e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Challenging Physics Lessons through questioning and collaborative work

research developed in Portuguese Higher Education Institutions

nilzacosta@ua.pt

Setting the problem (1) …

Introductory Physics courses in students' curriculum path have been pointed out as a **barrier for engineering student's success** (Jiang, & Freeman, 2011).

Students **have conceptual difficulties in understanding physics concepts and do not see its relevance for their degree and future profession** which decreases their engagement in the teaching & learning process (T&L) (Costa et al. 2012; Smaill, 2012).

Researchers (and Physics Teachers) feel the need to study how to (re)design the T&L process in order to overcome such obstacles and to promote academic success.

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Starting the reseach work (since 2004)

N Costa (PhD in Physics Education)

P. Oliveira (Pysics Teacher in a HEI, teaching IPhs to Eng.Sts) and C. Oliveira (Phys Tecacher) , both enrolled in a PhD in Education)

Stage 1 (*) - How to improve the **motivation and the learning** of engineering students attending introductury physic lectures?

(*) – In this talk one will refer only one part of the studies referred to the research done in the lectures

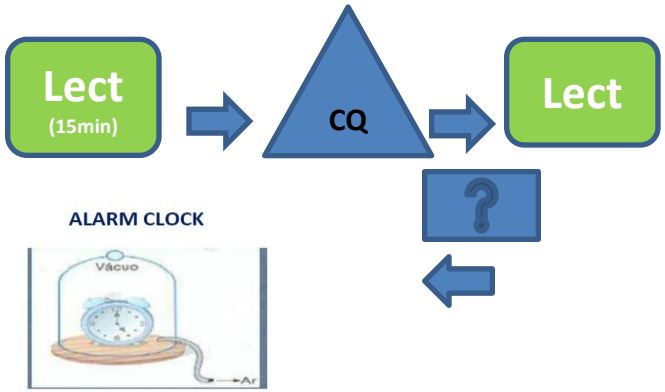
e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Theoretical Framework

Eric Mazur´s model - *peer instruction method* (90's of the 20th century)



ALARM CLOCK

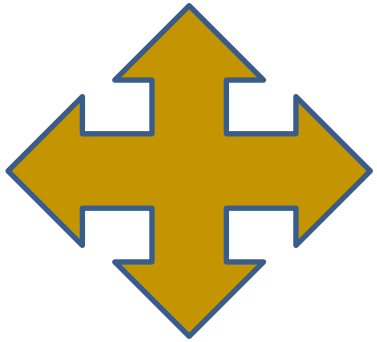
What happens to a bright and sonorous alarm clock when we put it in a bell vacuum?

A) it rings, but doesn't flash

B) it flashes, but doesn't ring

C) it doesn´t rings and doesn't' t flash

E) it flashes and rings normally



Active learning (Prince, 2004)

- Introducing students activities into the traditional lectures
- Promoting students engagement (collaborative learning, problem based learning, …)

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Methodological Approach

Action-research design (teacher as a researcher)

Data colleted through:

questionnaires and interviews to students

Teacher' s diaries

Statistical and content data analysis

The studies carried on …

2 HEI: ISE – Oporto and UA – Aveiro

Academic years: 2006/07; 2007/08

82 (40+42), 1st year engineering students attending Introductoring Physics Classes

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Some results (Oliveira & Olieira, 2013)

The students voices ….

"I think the questions were important for learning because when we discuss with others, we learn more. (…) they made the lessons more motivating. "(E2).

"The conceptual questions are important for us to understand how to apply physics in our everyday life. This motivates us to go to classes" (E5).

"These questions, after the theoretical explanation, were important to my learning because they generate discussion among students. These discussions oblige us to explain our points of view to our colleagues. They are always good for clarifying some topics. Another advantage (…) is that we don't need to do calculations. (…) we understand the physics concept before we do calculations" (E6).

Some results (Oliveira & Olieira, 2013)

The results show that "… the conceptual questions are a way to promote motivation, increase the interactions in class and promote learning" (p. 422).

Although one can not generalize from our studies about the positive impact of the strategies used, given the methodological approached used, there are evidence from other studies (see for example Freeman et al., 2014) that active learning, **namely using conceptual questioning**, **increases students' performance in engineering courses and should then challenge traditional lecturing**

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

DEVELOPMENT in the work of the researh team – STAGE 2

Setting the problem (2) …

Having in mind the same research problem (*), **how can we enhance the impact of our work?**

(*) How to improve the **motivation and the learning** of engineering students attending introductory physic lectures?
(stage 1)

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

The studied carried on (Oliveira, 2011)...

University of Aveiro (UA), in the academic year 2007/08, during one semestre

Participants:

The researcher (PhD student in Dydactics of Physics)

One Teacher (Physcis Department of UA)

42 engeneering students (attending a 1st year Introductury Physics Course)

Data collected:

Questionnaires and interviews to students

Teachers and researcher' s diaries

Interview to the teacher

Collaboration
(RESEARCHER & PHY TEACHER)

Same Aim
TO IMPROVE STUDENTS MOTIVATION AND LEARNING IN THE PHYSIC CLASSES

Kick off Meeting
- **Invitation** of the researcher to the teacher
- **Negociation** of the project to be developed
- **Presentation** of exemples of good practices of teaching Physics to Eng. Sts

(**Note**- Criteria for the invitation: experienced teacher with a wish to improve their practices)

Other Meetings
- **Formal** (preparation of the strategies and activities to implement in the classes; analysis and discussion of the results)
- **Informal** (feedback about the impelmentation of the strategies/activities)

Researcher Actions
- To suggest : strategies/activities; Instruments to collect data
- Emotional support
- To give feedbak to the practices
- ...

Teacher Actions
- To discuss the proposals presented by the researcher
- To implement them in the classrrom;
- To collect evidence;
- To refect upon the experience

Oliveira, 2011

Main results (Oliveira, 2011)

The teacher considered that the collaborative work with the researcher **has contributed to her professional development**, referring the **four main characteristics of the profile of the researcher** to this effectiveness:

her physics background

her didactic of physics background, namely in the domain of the T&L physics for engineering students

her availability (as teacher found that some strategies/activities are very time consuming…)

her relationship competences.

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

Recently, we extend our work to another educational context – Angola (Chivangulula, 2014) **although only at the diagnosis level**.

One HE Institution: Instituto Superior Politécnico da Huila

Academic year: 2013

Participants:

143, 1st year geological engeneering students atending an introductory pysics course

2 teachers

Some results …

Similar results have been found in terms of engineering students difficulties in physics
good receptivity from the teachers involved towards the alternative T&L strategies, namely with respect to conceptual questions

However, and as the context of this study was different from all the others carried on by the research team (Geology Engineering in a different country) the researcher felt a lack of concrete material, for example conceptual questions relevant for his context

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

From stage 1 and 2 of our work, and the recent extension made in Angola, we face two main constrains/challenges

A- Lack of didactical material to support teachers (for example list of conceptual questions for different physics topics and related to the context of the different engeneering degrees)

B- Uncertaintinity about what teachers continue to do in their classes after stoping working with the researchers

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

A

Active Learning in the Science and Engeneering Teaching in Higher Education: from theory to practice (Processo 37/ID/2014) – Cristina Oliveira

B

Sustainability of research results in educational innovation in Portuguese Universities (Reference: SFRH/BPD/103497/2014); 01/09/15-31/08/18) – Cecilia Guerra

e-DAUn

Estudo do Desenvolvimento Académico na Universidade

A Study of Academic Development in University

THANKS FOR YOUR ATTENTION!

QUESTIONS, COMMENTS, …

nilzacosta@ua.pt