as an educational engineering challenge, in which the students redesign the course by themselves, as an individual and as part of the community the course represents.

II. The Continuous Innovation Model

The CIM is based on radical constructivism as an epistemological platform and continuous social interaction as the practical base for individual transformation.

The main distinctive principles of our constructivist approach are (Vignolo et al., 2007):

- 1. Learning is understood, literally, as a permanent process of “self-construction” of the student. Supported by new approaches in biology of cognition (Maturana & Varela et al, 1973; Maturana y Varela et al, 1998), our understanding has been evolving gradually towards an interpretation of learning as a biological transformation of the learner, in the interaction and coexistence with the human community in which she/he lives, grows and develops.**
- 2. Knowing is understood, also literally, as a process of “construction” of reality, in which the learner participates actively involving her/his particular paradigms, moods and concerns (PMC), which are all subject of observation, design and transformation.**

Each student constructs his/her own class and course based on his/her PMC. That being so, the student is the main actor in the process of evaluating and improving the particular course he/she is living.

Enhancing student's capacity to observe him/her during the interaction with the course and modify the observer he/she is, as a way of creating a better course and improve learning becomes one of the main goals of the course. With this view apparently very inactive student could be creating a very powerful course for himself/herself.

Learning is part of an active social process of construction of the course. Students influence the course by proposing, asking, commenting, etc. The students learn when they assess and contribute with proposals of innovation for the course. The CIM helps this kind of learning and improvement of the course through the specific operational framework.

The teaching team and the alumni are part of the continuous construction of the course, the teaching team also continuously constructs the course based on their PMC and they also transformed themselves in the interaction with the course. Alumni continue to stay involved with the course forever; though a continuously evolving narrative and evaluation of the course.

Main operational components of the CIM model, related to student's role and activities are:

1. Moods and focusing setting practices.

- **“Tuning in” exercise at the beginning of any activity of the course (See appendix A). This practice is aimed at increasing their capacity to observe themselves and help them to activate and start creating the session.**
- **“Stretching” exercise at the end of every activity, aimed at improving their capacity to assess their learning and increase awareness of him/herself as active participant in the course (See appendix B).**

- 2. “Learning from peers learning” exercise. Students are obsessively induced to learn from peers and develop the capacity to transform peers in sources of learning and help. Especial focus is placed on learning from peers learning during the course.**

- 3. Special Innovation Sessions:**
 - **Final week of the course is designed to make students work in teams to generate proposals to redesign next version of the course.**

 - **End of the year evaluation and redesign session. The entire teaching team (normally around ten people) and a selection of good students of ending course (normally four) gather together for a day long journey in which a profound assessment and redesign of the course is generated.**

- 4. Student Surveys, in the middle and at the end of the semester.**

III. Results of CIM application

The application of the CIM system has generated permanent changes in three complementary domains: teaching team attitudes and course design, student’s attitude and learning results, and the CIM itself. Main impacts of the latest applications of CIM are:

III.1 Impact on the teaching team and course design

- 1. Increase awareness in the teaching team about the tendency to be inconsistent with the RCA predicaments, forgetting to ensure student’s understanding of the goals and methods of the course, which are completely different and therefore compete in adverse conditions with almost all other courses (parallels and previous ones). Radical changes in the design of first sessions of the course and bibliographical support were introduced as a result of this.**

- 2. Significant inefficiencies were discovered in the coordination of several course activities, especially among teaching assistants.**

Radical changes in the team and its practices and management systems were introduced.

- 3. As a result of the recognition the course has received from Department Authorities, the course obtained a special grant to finance the acquisitions of PRS (Personal Response System) – first in the Chilean university system- and a permanent research assistant to continuously observe and make proposals to improve the course.**

III.2 Impact on Student’s Attitude and Learning

- 1. Commitment and participation of students in the course significantly increased, according to direct observation of the teaching team**
- 2. A new especial survey applied to the student in current semester shows a significant improvement in student’s satisfaction and learning appreciation. As tables below show, learning and welfare in the course has been more than 50 % higher than expected. Remarkably is the 76% “higher than**



expected” and “much higher than expected” result on welfare out of the course (this item measures the impact of the course in the personal welfare in social and familiar context).

- 3. Much more participation of current students of the IN31A course in the Student’s Union, according to its present leaders.**
- 4. Beters course projects, more ambitious and more rigorously formulated.**

III.3 Impact on the CIM

- 1. New evaluating practices have been introducing, including the above-mentioned special survey to evaluate course performance and perception at an early stage.**
- 2. Changes on almost all CIM practices were introduced as the result of latest end of the year redesign session.**
- 3. Preparation of papers for the Congress on Engineering Education was introduced to the CIM systems, which implies a continuous learning from other experiences.**

IV. Conclusions

All the above described results show that active learning is a great possibility not only to improve learning but also to improve courses and to help teachers to learn and transform themselves; introducing innovations in the courses they conduct.

The obsession with permanent assessment and redesign appears to be especially useful in places that are not evaluative cultures, transforming the development of competencies in this sphere as a very significant pedagogical achievement, both for students and for teachers.

The CIM system allows students to be “better clients”, assessing, commenting, complaining and proposing changes to the course. Teachers learn to be better listeners and servers of the students.

As the total energy activated and generated from students increase a lot, students learn more in different domains, including very specially assessment and innovations skills and make positive impact on other parallel courses and students activities, apart from the contribution to improving the course. Most of them take control of the design and management of their learning process and became real learning entrepreneurs.

For this model to work it is crucial to have a very well trained and committed teaching team. It is also very important to be very rigorous in the application of the different components of the pedagogical technology. For example, the recurrence about the importance of recurrence as a way of learning skills is not an easy task in a traditional research university environment, but it is a cornerstone of a constructivist active learning approach as the one here presented.

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APPENDIX A

TUNNING IN

Name: _____ Date: _____

1. . Which are your moods (or emotions) at the beginning of this session?

Select three from the following list or add other distinctions

- | | | |
|---------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Enthusiasm | <input type="checkbox"/> Interest | <input type="checkbox"/> Confusion |
| <input type="checkbox"/> Acceptance | <input type="checkbox"/> Peace | <input type="checkbox"/> Restlessness |
| <input type="checkbox"/> Ambition | <input type="checkbox"/> Resentment | <input type="checkbox"/> Gratitude |
| <input type="checkbox"/> Expectation | <input type="checkbox"/> Optimism | <input type="checkbox"/> Skepticism |
| <input type="checkbox"/> Confidence | <input type="checkbox"/> Apathy | <input type="checkbox"/> Anger |
| <input type="checkbox"/> Indifference | <input type="checkbox"/> Tranquility | <input type="checkbox"/> Impatience |
| <input type="checkbox"/> Curiosity | <input type="checkbox"/> Preoccupation | <input type="checkbox"/> Prudence |
| <input type="checkbox"/> Hope | <input type="checkbox"/> Happiness | <input type="checkbox"/> Anxiety |
| <input type="checkbox"/> Euphoria | <input type="checkbox"/> Resignation | <input type="checkbox"/> Distrust |

OTHERS: _____

2. Which interests, “breakdowns” and intentions do you have at the beginning of this class that could affect the benefits that you can take of it?

3. What questions, proposals and comments would you like now to make to the facilitator of the session as a way of helping you to produce a great experience, very profitable and ideally also very pleasant and?

APPENDIX B

STRETCHING

Name: _____ Date: _____

(You have to give back this exercise)

1. - ¿ Which are your moods (or emotions) at the end of this session?
Mark the three options that most accommodate you

- | | | |
|---------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Enthusiasm | <input type="checkbox"/> Interest | <input type="checkbox"/> Confusion |
| <input type="checkbox"/> Acceptance | <input type="checkbox"/> Peace | <input type="checkbox"/> Restlessness |
| <input type="checkbox"/> Ambition | <input type="checkbox"/> Resentment | <input type="checkbox"/> Gratitude |
| <input type="checkbox"/> Expectation | <input type="checkbox"/> Optimism | <input type="checkbox"/> Skepticism |
| <input type="checkbox"/> Confidence | <input type="checkbox"/> Apathy | <input type="checkbox"/> Anger |
| <input type="checkbox"/> Indifference | <input type="checkbox"/> Tranquility | <input type="checkbox"/> Impatience |
| <input type="checkbox"/> Curiosity | <input type="checkbox"/> Preoccupation | <input type="checkbox"/> Prudence |
| <input type="checkbox"/> Hope | <input type="checkbox"/> Happiness | <input type="checkbox"/> Anxiety |
| <input type="checkbox"/> Euphoria | <input type="checkbox"/> Resignation | <input type="checkbox"/> Distrust |

OTHERS: _____

2. - What new possibilities do you see for yourself trigger from this session?

3. - Name three people that reported a higher benefit for you?

4. - In a phrase: ¿ which is your balance of this session?

5. - Put a mark to this session from 1.0 to 7.0

6. What mark would you put to yourself as responsible and constructor of your learning process in this session?

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