UNIVERSITATEA DIN BUCUREȘTI

VIRTUTE ET SAPIENTIA

Exploratory strategies on research mobilization in training of academics

Studies on research and teaching link at bachelor level

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Introduction and Motivation

International context

- Higher education institutions must combine
  teaching activities & scientific research & quality assurance procedures
  ➡ reflected in institutional strategies.

- Although the stated mission of the universities is a dual one,
  of teaching & research,

it is often not transposed in the strategies applied or in the evaluation and reward modalities of performance (Taylor 2007).

- For the modern academic world, the desire to combine research and teaching is far from being accomplished, with no automatic link (Jenkins and Zetter 2003).

Introduction and Motivation

National context

- In Romania, the strategies of higher institution focus on **scientific research** quality and quantity, as for example:
  - number of published articles in indexed journals,
  - citations *(h-index)*.

- The very large number of **effective teaching hours** imposed by legislation (and governmental financing) for **academic staff** leaves very little time for research,

while

- the evaluation and promotion criteria rely mainly on **scientific research outcomes**.

Introduction and Motivation

Aim of the study

- On the long run, our goal is to test research transfer strategies in the training of academics, focusing also on reflective thinking and motivational association.
- We analyse approaches of integrating **correlated research & teaching**.
- We present an experimental situation with

Physics and **Pedagogy**

second year bachelor **students** and **academics** at University of Bucharest.

Approaches for linking research and teaching in higher education - overview and typologies

- How the academic environment interprets the terms:
  - **research**,
  - **scholarship or performance**
  - **teaching**

  can influence the connection between research and teaching (***R&T link***)

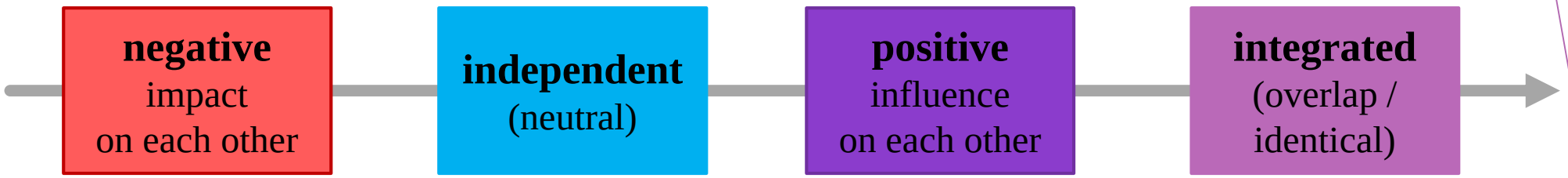
  (Healey 2000, Brew 2003).

- **Research** is mainly viewed as:
  - **results/outcome** oriented (external),

  or
  - **learning** oriented (internal).

Approaches for linking research and teaching in higher education

- **Typologies** of relation between research and teaching (Coate et al. 2001):



- The connection between research and teaching can be made in both directions (Jenkin & Zetter 2003):
  - ***Research into Teaching* [RtoT],**
  - ***Teaching into Research* [TtoR].**

  balanced by **domain** and **department** (Rowland 1996)

  influencial factors

- **The learning process** must remain at the intersection of the two.

Approaches for linking research and teaching in higher education - influencing factors

The main (influential) factors in forming the connection between research and teaching at the level of a university are:

[**RtoT**] strategies [**TtoR**]

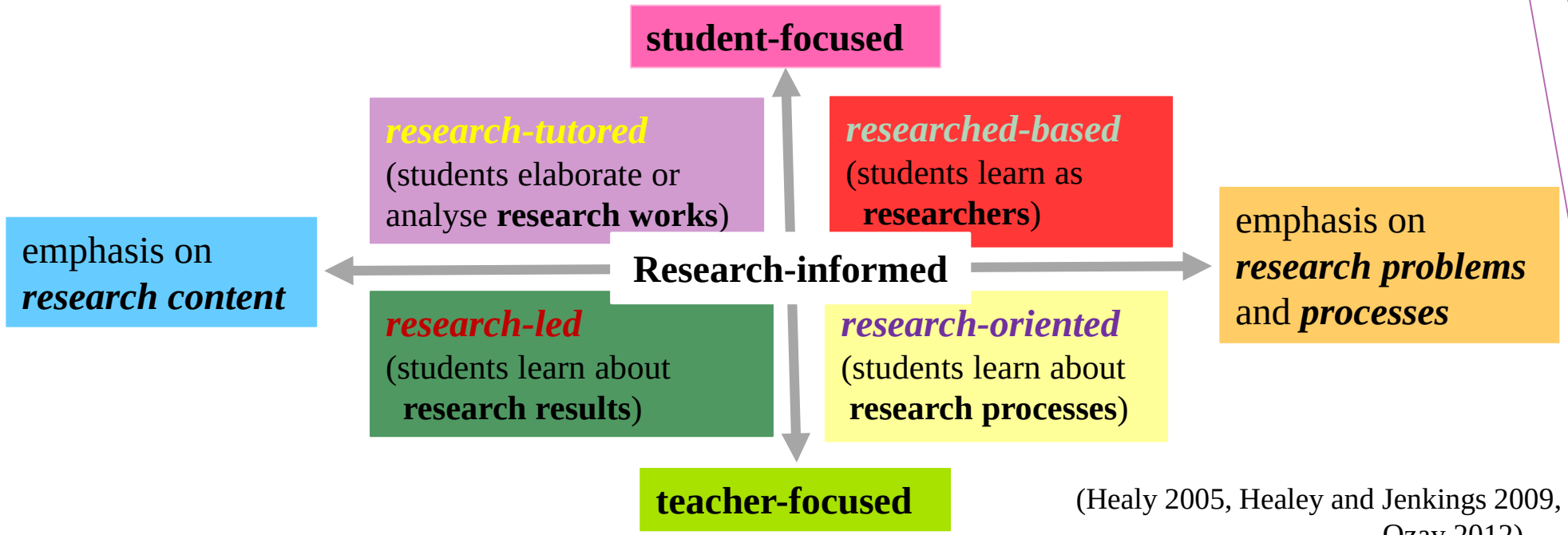
- **type of department** (oriented mainly toward research or teaching)
- **type of discipline** (applied vs. fundamental disciplines)
- **level of studies**
  - The research and teaching link is most difficult to achieve in the **bachelor** cycle (McLernon & Hughes, 2003; Lindsay et al, 2002; Jenkins, 2000).
  - Additional to the constraints related to the curricula, to the content of the courses which is sometimes less correlated with the dynamism of the research, one might have additional constrains from national agencies for quality assurance etc.

individual motivation and ability (Colbeck 1998)

stakeholder perspectives (academic staff, students, administrators, funding bodies)

cultural factors (Elton 2001)

- **Research-based teaching** can take different forms depending on the degree and manner in which research is incorporated into teaching. Griffiths (2004) agrees on four ways in which research can be embedded in teaching:



(Healy 2005, Healey and Jenkings 2009, Ozay 2012)

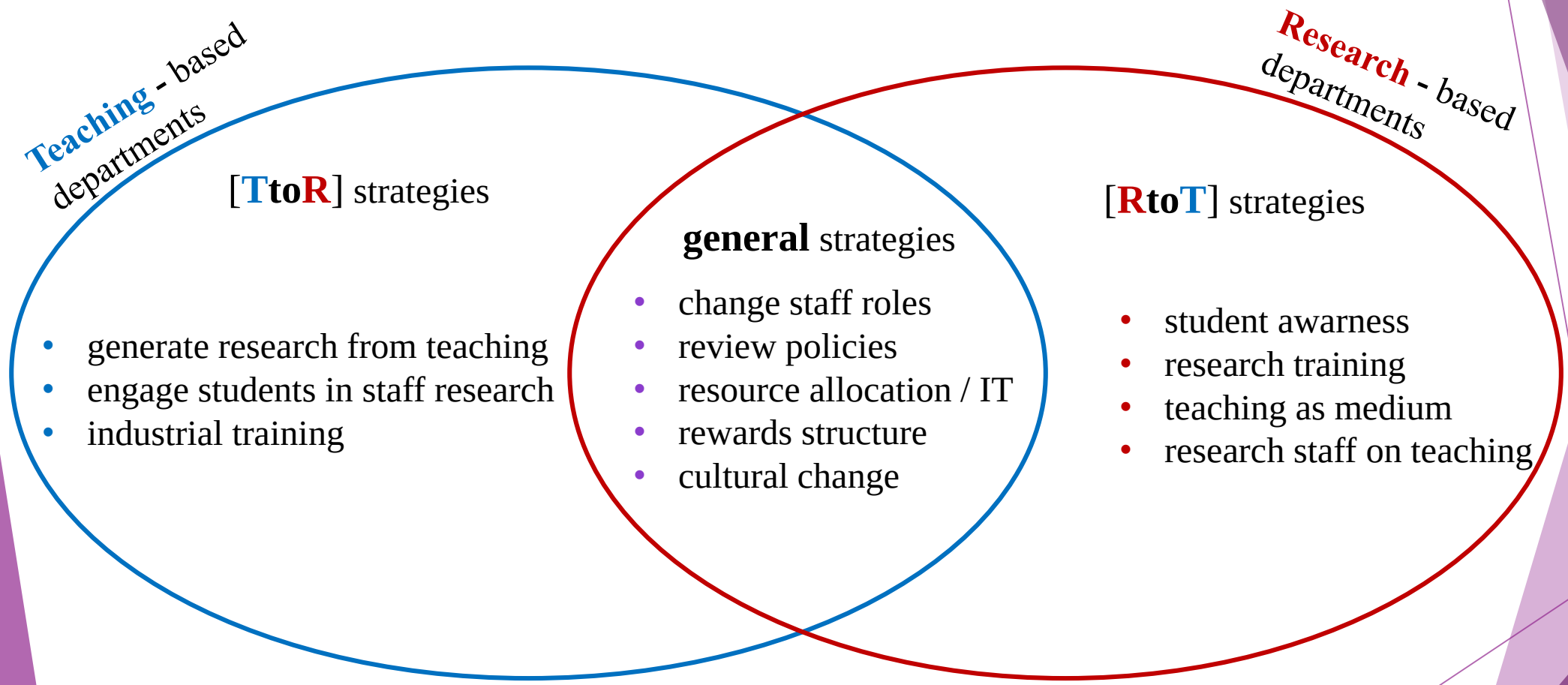
- **The mixed approach**, in which both, the research processes and the content of the research are presented to students is the most effective (Hughes 2004).

- **Student-focused teaching** is easier to adapt in **applied disciplines** than in those that address **fundamental** ones**,** where a **teacher-focused** is wider used (Griffiths 2004).

Approaches for linking research and teaching in higher education - learning factors

- The influential factors in **linking research** and **teaching** need to be adapted to the **learning styles** (Smith 2002), as we speak of
  - "field dependency" theories – learning can be influenced by the context;
  - "holistic versus sequential" learning theories – e.g. visual or verbal approaches;
  - "experiential learning" theory (Kolb 1984) – learning cycle: concrete learning, reflective observation, abstract conceptualization and active experimentation
  - "surface versus deep" learning theories.

Approaches for linking research and teaching in higher education - strategies



(Senaratne et al. 2006)

Experimental situation

Faculty of Physics:

Physics and **Technological Physics** (Applied Engineering Sciences)

Faculty of Psychology and Educational Sciences:

Pedagogy

- **Target**:
  - academics with different scientometric profile
  - second year bachelor students
- **Research problem**:
  - How is the transfer [**RtoT**] or [**TtoR**] carried out in the case of a group of second year bachelor students, for two different fields: Physics and Pedagogy (education sciences)?
  - If / how does the **interest in research** increase? Is it correlated with the **profile** of the teacher?

Experimental situation

- **Research questions**:
  - Are there any differences or correlations between the way students evaluate
    - the **didactic performance** of the academic staff or
    - the **research topic**

    and the **profile of the teacher** (field, university degree, scientometric performance in research, for example Hirsch index etc.)?
  - Are there differences or particularities in the way students in the two fields react to certain information / stimuli, for example:
    - mentioning a Nobel Prize;
    - mentioning an article and specifying a large impact factor of a scientific journal?
  - Does the student's **interest in research** increase?

Experimental situation

- **Research hypothesis** (open to further development):

  - There are differences between the teaching performance and the scientometric profile of the academics.

Literature review indicates that research performance reflects positively on quality of teaching (for example, Cadez et al. 2017, Palali et al. 2018), but we expected differences according to the field of study.

  - Students might show a different interest in the presented research topics by the full professors compared to the ones introduced by lecturers.

  - The reaction of the students when mentioning indicators of performance in scientific research (articles in journals with high impact scores, Nobel prizes etc.) might be different, depending on the field of study.

Experimental situation - Research method

- **Sample selection** :

Faculty of Physics:

- **Lecturer (LP)**
- **Professor (PP)**

- 30 students (2nd year)

Faculty of Psychology and Educational Sciences:

- **Lecturer (LE)**
- **Professor (PE)**

- 50 students (2nd year)

- **Lectures** (fall 2019):
  - Academics chose topics related to scientific research (apart from the minimal curricula they have to teach in the study programme), which can be accessible to the 2nd year bachelor students.
  - No teaching methods or approaches were imposed.
  - Initially, it was intended that the teachers will design the lecture 'researched-led' or 'research-oriented', but for Education Sciences it was rather 'research-tutored'.

Experimental situation - Research method

- **Data collection**:
  - online questionnaire for academics;
  - online anonymous questionnaire for students.

Variables

- **academic staff**:
  - faculty / department;
  - field;
  - university degree / position;
  - scientometric profile (no. published ISI articles, the Hirsch index, national scientific performance indicator);
  - age;
  - years of experience in academic education, scientific research and / or teaching in secondary schools.

- **students**:
  - faculty;
  - field of study;
  - average grade of the first year of study;
  - attendance at courses / tutorials;
  - age etc.

Experimental situation - Research method

- **Dependent variables** (criterion variables) are grouped in two categories:
  - to reflect the opinion of the **academics** involved;
  - to investigate the **student** appreciation on the impact of lecture.

Academics:

- evaluated the impact on students;
- evaluated how students respond to certain information / stimuli during the lecture

  (as the Nobel Prize, impact factor of a publication);

- estimated the effort involved in preparing the lecture;
- mentioned the teaching methods they have used.

Experimental situation - Research method

Students evaluated:

- **Teaching** - on a five-point level from ‘total disagreement’ to ‘total agreement’, the extent to which the speaker:
  - clearly states the objectives of the talk (lecture objectives);
  - has good knowledge on the scientific topic;
  - makes connection to practical examples;
  - encourages the students to ask questions;
  - offers clear answers and has a good connection with the students.
- Overall score of teaching performance
- **Research** topic: interesting; understandable; motivating to further study etc.

Among the other questions, the overall scientific impact is analysed (student interested in research / motivated in the spirit of the research).

Data:

- almost all Pedagogy students
- half of the Physics students

present have answered the questionnaire.

The data were analysed using JASP (JASP 2019).

Experimental situation - Results

Students answers - Teaching:

- The questions asking to an evaluation from ‘total disagreement’ to ‘total agreement’ were scaled for the data analysis from 1 to 5.
- Overall score of teaching performance was on a scale from 1 to 10 (as the grading system in Romania).

	Lecture objectives				Encourage communication				Overall performance			
	LE	LP	PE	PP	LE	LP	PE	PP	LE	LP	PE	PP
Valid	45	12	53	17	45	12	53	17	45	12	53	17
Mean	4.49	4.17	4.45	4.47	4.58	4.58	4.68	3.82	9.53	7.83	9.51	9.06
Std. Dev.	0.70	0.84	0.89	0.80	0.58	0.67	0.61	1.24	0.63	1.59	1.19	1.48
Minimum	2.00	3.00	1.00	2.00	3.00	3.00	3.00	1.00	8.00	5.00	2.00	4.00
Maximum	5.00	5.00	5.00	5.00	5 .00	5.00	5.00	5.00	10.00	10.00	10.00	10.00

Table 1: Descriptive statistics for teaching performance (selection).

Experimental situation - Results

Students answers – impact of **research** topic**:**

	Interesting topic				Understanding				Continue to study the topic			
	LE	LP	PE	PP	LE	LP	PE	PP	LE	LP	PE	PP
Valid	45	12	53	17	45	12	53	17	45	12	53	17
Mean	4.31	4.50	4.43	4.24	4.24	3.92	4.28	3.59	4.07	4.33	4.11	3.88
Std. Deviation	0.63	0.67	0.67	1.03	0.68	1.08	0.72	0.71	0.81	0.99	0.82	1.11
Minimum	3.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Table 2: Descriptive statistics for the impact of the research topic (selection).

As for the teaching performance, here we can also notice differences for the academics in Physics, while at Educational Sciences the scores are quite similar.

Experimental situation - Results

- The **correlation** of different variables was analysed twofold:
  - overall, for both faculties,
  - separately, for each field of study: Physics and Pedagogy.

We have used both, Pearson correlations with correlation plots to analyse the steepness of the linear regression and distribution of data and, where applicable, the chi-squared tests with Cramér's V.

- The overall analyses has shown very strong correlations (with p ranging from 10-4 up to 10-21) with medium up to large effects (Pearson's r from 0.300 up to 0.786) for all the two by two correlation of variables related to the score the **quality of the lecture**, of the **academic performance** and of the **research topic**.

- We have also investigated if there are any correlations in between the criterion variables and the academic performance of the students (average grade, their motivation to study in the chosen field of study/ faculty etc.). We have found no significant correlation with two exceptions:
  - the score evaluating how interesting the topic was
  - the students' willingness to continue to read on the presented research topic

(not a significant effect $r \approx 0.2$, $p = 0.02 < 0.05$).

The effect was medium when we have separately analysed the answer of the physics students, but only regarding how interesting the topic was.

Experimental situation - Results

- In a subsequent step, we have searched for different correlations with the academic title and / or the field of study. Of statistical significance, with large effect, there were:
  - the communication encouragement of students,
  - the overall relation to students and
  - the overall teaching performance of the academics.

- The students were also asked if they believed the topic could be better presented by the other speaker (LE ↔ PE and LP ↔ PP). The result (with large effect mainly due to physics, as separate analysis shows) were

	Academic				
Comparison	LE	LP	PE	PP	Total
No	24	2	37	10	73
Not relevant	16	5	14	6	41
Yes	5	5	2	1	13
Total	45	12	53	17	127

Table 3: Number of students that believed the topic could be better presented by the other speaker.

Experimental situation - Results

Students' **background experience** with **research** topics:

- The teachers usually relate to scientific research in regular lectures:
  - common practice for the Pedagogy teachers,

  while
  - less usual for Physics.

- Students already **involved in research** in their second year of study:
  - 16% in the case of Physics;
  - 4% for Pedagogy.

Students' willingness to start **working on research**

(based on their experience with the presented lectures in the experimental situation):

- **~ 70%** of the students are willing to start to work on research for both, Physics and Pedagogy;

- 30% of Physics students choose the theme introduced by PP and 62% have no preference;
- 50% of Pedagogy prefer the theme introduced by PE and 48% have no preference.

Experimental situation - Results

Variables that describe the academic staff, especially

their **scientometric profile** (no. published ISI articles, the Hirsch index, national scientific performance indicator), but also the age, years of experience in academic education, scientific research and / or secondary schools are **correlated** to the recorded **scores** from the **students**?

(Note: We cannot expect results that are statistically significant at this level of our study.)

- We have found some **negative correlations** in between the
  - **communication with students** and **number of published ISI articles** (r=-0.994 and p=0.006)

    experience in research (r=-0.991 and p=0.009)

    The largest discrepancy was for Physics, where the professor, has both, a large number of publication and of the Hirsch index. During his lecture, the students felt less encouraged to ask questions or initiate discussions.

- **Positive correlation** was related to the fact that the academics with a **larger Hirsch index** (i.e. the full professors), **allocated more time** to prepare the presentations. Even if counter-intuitive, the full professors declared that they have spent more than double the time the young lecturers used to prepare the lessons for our experimental situation, the largest discrepancy being in between the PL and PP.
- The allocated time might partly justify the overall performance scores that were higher for PP.

Experimental situation - Results

Academics answers (selected outcomes)**:**

- Both lecturers (LE and LP) indicated more than 3/4 of the students as interested and following the lecture, while the professors a smaller percentage.

- **Scientific impact** on **students** and how they respond to certain information / stimuli during the lecture:
  - 50-75% percentage of a noticeable change for the Physics students when they have heard the mentioning of a **Nobel Prize**, while less than 25% of the Pedagogy students reacted;
  - when a **scientific article** was mentioned, about half of the Physics students were interested, while less than 25% from Pedagogy;
  - Physics students were also interested in the **impact factor of scientific journals**;
  - the majority of students were positively reacting to examples from **practice** (no matter their field of study).

Summary and Outlook

Motivated by some key aspects present in the literature (see Senaratne et al. 2006):

- the importance of teaching by academics with rich activity in research;
- the importance of the way in which the research knowledge is transmitted to the students;
- the importance of the skills that students need to develop, and further, to be maintained and evaluated,

we want to investigate strategies for mobilizing research in various stages of training in higher education, taking mainly into account the type of department / faculty, field, specialization and level of study and correlating them with the scientific and teaching profile of the academics.

Summary and Outlook

- Preliminary findings from the experimental situation involving Pedagogy and Physics bachelor students indicate that there are some correlations on the teaching quality and the scientific profile of the academics for Physics (scientometric indicators were with one order of magnitude higher for the full professor).

- For Education Sciences, even if the scientometric indicators were higher for the full professor (but still within the same order of magnitude as for the lecturer), there were no significant differences in the evaluation of students, especially on the teaching performance.

- Further investigation should be carried out especially on the communication from / to students and their well-being. Our current results show negative correlation on the communication from students to academics with extensive experience in research and a high scientometric scientific profile.

- More than 2/3 of the students from both faculties felt motivated by the lectures of the experimental situation to start working on a research topic.

  50% from the Pedagogy students willing to get involved in a research theme, preferred the topic presented by the full professor, while 48% had no specific preference on the topic. For physics, there were 30% for the topic of the full professor and 62% were open to any theme.

Summary and Outlook

- Some of the Physics students (41%) indicated that the research topic could have been probably better introduced by the full professor, but in all other cases most of them agreed that either the speaker was appropriate or is not relevant.
- This finding and the larger overall score of the Physics professor might be correlated to the time used by the young academics to prepare the lecture. They spent less than a half of the time allocated by the full professors, the largest discrepancy being in between the Physics lecturer and the Physics professor.
- The allocated time can be a constraint related to the promotion criteria that favour the staff with a dominant research profile forcing the young academics (and not only) to spend less time for preparing their lectures and focusing more on research. To be noted that in Romania, the academics on lower positions also have a considerably larger amount of teaching duties (double than for the full professors).

- The data we have already gathered will allow us also to make a further analysis (for example on the efficiency of the teaching methods used by the academics, including the manner in which the research is embedded in teaching) and to improve the design of the experimental situation.
- We plan to repeat the experimental situation firstly on a new group of students, and at a later stage extending the number of academic staff involved and the type of departments.

References (selection)

- Brew, A. (2003). 'Teaching and Research: New relationships and their implications for inquiry-based teaching and learning in higher education'. *Higher Education Research & Development* 22(1): 3-18.
- Cadez, S., Dimovski, V., Zaman Groff, M. (2017). 'Research, teaching and performance evaluation in academia: the salience of quality'. *Studies in Higher Education* 42(8), 1455-1473.
- Coate, K., Barnett, R., Williams, G. (2001). 'Relationships between Teaching and Research in Higher Education in England'. *Higher Education Quarterly* 55(2), 158-174.
- Cohen, L., Manion, L., Morrison, K. (2011). *Research Methods in Education* (7th ed.). New York: Routledge.
- Colbeck, C. L. (1998). 'Merging a seamless blend: how faculty integrate teaching and research'. *The Journal of Higher Education* 69(6): 647-671
- Elken, M., Wollscheid, S. (2016). *The Relationship between Research and Education: Typologies and Indicators: A Literature Review*. Oslo, Norway: Nordic Institute for Studies in Innovation, Research and Education (NIFU).
- Elton, L. (2001). 'Research and Teaching: conditions for a positive link'. *Teaching in Higher Education* 6(1): 43-56.
- Griffiths, , R. (2004). 'Knowledge production and the research-teaching nexus: the case of the built environment disciplines'. *Studies in Higher Education* 29(6): 709-726.
- Healey, M. (2000). 'Developing the scholarship of teaching in higher education: A discipline based approach'. *Higher Education Research and Development* 19(2): 169-189.
- Healey, M. (2005). 'Linking research and teaching: exploring disciplinary spaces and the role of inquiry-based learning'. *Reshaping the University: New Relationships between Research, Scholarship and Teaching.* R. Barnett. McGraw Hill, Open University Press.
- Healey, M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry.* New York: Higher Education Academy.
- Hughes, M. (2004). 'The relationship between research and teaching in higher education – a review of literature (1990-2002)' - Occasional paper No 2. University of Brighton, UK.
- Jenkins, A. & Zetter, R. (2003). *Linking Research and Teaching in Departments*. LTSN Generic Centre, Learning and Teaching Support Network, Oxford Brookes University, UK.
- Kolb, D. (1984). *Experiential Learning: experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice Hall.
- Lindsay, R., Breen, R. et al. (2002). 'Academic Research and Teaching Quality: the views of undergraduate and postgraduate students'. *Studies in Higher Education* 27(3): 309-327.
- McLernon, T. & Hughes, D. (2003). 'Research versus Teaching in the built environment discipline'. *CIB W89 Building Education and Research Conference*, Salford.
- Ozay, S. B. (2012). 'The dimensions of research in undergraduate learning'. *Teaching in Higher Education* 17(4), 453-464.
- Palali, A., van Elk, R., Bolhaar, J., Rud, I. (2018). 'Are good researchers also good teachers? The relationship between research quality and teaching quality'. *Economics of Education Review*, 64, 40-49.
- Rowland, S. (1996). 'Relationships between teaching and research'. *Teaching in Higher Education* 1(1): 7-20.
- Senaratne, S., Amaratunga, D. et al. (2006). 'Integrating research and teaching in higher education: conceptual issues'. *CIB W89 International Conference on Building Education and Research (BEAR)*. The Hong Kong Polytechnic University, Hong Kong.
- Smith, J. (2002). *Learning styles: Fashion fad or lever for change? The application of learning style theory to inclusive curriculum delivery.* Innovations in Education and Teaching International 39(10): 63-70.
- Taylor, J. (2007). 'The Teaching: Research Nexus: A Model for Institutional Management'. *Higher Education* 54(6): 867–84.