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Exploratory strategies on research mobilization in training of academics

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Summary:

Although the declared mission of the universities is a dual one, of teaching and research/ innovation, the applied strategies and the criteria of evaluating and rewarding the staff performance are dominated by research results. Most studies confirm that teaching and research in higher education institutions are scarcely correlated and building an effective link is a challenge debated in many specialty articles. The main factors in forming the connection between research and teaching (and if one should consider one group of strategies or another, as "Research into Teaching" or "Teaching into Research") are related both to the particularities of the field and the level of study, but also to the educational institution/ department. We investigate approaches for mobilizing research in various stages of training of higher education staff, focusing on the bachelor level, viewed as the most difficult one. An experimental situation is carried on, involving on one hand, a scientific research driven field, namely Physics and on the other hand, a field of study highly valuing also the research on teaching, namely Pedagogy.

Keywords:

Research and teaching link, academic scientometric profile

1. Introduction and Motivation

The current context, in which higher education institutions must combine the teaching activities (student-centered – Li et al. 2015), with the quality assurance procedures, but especially with the scientific research ones, which have a distinct financing line, is reflected both in institutional strategies at international level, as well as in national strategies. In general, although the stated mission of the universities is a dual one, of teaching and research, it is often not transposed in the strategies applied or in the evaluation and reward modalities of performance (Taylor 2007). The situation at international level (see for example the dedicated series of articles from Shin et al. 2013), can be also found in Romania with some peculiarities. In addition to the obvious funding problems, the local or/ and national regulations on teaching and research duties influences the number of students choosing an academic career, especially in the fields of exact sciences, nature and engineering (STEM). In Romania, the very large number of effective teaching hours imposed by legislation (and governmental financing) leaves very little time for research, while the evaluation and promotion criteria are dominated by research. Therefore, the graduating students tend to avoid academic careers in many specialties as, for example, in Physics.

Thus, 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). As mentioned for example in Healey (2000) and Brew (2003), how the academic environment interprets the terms research, scholarship or performance and that of teaching can influence the connection between research and teaching.

As 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 in this article approaches of integrating correlated research and teaching. Finally, we present the design and results of an experimental situation that targets students and academics from two faculties of the University of Bucharest with a different profile, namely Faculty of Physics and Faculty of Psychology and Education

Sciences. The experimental situation we present, targeted the students from the second year of study in bachelor programmes: Physics and Technological Physics (Applied Engineering Sciences) and Pedagogy students. The first fields of study are mainly connected with pure scientific research in applied and natural sciences and less with research on teaching, while the last is highly connected also with research on teaching strategy.

2. Approaches for linking research and teaching in higher education

Although, on an individual level, balancing research with teaching activities is necessary for each academic and, therefore, to stimulate teaching from a research perspective, the literature reviews different perspectives on the most influential factors in forming the research and teaching link. C.L. Colbeck (1998) explains that the time allocated for research and teaching is not directly reflected in their results measured by the number of publications and, respectively, through the evaluation of students. He indicates as main factors both, the individual motivation and ability, and the contextual factors (resources, disciplines and institutional ones). L. Elton (2001) considers that among the factors that influence the strategies of forming the connection between research and teaching are: the evaluation unit; the dominant level of competence (teaching or research); stakeholder perspectives (academic staff, students, administrators, funding bodies) and cultural factors. Combining with several other studies and reviews, one can conclude that the main (influential) factors in forming the connection between research and teaching at the level of a university are: the type of department (oriented mainly toward research or teaching); type of discipline (applied disciplines vs. fundamental); the level of studies (bachelor, master or doctorate).

Recent articles (e.g. Malcolm 2014) indicate ways in which the relationship between research and teaching could or should work. Considering both the institutional profile, the type of discipline, but also the profile of the academic staff, as Jenkins & Zetter (2003) point out, the connection between research and teaching can be made in both directions: from "Research into Teaching" [RtoT] and from "Teaching into Research" [TtoR]. Of course, both approaches, [RtoT] and [TtoR] need to be balanced by domain and department (Rowland 1996) until the two activities tend to overlap, while the learning process is the one that must remain at the intersection of the two. For a predominantly research-oriented department, [RtoT] strategies are more appropriate, while for a teaching-oriented one, [TtoR]. There is also a third type of strategies, of a general nature, needed for both types of departments. For an extended overview, see for example (Senaratne et al. 2006).

Consistent with the two types of approaches, the most widely used model to describe the formation of the link between research and teaching was developed by M. Healey (Healey 2005), distinguishing between student and teacher focus and content versus process. Based on the ideas of R. Griffiths (2004), the literature review, as for example (Senaratne et al. 2006) or (Elken and Wollscheid 2016), agrees on four ways in which research can be embedded in teaching. Research-based teaching can take different forms depending on the degree and manner in which research is incorporated into teaching:

- "research-led (students learn about research results)";
- "research-oriented (students learn about research processes)";
- "researched-based (students learn as researchers)";
- "research-tutored (students elaborate or discuss / analyse research works)".

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). However, as mentioned for example in Griffiths (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. The didactic approach can influence the relationship between research and teaching depending on if it is a deep or a surface approach (Brew 2003), in other words if is focused on conceptual changes or more on transmitting the information. 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 (as in Romania ARACIS).

In addition, the level of competence can play an important role. Thus, the way in which the research is interpreted (result-oriented or learning-oriented) depends not only on: department, field, level of study, but also most often on the academics' profile. Thus, we can discuss about academics who may have a dominant research profile, a teaching one or seldom, a balanced one (mixed: research and teaching). Moreover, the profile of academics is continuously changing. The evaluation of the performance in universities is inclined towards indicators that measure research results, the tendency being to increase the number of quantitative indicators (Bogt & Scapens, 2012). The financing modalities of universities, including research grants, the desire to be in the best positions in international hierarchies, determines many universities to adopt recruitment and reward strategies that encourage academics with a large number of scientific publications in journals with a high impact factor (see for example also Douglas 2013, Parker 2012, Gendron 2008). Several studies address the problem of correlating the research productivity and the quality of teaching, as for example, (Cadez et al. 2017). The authors emphasize that an evaluation based on research performance is not detrimental to the quality of teaching. The same is found in the analysis published by Palali et al. (2018).

As repeatedly stated in literature (Senaratne et al. 2006), creating research topics on teaching is viewed as less complicated, even if despite its quality,this type of research is not always valued especially for applied sciences. On the other side, the transfer of research into teaching is comparatively more difficult than from teaching into research, demanding to a larger extent the involvement of students. Thus, in the literature, most articles are aimed at integrating [RtoT]. Likewise, we propose below, an experimental situation in two different fields of study: Physics and Education Sciences.

3. Experimental situation

In order to investigate the main factors in linking research and teaching and the ways of integrating research into teaching, we initiated an experimental situation with academic staff from the University of Bucharest, as one of the reference institution at national level. The questions to be investigated aimed to look for possible correlations between the teaching performance of the academic staff and their scientometric profile. Through questionnaires administered to students, we tried to investigate to what extent there was a connection between research and teaching, but also the student satisfaction / well-being.

Below, we briefly describe the experimental situation taking place in the fall of 2019 at the Faculty of Physics and Faculty of Psychology and Educational Sciences (University of Bucharest) and the results obtained so far, as we aim to further investigate the proposed research problem.

3.1. Description

The experimental situation took into account some of the main factors mentioned in the literature as relevant in forming the connection between research and teaching. As mentioned above, we selected two faculties with different profiles, and decided to conduct the experimentation with second-year bachelor students. As the literature indicates, the research and teaching link is most difficult to achieve in the bachelor cycle (McLernon and Hughes 2003; Lindsay et al. 2002; Jenkins 2000), especially for the first two years of study.

3.1.1. Research problem

Research problem: How is the transfer of research into teaching or teaching into research 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?

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?

Research hypothesis: We have formulated several research hypotheses, but left this point open to further development. For example:

- 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), 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 prises etc.) might be different, depending on the field of study.

3.1.2. Research method

Sample selection: From each faculty, we chose one lecturer, if possible at entry level, and one full professor, trying to make the selection as similar as possible in between departments (age, experience, scientometric scientific profile etc.). The lecturer is equivalent to assistant professor, should have a PhD in the field of study and already some minimal number of scientific publications (the number is field of research dependent).

Each academic involved in the experimental situation selected a topic related to scientific research (apart from the minimal curricula they have to teach in the study programme), which can be accessible to the second year bachelor students, as target audience. No teaching methods or approaches were imposed. As the researched based teaching should become (if is not) part of regular lectures, the academics addressed at once to all students following a study programme, complying with their lecture schedule. Given the short period of time, the experimental situation intended that the teachers will design the lecture 'researched-led' or 'research-oriented', but for Education Sciences it was rather 'research-tutored' (Griffiths 2004).

The sample lectures on research topics took place at the two faculties during the same week. Due to schedule constrains, the lectures for future physicists were hold in the same day by the lecturer and the full professor, while the ones for the Pedagogy students were two days apart. The target group was not changed, but small differences in attendance occurred. Also due to the specificity of the field of study, the groups are not equivalent numerically in between faculties. While for Pedagogy, there were around 50 students present, for Physics, the average was around 30 students per lecture.

The quality of the variables needs carefully monitoring because it is difficult to initiate equivalent situations in different fields of study. An additional risk was assumed because two of the academics involved (the full professors) knew the purpose of the research. We intended to initiate a controlled model.

Data collection: Data from the experimental situation was collected online, using Google Forms. After the sample lectures, both, the students and academics were asked to answer one questionnaire with several parts. For the students, the questionnaire was anonymous, but if agreed, interviews could be furthered carried on.

Variables: For our investigation, we use several sets of variables in order to establish both, the academic staff and the students' profile and to investigate the impact of the lectures on students.

Variables that describe the academic staff are:

- 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.

The variables that describe students include:

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

Dependent variables (criterion variables) are grouped in two categories, one to investigate the student appreciation on the impact of lecture, the other to reflect the opinion of the academics involved.

In the online questionnaire, the student evaluated 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.

An overall score for the teaching performance is also asked. The first part of the questionnaire was specifically designed to resemble to some extent "The questionnaire for evaluation of academics by students" used in the University of Bucharest. In the second part, the students were asked to evaluate the research topic: interesting; understandable; motivating to further study etc. Among the other questions, the overall scientific impact is analysed (interested in research / motivated in the spirit of the research).

Separately, each of the academics evaluated the scientific impact on students and how they respond to certain information / stimuli during the lecture (as the Nobel Prize, impact factor of a publication). They were also asked about the effort involved in preparing the lecture and the teaching methods they have used.

3.2. Results

The data were analysed using JASP (JASP 2019), both the graphs and tables being generated with this software.

For academics, their scientific profile was needed and even if known in the study, they will be further identified as LE for the lecturer and PE for the professor in Education Sciences and LP and PP for the lecturer and professor of the Faculty of Physics, respectively.

Below, selected results from the investigation of the pedagogical skills and also of the impact of the research topic are presented. The percent of respondents varied with the field of study. While almost all Pedagogy students present have answered the questionnaire (probably used with and valuing this type of research), we have registered answers from only half of the Physics students. The questions asking to an evaluation from 'total disagreement' to 'total agreement' were scaled for the data analysis from 1 to 5. The students were asked to evaluate the overall teaching performance of the academics on a scale from 1 to 10 (as the grading system in Romania). Selected results from the descriptive statistics on the teaching performance are presented in Table 1, where the first set of results refers to how good the aim of the lecture was formulated (lecture objectives column), the second to the extent to which the communication from students was encouraged (second column of answers) and the last, the overall performance.

	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. Deviation	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).

An overall look at the descriptive statistics (as in the selection), does not show significant differences for the two academics from educational sciences (LE and PE), while for the one of physics (LP and PP) there are.

For the academics from Physics, according to scores, professor's knowledge is more valued by the students, as well as his overall performance and relation to students, but the students feel more encouraged to communicate by LP rather than PP.

Table 2 includes some of the results from the investigation on the impact of the research topic in the sample dedicated lectures.

	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.

The correlation of different variables was analysed twofold: as an overall, for both faculties, but also separately, on 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 is any correlation in between the criterion variables and the academic performance of the students (as for example the average grade from their first year of study, their motivation to study in the chosen field of study/ faculty etc.). We have found no significant correlation with two exceptions, for the score evaluating how interesting the topic was and for the students' willingness to continue to read on the presented research topic, but even in this case was not a significant effect ($r\approx0.2$, $p=0.02<0.05$). The effect was medium when we have separately analysed the answer of the physics students, but only regarding how interesting the topic was.

In a subsequent step, we have searched for different correlations with the academic title and / or the field. 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) are comprised in Table 3.

	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 (LE ↔ PE and LP ↔ PP).

In the students' questionnaire, there were also a series of questions regarding the students' willingness to start working on research, based on their experience with the presented lectures in the experimental situation. In order to check and correlate also with the students' background experience with research topics, we have asked if in the regular lectures, the teachers usually relate to scientific research. The outcomes revealed that is common practice for the Pedagogy teachers, while surprisingly, much less for Physics. The percentage of questioned students already involved in research in their second year of study is 16% in the case of Physics and 4% for Pedagogy. For both, Physics and Pedagogy, around 70% of the students are willing to start to work also on research. Among them, if we talk about the students in Physics, 30% choose the theme introduced by PP and 62% have no preference. For pedagogy, about 50% prefer the theme introduced by PE and 48% have no preference. A preliminary conclusion might be that some of the students feel more confident to work with recognized and experienced academics.

We have further investigated if the 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 teaching in secondary schools are correlated to the recorded scores from the students. The purpose of our research is to see if the research proficiency influences the quality of teaching (as for example in the papers of Cadez et al. 2017, Palali et al. 2018), reversed sense to the study of Feldon et al. (2011) who investigated how teaching experience can contribute to improvement of research skills. The number of academics involved is very small, therefore we cannot expect results that are statistically significant at this level of our study. At a later stage, more academics and departments / faculties will be involved, as this part was the main point of interest in our experimental situation. For now, we have found some negative correlations in between the communication with students and the number of published ISI articles (*r=-0.994* and *p=0.006*) / experience in research (*r=-0.991* and *p=0.009*) of the academics. 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. Another correlation, positive this time, 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 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. On the other hand, young academics in Romania might have to spend less time in preparing lectures as their teaching duties (number of effective teaching hours settled at nation level) are double than the one of full professors. Moreover, if they want to advance in carrier, they need to concentrate on scientific research, as promotion criteria are mainly valuing the publications impact factor, number of citations etc., especially for physicists.

Each of the academics was also asked to approximate the number of interested students during their lecture, the ones that were attentive during the activity etc. 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. Regarding the scientific impact on students and how they respond to certain information / stimuli during the lecture, there were about 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. Similarly, when a scientific article was mentioned, about half of the Physics students were interested, while less than 25% from Pedagogy. The physics students were also interested in the impact factor of scientific journals. No matter their field of study, the majority of students were positively reacting to examples from practice.

4. Conclusion and Outlook

Our study was motivated by some key aspects present in the literature (see for example also the synthesis of 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. Combining these key aspects with the experience of the author as a lecturer in Physics and the collaboration with colleagues from Educational Sciences, 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.

Our 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, a fundamental research driven field. In this case, the 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.

Our results do not necessarily contradict the previous findings that quality teaching is positively correlated to research active academics, but indicate that 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.

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 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).

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. 16% of the Physics students were already involved in a research project, while just 4% from Pedagogy. 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.

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.

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References

ARACIS - The Romanian Agency for Quality Assurance in Higher Education (http://www.aracis.ro/)

Beckman, M., & Hensel, N. (2009). 'Making explicit the implicit: Defining undergraduate research'. *CUR Quarterly* 29(4), 40-44.

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.

Bogt, H. J., and R. W. Scapens. 2012. 'Performance Management in Universities: Effects of the Transition to More Quantitative Measurement Systems.' *European Accounting Review* 21 (3): 451–97.

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.

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.

Douglas, A. S. (2013). 'Advice from the Professors in a University Social Sciences Department on the Teaching-Research Nexus'. *Teaching in Higher Education* 18 (4): 377–88.

Elton, L. (2001). 'Research and Teaching: conditions for a positive link'. *Teaching in Higher Education* 6(1): 43-56.

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).

Feldon, D.F., Peugh, J., Timmerman, B.E., Maher, M.A., Hurst, M., Strickland, D., Gilmore, J.A., Stiegelmeyer, C. (2011). *Graduate Students' Teaching Experiences Improve Their Methodological Research Skills*. Science (New York, N.Y.) 333: 1037

Gendron, Y. (2008). 'Constituting the Academic Performer: The Spectre of Superficiality and Stagnation in Academia'. *European Accounting Review* 17 (1): 97–127.

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.

JASP Team (2019). JASP (Version 0.11. 1)[Computer software]

Jenkins, A. (2000). 'The relationship between Teaching and Research: where does geography stand and deliver?' *Journal of Geography in Higher Education* 24(3): 325-351.

Jenkins, A. & Zetter, R. (2003). *Linking Research and Teaching in Departments*. LTSN Generic Centre, Learning and Teaching Support Network, Oxford Brookes University, UK.

Li, M., & Zhao Y. (Eds.). (2015). *Exploring learning and teaching in higher education.* London: Springer.

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.
Malcolm, M. (2014). 'A Critical Evaluation of Recent Progress in Understanding the Role of the Research-Teaching Link in Higher Education'. *Higher Education* 67 (3): 289–301.
Marsh, H. W. & Hattie, J. (2002). 'The Relation Between Research Productivity and Teaching Effectiveness – Complementary, Antagonistic, or Independent Constructs?' *The Journal of Higher Education* 73 (5): 603–41.
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.
Parker, J. (2012). 'International comparisons of the integration of research into undergraduate degrees in the social sciences'. *CUR Quarterly* 32(3), 28-33.
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.
Shin, J.C.; Arimoto, A.; Cummings, W.K.; Teichler, U. (Eds.). (2013). *Teaching and Research in Contemporary Higher Education. Systems, Activities and Rewards*. Dordrecht: Springer.
Taylor, J. (2007). 'The Teaching: Research Nexus: A Model for Institutional Management'. *Higher Education* 54(6): 867–84.