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## Assessing innovation-related competences in the MaRIHE program: Teacher and student perceptions

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### Abstract

The paper aims at expanding the body of research on innovation pedagogy and competence assessment by exploring the teaching and learning of innovation-related competences in an Erasmus Mundus Master program in Research and Innovation in Higher Education (MaRIHE). It does so by comparing the results of two quantitative case studies on MaRIHE teachers' and students' self-assessment of innovation-related competences. Results reveal that teachers' perceptions of facilitating innovation-related competences and learners' perceptions of acquiring them are generally favorable and complement each other. Nevertheless, there is considerable incongruity between the two stakeholder groups with respect to specific innovation-related competences. Furthermore, overall student satisfaction with their competence level is lower than teacher satisfaction with their contribution to its development. The study offers a practical approach to the assessment of innovation-related competences that brings together the perspectives of different stakeholders, highlights possible gaps in teaching and learning, and advances innovation pedagogy in higher education.

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## 1. Introduction

In the process of global transition to a knowledge-based economy, increased attention has been paid to the role of innovation in higher education institutions and degree programs. Recognizing the need to ensure that graduates are equipped with competences required for their entry into the labor market, the EU has committed to endorse programs fostering student entrepreneurship and innovation skills (Bologna Process, 2015). Along with that, professionalization of academics as teachers, regarded by the EU as “the essential challenge for the higher education sector” (High Level Group Report, 2013, p. 12), has gained significance in policy discussions. In the given context, recent pedagogical approaches have been geared towards enhancing students’ innovation-related competences (IRCs) and contributing to their personal and professional growth.

At the same time, innovation and entrepreneurship competences in higher education and their assessment, in particular, remain massively underresearched. While studies on competence measurement concentrate mostly on the assessment of students’ competences (Bjornali & Støren, 2012; Cuenca *et al.*, 2015; Zlatkin-Troitschanskaia, Shavelson, & Kuhn, 2015), or on the assessment of teachers’ technological pedagogical content knowledge (Schmidt *et al.*, 2009), studies on innovation pedagogy and faculty abilities in cultivating IRCs in students are remarkably scarce. Likewise, while a number of studies deal with measuring IRCs in higher education (Cuenca *et al.*, 2015; Watts, Marín-García, García-Carbonell, & Aznar-Mas, 2012), studies that investigate students’ perceptions of innovation and entrepreneurship competences are, as it were, anecdotal (Edwards, Sánchez-Ruiz, Tovar-Caro, & Ballester-Sarrias, 2009; Edwards-Schachter, García-Granero, Sánchez-Barrioluengo, Quesada-Pineda, & Amara, 2015).

Accordingly, this study aims to compare and contrast the perceptions of students and graduates on the acquisition of innovation-related competences in the Master course in Research and Innovation in Higher Education (MaRIHE) with the teachers’ self-assessment of their effectiveness in developing these competences in the students. MaRIHE is a European-funded joint master degree program, started in 2012 by a consortium of four institutions: Danube University Krems, University of Tampere, Beijing Normal University, and University of Applied Sciences Osnabrück. The analysis is guided by the theoretical framework of innovation pedagogy which aims to improve the relevance of university training and foster the link between education, research, and labor market (Lehto & Penttilä, 2013). Specifically, the study employs the *INCODE Barometer* - a framework of 25 innovation-related competences that were elaborated in the course of the *Innovation Competencies Development Project* funded by the EU in 2013 (Watts, García-Carbonell, & Andreu-Andrés, 2013).

The *INCODE Barometer* was designed to assist in the training and assessment of innovation-related competences in higher education by measuring three dimensions of capacities and skills: individual, interpersonal, and networking. The first dimension accounts for the abilities to use available resources ingeniously and present task-oriented and creative ideas, as well as new ways to implement them; to identify relationships among different components of a given task and orient it towards a given target; to face a task from different points of view, evaluate the advantages and disadvantages of potential actions, and foresee how events will develop; and, finally, to show enthusiasm, persistently pursue goals, and take daring yet reasonable risks. The second dimension comprises the abilities to listen to teammates, establish constructive group relationships through dialog, and transmit ideas effectively; to collaborate actively and contribute to group functioning; to take initiatives, drive others to act, and face conflicts with flexibility to reach agreement. The last dimension pertains to the abilities to apply ethical values in decisions and actions, take into account the implications of a given task for society, work in multidisciplinary and multicultural environments, and use networking contacts to reach goals.

Piloted and tested extensively with university students (Marín-García, Pérez-Peñalver, & Watts, 2013; Watts, Aznar-Mas, Penttilä *et al.*, 2013), the *INCODE Barometer* acts as a validated instrument to measure innovation competences in a university setting, and can also be utilized for self-assessment purposes. Aligned with the aims of the European Union Erasmus Programs, it is well fit for a study of an Erasmus Mundus Joint Master Degree program. In the context of the MaRIHE program that specializes in research, innovation, and management in higher education, IRCs are conceptualized as generic competences.

## 2. Methodology

This paper analyzes the perceptions of two stakeholder groups (1 - students and graduates, and 2 - lecturers) with respect to the development of innovation-related competences in the MaRIHE program. Results of two exploratory case studies were utilized to compare students' and graduates' perceptions of the development of innovation-related competences in the program with the lecturers' perceptions of their contribution to the respective development. Both cases adopted self-assessment as a research method and incorporated the INCODE innovation-related competences into the content of the instruments.

The first study, conducted in March 2015, explored the concept of *learning innovation* in the MaRIHE program by investigating students' and graduates' perceptions of the program's effectiveness in facilitating their development of innovation-related competences. For that purpose, a questionnaire was sent to a sample of 56 students and graduates, of which 39 completed it successfully. Participants were asked to provide answers referring to their background and to indicate, firstly, their current level of IRCs acquired as a result of studying in the MaRIHE program, and, secondly, the level of IRCs that would be optimal for their professional activities. The survey featured other questions as well, but only those pertaining to students' and graduates' self-assessment of innovation-related competences were utilized for the purpose of this study. Statistical tests confirmed that the instrument was both reliable (Cronbach's  $\alpha = 0.905$ ) and sufficiently valid (Factor Loading, PC test  $> 0.3$ ).

The second study examined the concept of *teaching innovation* by analyzing teachers' perceptions of their innovative pedagogy and their contribution to the development of students' innovation-related competences. The study was conducted in December 2015 and employed a mixed method research approach, comprised of qualitative and quantitative analyses. As part of the latter, a survey was designed and distributed to 51 course supervisors and guest lecturers, 32 of which completed all the required sections. The instrument as a whole was designed to test four dimensions and was validated by a panel of experts; however, for this study, only quantitative findings derived from one dimension were utilized, namely those pertaining to *the teachers' self-assessment of teaching innovation-related competences to students*. Statistical tests demonstrated that the instrument was both reliable (Cronbach's  $\alpha = 0.980$ ) and sufficiently valid (Factor Loading, PC test  $> 0.3$ ).

## 3. Data analysis

### 3.1. Assessment of the current level of IRCs development

The graph below (*Figure 1*) juxtaposes MaRIHE students' and graduates' perceptions of the average development of each innovation-related competence in the course of the program with the lecturers' perceptions of their contribution to the respective development. Both indexes created for this purpose use a 5-point Likert scale, where 1 indicates no development/contribution, 2 - insufficient, 3 - satisfactory, 4 - good, and 5 - excellent development/contribution.

Firstly, it can be observed that the teachers' perceptions of their contribution to the development of student IRCs are more optimistic than the students' perceptions of their actual development. Only four out of 25 IRCs were rated lower by the teachers than by the students (IRCs 1, 14, 17, & 24), and the differences are practically insignificant. While the students viewed their IRCs 3 - *present new ways to implement ideas*, 8 - *foresee how events will develop*, and 11 - *take daring yet reasonable risks* as least developed, the teachers supposed they were least effective in developing IRCs 7 - *use available resources ingeniously (innovatively)*, 8, 11, and 20 - *face conflicts with flexibility to reach agreement*, and also assessed IRC3 rather low.

Similarly, while the students held IRCs 16 - *collaborate actively*, 17 - *contribute to group functioning*, and 24 - *am able to work in multicultural environments* as most advanced, the teachers presumed that they were most successful in facilitating IRCs 9 - *show enthusiasm*, 16, and 24, which reveals congruity of assessments. However, seven competences were assessed considerably higher ( $> 0.5$  point difference) by the latter group than by the former: IRCs 11 (0.94 point difference), 9 (0.9 point difference), 7 (0.6 point difference), 22 (0.58 point difference),

2 (0.54 point difference), 3 (0.53 point difference), and 10 (0.52 point difference). Here, the teachers’ idea of the extent, to which their teaching should be instrumental in developing these IRCs, is at variance with the students’ apprehension of their levels.

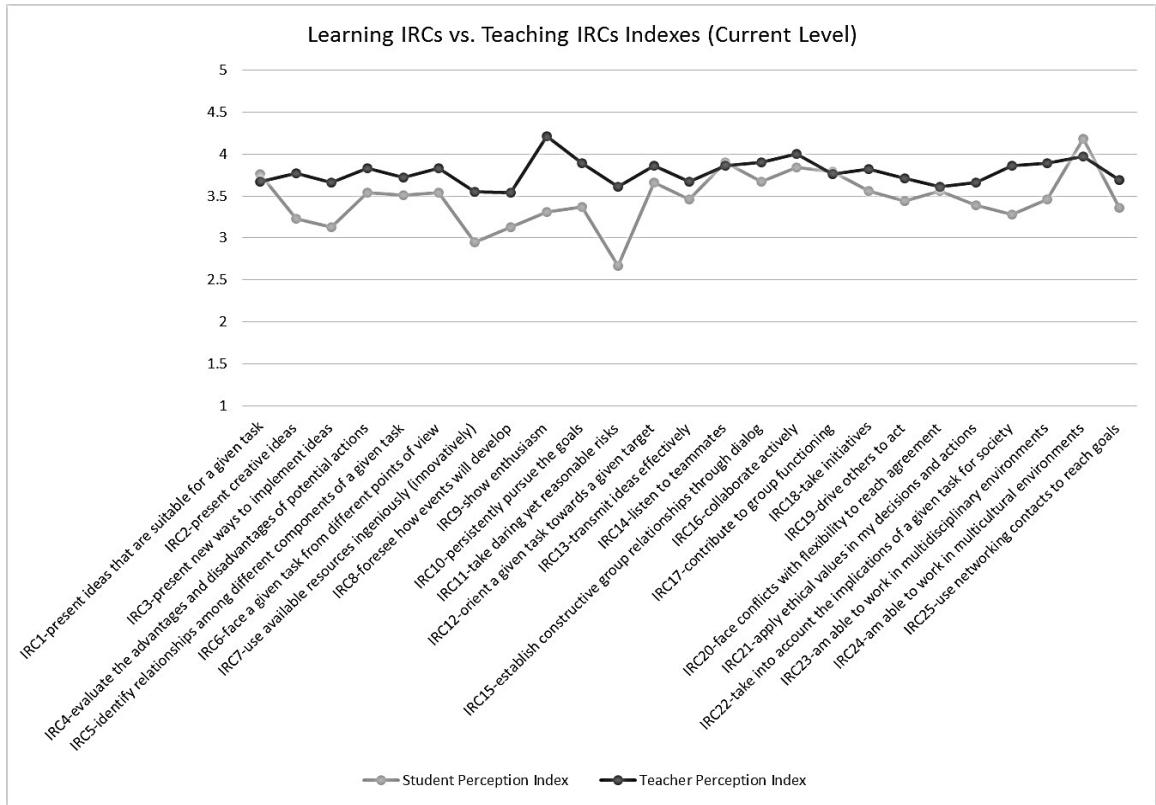


Fig. 1. Comparison between the students’ and graduates’ average assessment of current IRCs development and the teachers’ average assessment of their contribution to this development (aggregate indexes).

Furthermore, both survey results demonstrate that the teachers were confident in that they contributed to the development of every single IRC, whereas some students and graduates (2.6%-15.4%), on the contrary, considered at least one out of 23 IRCs (excluding IRCs 1 & 24 that were believed to be acquired by everybody) as not developed at all. Likewise, only one faculty member reported an insufficient degree of contribution to the development of five IRCs. On the other hand, up to a quarter of the students and alumni (2.6%-28.2%) declared that their IRCs (except *IRC17*) were developed somewhat insufficiently. Besides that, in 16 out of 25 instances, the instructors that perceived their teaching as satisfactory for the enhancement of a specific IRC outnumbered the students who deemed these IRCs as sufficiently developed; and 17 out of 25 IRCs were more often rated as “good” by the teachers than by the students.

Finally, the opinions on the “excellence” of each competence level appear rather polarized. In contrast to the two previous scales (“satisfactory” and “good”), the students prevailed in 14 out of 25 instances. Additionally, they were much more convinced (by 20.6%) of the excellence of their ability to work in multicultural environments (*IRC24*)

than the lecturers of their excellent ability to aid with it. Conversely, the number of lecturers who perceived their teaching as excellent for training *IRC9 - show enthusiasm* exceeded the number of students who believed it was excellently developed by 22.1%. Remarkably, no student or graduate estimated the current level of *IRC11 - take daring yet reasonable risks* as “excellent”, as opposed to 9.4% of teachers who surmised their classes would excellently promote it.

### 3.2. Assessment of the optimal level of IRCs development

The study also analyzed and compared the perceptions of the two stakeholder groups with respect to the average optimal development level of innovation-related competences. This analysis was run to identify proxy measures for the students’ and alumni’s satisfaction with their current development level of IRCs, as well as for lecturers’ satisfaction with their contribution to the respective development. For that purpose, indexes were computed for both groups, where 1 refers to IRCs as not desired, 2 - to an optimal level that is same as current, and 3 - to an optimal level that is higher than current. *Figure 2* illustrates the average optimal level of development for each innovation-related competence, as perceived by the students and by the lecturers.

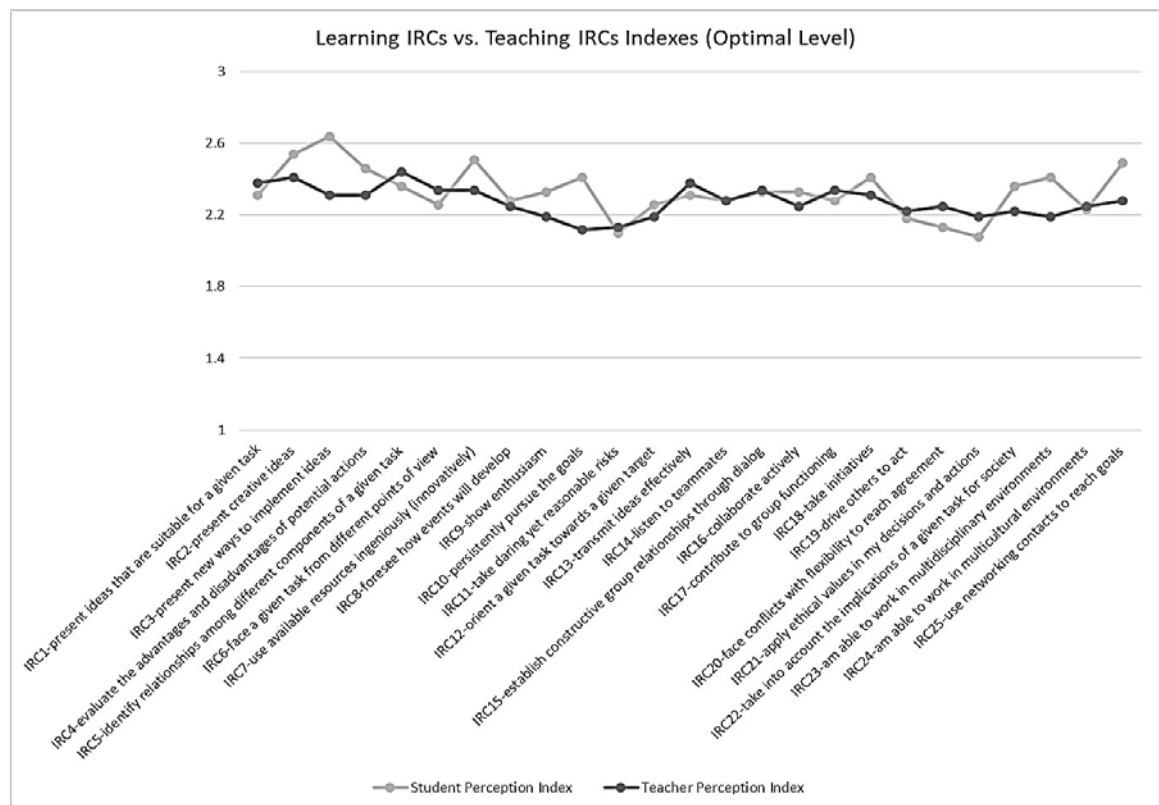


Fig. 2. Comparison between the students’ and graduates’ average assessment of optimal IRCs development and the teachers’ average assessment of optimal IRCs development for the students (aggregate indexes).

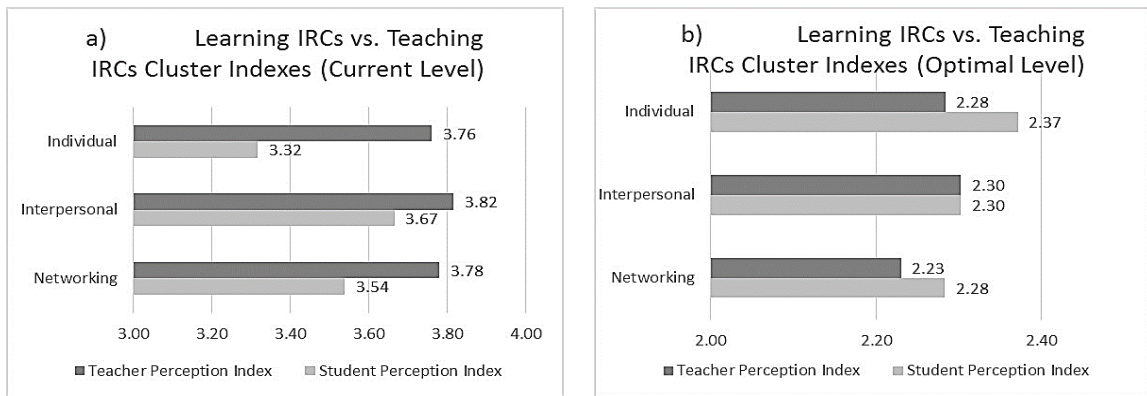


Fig. 3. Comparison between a) the students' and graduates' average assessment of current IRCs development and the teachers' average assessment of their contribution to this development; and b) between the students' and graduates' average assessment of optimal IRCs development and the teachers' average assessment of optimal IRCs development for the students (cluster indexes).

On average, the incidence of optimal levels of IRCs assessed at a level “higher than current” is greater for the students compared to the teachers. To specify, three IRCs were assessed as desired the most by the students (mean > 2.5), namely IRCs 2 - *present creative ideas*, 3 - *present new ways to implement ideas*, and 7 - *use available resources ingeniously*. Lecturers, on the other hand, seem to perceive their contribution to the development of students' IRCs as sufficient, considering that the means for all IRCs could be approximated to the level described as “same as current” (2.12-2.44 mean range).

In addition, 11 IRCs were assessed higher by the lecturers compared to the students. The largest differences were found with respect to IRCs 20 - *face conflicts with flexibility to reach agreement* (0.12 point difference) and 21 - *apply ethical values in my decisions and actions* (0.11 point difference). Contrastingly, 13 IRCs were assessed higher by the students compared to the teachers. The most notable differences were identified for IRCs 3 - *present new ways to implement ideas* (0.33 point difference), 10 - *persistently pursue the goals* (0.29 point difference), and 23 - *am able to work in multidisciplinary environments* (0.22 point difference). Only in the case of one IRC (14 - *listen to teammates*), the average optimal development level was identified to be the same for both groups.

Furthermore, results reveal that 17 out of 25 IRCs were assessed as “same as current” by more than 50% of student and alumni respondents. Likewise, all IRCs were assessed as “same as current” by more than 50% of teacher respondents except for IRC5 - *identify relationships among different components of a given task*, which was desired at a level “higher than current” by exactly 50% of teachers. Within the same analysis, more than 50% of students assessed the optimal development level of four IRCs at a level higher than current: IRCs 3 - *present new ways to implement ideas* (64.1%), 7 - *use available resources ingeniously (innovatively)* (61%), 2 - *present creative ideas* (59%), and 25 - *use networking contacts to reach goals* (51.3%).

Lastly, the competences that appeared to be the least desired by the students were IRCs 11 - *take daring yet reasonable risks* (23.1%), 21 - *apply ethical values in my decisions and actions* (12.8%), 7 - *use available resources ingeniously (innovatively)* (10.3%), and 20 - *face conflicts with flexibility to reach agreement* (10.3%). With respect to the lecturers, it is worth mentioning that the percentage of respondents listing “not desired” as an answer was identified to be less than 10%.

When the 25 IRCs are grouped into *individual* (12 IRCs), *interpersonal* (8 IRCs), and *networking* (5 IRCs) in accordance with the INCODE Barometer (Watts, García-Carbonell, & Andreu-Andrés, 2013), it becomes apparent that the teachers, in general, rated their contribution to the current development of all types of student competences higher than the students evaluated their levels, which is particularly obvious in the case of *individual* IRCs (0.44

point difference, *Figure 3a*). Consistent with this observation is the fact that the lecturers were less likely to desire higher levels of *individual* and *networking* IRCs for the students than the students themselves. Yet, as regards optimal *interpersonal* IRCs, there was no difference in assessment between the teachers and learners (*Figure 3b*).

Interestingly, with respect to the assessment of the current level of IRCs development, statistically significant differences between students and graduates vs. teachers were identified by means of an independent-samples t-test for both the aggregate ( $t(58) = 8.342, p = .000$ ) and clustered indexes, i.e. current *individual* ( $t(60) = 9.165, p = .000$ ), *interpersonal* ( $t(64) = 6.309, p = .000$ ), and *networking* IRCs ( $t(64) = 6.634, p = .000$ ). At the same time, there were no statistically significant differences between the two groups as regards the assessment of the optimal levels of IRCs development.

#### 4. Conclusion

This study aimed at enriching the existing body of literature on innovation pedagogy by exploring students' and teachers' perceptions of the development of innovation-related competences in the context of a higher education studies program. To achieve this objective, results of two exploratory case studies on students' and teachers' self-assessment of innovation-related competences were compared. The former focused on the concept of *learning innovation* and identified students' and graduates' perceptions of their personal level of IRCs development. The latter explored the concept of *teaching innovation* and elucidated teachers' perceptions of their contribution to the corresponding development.

Overall, both the MaRIHE faculty assessment of their contribution to students' IRCs development and the students' and alumni's assessment of their current levels of IRCs are favorable, and their perceptions, for the most part, complement each other. Nevertheless, there is considerable incongruity between the two stakeholder groups with respect to specific innovation-related competences.

Students are, on average, less satisfied with their current level of IRCs than the teachers with their contribution to IRCs development. To specify, teachers are content with the way they enable students' IRCs referring to presentation of ideas, creativity, networking, adaptability, efficiency, communication, teamwork, and social responsibility. The students corroborate this perception in relation to teamwork, but their self-assessment also suggests that more attention should be paid to the development of other competences, especially those pertaining to leadership. In addition, teachers and learners appear to express diverging opinions regarding the value of IRCs. Thus, a considerably lower number of teachers, as compared to students and graduates, assessed certain IRCs as unnecessary. As a matter of fact, the latter group seemed to show disinterest in developing IRCs referring to risk taking, ethical values, conflict management, and innovative use of resources.

To reiterate, the faculty are both more confident and more satisfied with their teaching of individual and networking competences to students, while students feel less self-assured about their current level of attainment and desire more of these competences. Interpersonal competences, by contrast, have been found to be more effectively taught and learned in the MaRIHE program, insomuch that the students and teachers share similar opinions vis-a-vis the optimal level of their development. Nevertheless, even a modest difference between the two stakeholder groups cannot be discounted, and, although increased consideration must be given to strengthening individual student IRCs, interpersonal and networking competences should not be overlooked by the educators, either. In sum, the heterogeneity in outcomes could be attributed to *teaching*, suggesting that MaRIHE faculty could invest more effort in developing particular IRCs in students. Alternatively, it could be attributed to *learning*, pointing to the students' negligence of the activities meant to enhance those specific IRCs.

The study offers a practical approach to the assessment of innovation-related competences in higher education that brings together the perspectives of different stakeholders and highlights possible gaps in teaching and learning. It advances the practice of innovation pedagogy in the MaRIHE program and promotes the respective conceptual framework for research on educational innovation. Despite the evident limitations, such as non-generalizability of findings, the use of proxy instead of direct measures, and bias that might be associated with self-assessment as a method, similar studies could be conducted for other educational programs that aim to improve the quality and

relevance of university training and establish a close connection between the academia and the labor market that requires innovation-related skills.

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