DESIGNING A TOOL TO MEASURE INNOVATION COMPETENCE SELF-PERCEPTION IN ENGINEERING STUDENTS

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ABSTRACT

This paper presents the development and validation of a survey as a tool to measure innovation self-perception competence in early-year engineering students at the Faculty of Physical and Mathematical Sciences, University of Chile. Based on the INCODE Innovation Competencies Barometer, the self-assessment tool was adapted to the local context, validated, and refined through a pre-pilot and pilot study before the subsequent deployment. This validation included psychometric tests and factor analysis. The results show that the tool is reliable and effective in assessing key dimensions of innovation self-perception, such as creativity, critical thinking, initiative, teamwork, and networking. The information obtained helps identify areas for improvement in educational programs, ensuring that courses align with formative objectives and contribute to developing engineers prepared to address technological and social challenges with an innovative mindset. This tool provides a robust basis for continuous improvement in teaching innovation, aligning academic training with labour market demands and global challenges for engineering graduates.

KEYWORDS

self-assessment, competence measurement, educational evaluation, innovation, CDIO Standards 2, 5, 7.

INTRODUCTION

Engineering education increasingly recognises the critical role of strengthening innovation competence in preparing students to tackle complex global challenges. According to The Oslo Manual (OECD, 2018), innovation significantly improves products, processes, or services. This is well integrated into some LATAM Engineering and Sciences schools, such as the Faculty of Physical and Mathematical Sciences (FCFM) of the University of Chile, the oldest engineering school in Chile.

Innovation competence fosters the ability to identify opportunities, generate novel ideas, and implement effective solutions (OECD, 2018) in students; however, the measurement of competence progression through time has not been achieved yet. Frameworks such as the Innovation Competence Barometer (ICB) identify five essential dimensions for fostering innovation: creativity, critical thinking, initiative, teamwork, and networking (Marín-Garcia et al., 2013). These dimensions align closely with the CDIO Standards, particularly Standard 2, which emphasises learning outcomes tailored to professional and societal needs.

At the Faculty of Physical and Mathematical Sciences (FCFM) of the University of Chile, innovation is a cornerstone of the "Common Curriculum Plan” for early-year engineering students, aiming to prepare graduates with skills that effectively address technological and societal challenges. Three innovation courses (CD1100, CD1201, and CD2201) incorporate methodologies such as project-based learning (PjBL) and challenge-based learning (CBL), which consider group projects, hands-on activities, and interdisciplinary challenges designed to foster collaboration and innovation. For instance, CD1201 introduces students to real-world problems, requiring teamwork and critical thinking to propose viable solutions. This systematic alignment ensures that the curriculum supports the progressive development of innovation competence (Bravo-Cordova, 2021; Hélice, 2022). This set of courses has been taught to early-year students since 2018. Nevertheless, the faculty has not accurately measured the progress of innovation competence to improve educational programs continuously.

As highlighted by Guo et al. (2020), cognitive, behavioural measures, and self-perception—also referred to as self-reflection—are recognised as valid and meaningful dimensions for assessing student learning outcomes. The affective outcomes, such as students’ perceptions of the benefits and experience of project-based learning (PjBL), are among the most frequently applied measures in higher education. This approach acknowledges that students’ self-awareness and evolving understanding of their own abilities are key indicators of learning progression, particularly in the early stages of professional development. Therefore, this study aims to develop, design, and validate a tool focused on students’ self-perceived competence in innovation, aligning with broader educational research that views self-reflection as a critical mechanism for both formative assessment and curriculum improvement (Guo, Saab, Post, & Admiraal, 2020).

The initial design of the tool for measuring the self-perception of students was adapted from the INCODE Innovation Competence Barometer (ICB) developed for the INCODE (Innovation Competencies Development) project of the European Union (Andreu-Andres et al., 2017). Later extended to FINCODA (Framework for Innovation Competencies Development and Assessment), which has been used to assess innovation competence in various educational contexts (Andreu-Andres et al., 2018; Guzmán-Soria et al., 2022; Marín-Garcia et al., 2013; Penttilä, 2012).

The 5-dimension survey used in the ICB (Peñalver et al., 2018) considers the competencies of (1) Creativity, (2) Critical Thinking, (3) Initiative, (4) Teamwork, and (5) Networking (Figure

2). This survey encompasses individual competencies (creativity, critical thinking, initiative), interpersonal competencies (teamwork), and network management (networking). These competencies have been validated in different iterations of this survey, with the most relevant being those of Marín-García et al. (2013), Butter & van Beest (2017) and Keinänen et al. (2018).

The competencies (Peñalver et al., 2018) are as follows:

1. Creativity: Thinking beyond existing ideas, rules, patterns, or relationships.
2. Critical Thinking: The ability to analyse problems, evaluate advantages and disadvantages, and assess the risks involved for a given purpose.
3. Initiative: The ability to make decisions or take actions to implement ideas that foster positive change and influence creative individuals and those responsible for executing the ideas.
4. Teamwork: The ability to work effectively with others in a group.
5. Networking: The ability to engage stakeholders outside the team.

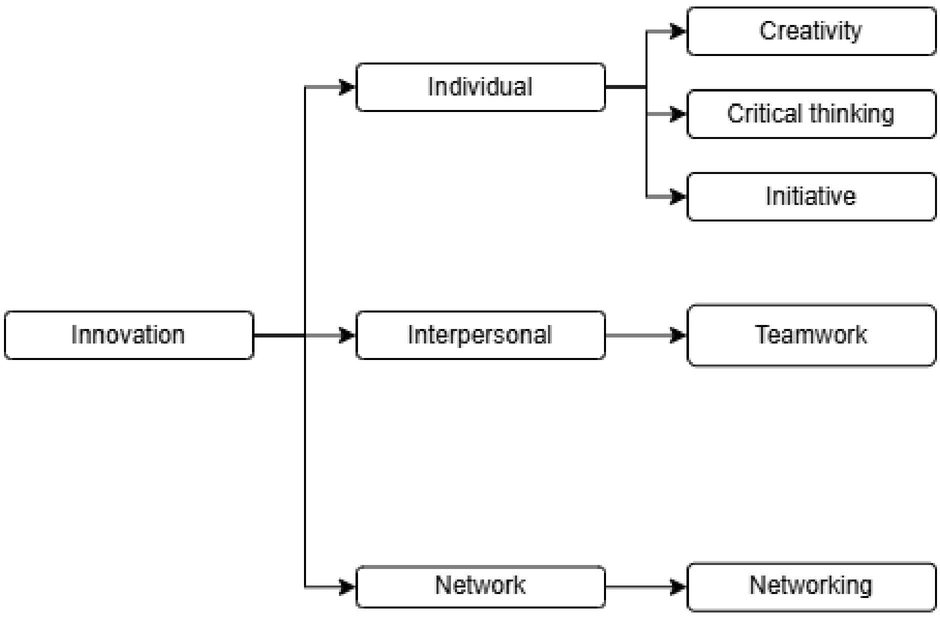

Figure 31. ICB innovation competency tool adapted from Marín-García et al.(2013) and Keinänen et al.(2018)

The survey employs a 5-point Likert scale (Vannette & Krosnick, 2017), with the lowest performance option on the left and the highest on the right (Youn et al., 2018). This makes option 1 "Strongly Disagree" and option 5 "Strongly Agree," providing a balanced middle option at 3 to facilitate decision-making during responses (Vannette & Krosnick, 2017). The ICB survey (Pérez-Peñalver et al., 2018) is detailed in Appendix A, separating the questions by innovation competencies.

The tool was modified and adapted to fit the local Chilean context, statistically validated, and implemented in the three innovation courses taught at the Faculty of Physical and Mathematical Sciences at the University of Chile to ensure relevance and applicability. This adaptation aimed to ensure that the instrument is aligned with the institution's educational objectives and relevant to the experiences of early-year engineering students.

METHODS

The tool design process was carried out in two stages: pre-pilot and pilot, which would allow the final survey to be designed and validated. After the validation process, the survey was applied at the beginning and end of a subsequent semester, resulting in 1005 responses across both applications. Comparative statistical tests were conducted to assess changes in students' perceptions of individual innovation competence and to validate the tool. Figure 1 describes the design and validation process to finalise the survey and its subsequent application in its definitive version.

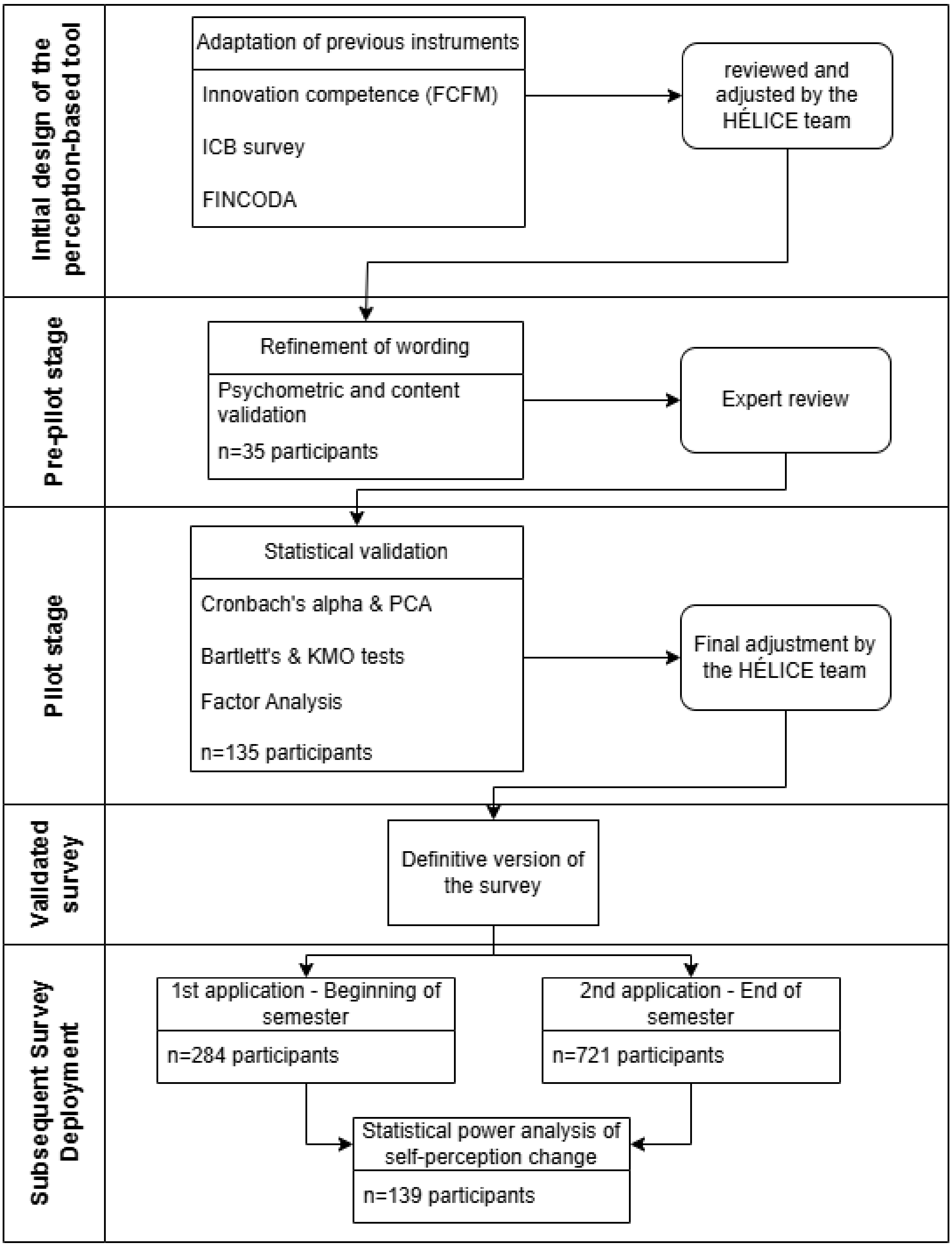

Figure 32. Diagram of the design, validation, and application process of the innovation competence perception-based tool

Pre-pilot stage

This phase focused on identifying issues related to the survey items' clarity, adequacy, and comprehensibility. As part of the pre-pilot stage, a psychometric validation of the phrasing of the questions was conducted by a committee of experts in the field (Aithal & Aithal, 2020), followed by implementation with a small sample of students (n=35) to gather feedback on question comprehension. A small sample size at this stage is justified as an exploratory effort to refine the instrument before broader implementation. This aligns with standard practices in survey development, where initial testing with limited participants identifies ambiguities or misinterpretations (Creswell, 2014).

The design of the pre-pilot survey was based on the current model of innovation competence in the engineering and science program defined for the first progression level of the competence (Hélice, 2022) and the ICB survey from the INCODE project with its underlying framework of five dimensions. The ICB survey was redesigned to adapt it to the context of the pre-pilot deployment at the University of Chile. This redesign included rephrasing several questions to clarify them for students recently admitted to higher education. Minimal changes were made to the original wording to prioritise the coherence of the survey without introducing additional bias. The original order was preserved to avoid introducing new biases due to order changes before subsequent analyses in this study (Elson, 2017). In any case, validation is required when applied in a context different from validated studies.

Pilot stage

After the pre-pilot stage, psychometric tests were conducted to evaluate the tool’s internal consistency and structural validity. The refined survey was tested on a larger sample (n=135) to assess reliability and structural validity. Reliability tests were conducted on the survey for each dimension using Cronbach’s Alpha for internal consistency, in which 1 indicates perfect internal consistency, above 0.9 is excellent, and above 0.7 indicates high consistency (Aithal & Aithal, 2020). Additionally, data and question quality were assessed using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure (Kaiser, 1970).

Then, a factor analysis was used to identify the appropriate number of factors to separate the questions. This factor analysis was conducted using Principal Component Analysis (PCA) with Varimax rotation (Dilbeck, 2017), which produces orthogonal factors and a better explanation of the descriptive concept of each factor. This factor analysis allowed us to assign questions to each factor, thereby determining the final dimensions of the new survey.

Subsequent Survey Deployment

After the validation process, the survey was applied at the beginning and end of a semester, and it involved 1005 responses. Comparative statistical tests (Student’s t-test) were conducted to evaluate student self-perception changes over time. These applications allowed for identifying statistically significant differences in perceived innovation competence. To further validate the survey, statistical power analysis was performed at each stage to ensure survey validity, revealing adequate power for detecting medium and large effect sizes (See Appendix E).

RESULTS

The results obtained from the pre-pilot and pilot stages and the subsequent deployment are presented below.

Pre-Pilot Stage Results

First, during the psychometric validation of the wording of the questions in the first version of the survey, experts reviewing these questions identified ambiguities in the phrasing of questions 1, 4, 5, 7, 8, 9, 11, 12, 19, and 21 (See Appendix A). Then, the survey was administered via the university's Learning Management System (LMS) "Ucampus" to n=35 participants. Among these, 19 were students, including 2 in the pre-admission stage to higher education, one second-semester student in the curriculum, and 16 third-semester students. This sample also included 16 teaching assistants from Level 1 innovation courses. Feedback was collected to adjust the questions' wording and improve the survey's overall structure. Six students highlighted difficulties in understanding the concepts in the questions within the Networking dimension, while seven teaching assistants raised similar concerns. No other comments were recurrent.

Pilot Stage Results

The refined survey was administered to a larger sample of early-year engineering students (n=135). The results of the improved version of the survey were used to assess the consistency of the initial tool, yielding the following Cronbach's Alpha reliability scores: 0.79 for the Creativity dimension, 0.79 for Critical Thinking, 0.80 for Initiative, 0.57 for Teamwork, and 0.83 for Networking.

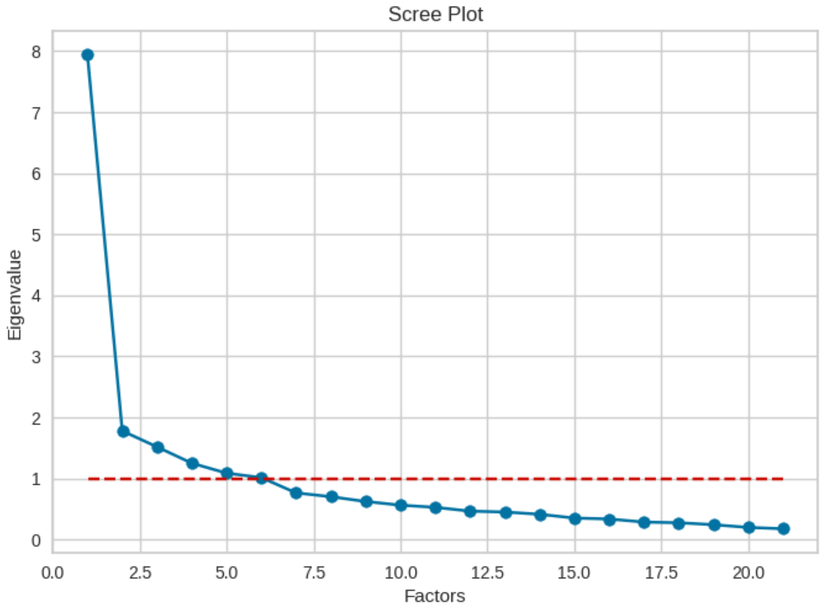

Figure 33. Eigenvalues by a number of factors

Subsequently, Bartlett's sphericity test indicated statistical significance for rejecting the null hypothesis of no correlation among the variables, with a chi-squared value of 1522.83 ($p < 0.001$). This confirmed that measured dimensions were independent; therefore, a factor analysis could be performed on the results. Also, the KMO adequacy test yielded a value of 0.87, above the recommended threshold of 0.70 (Kaiser, 1974) within the meritorious range, confirming that the data were appropriate for factor analysis. Principal Component Analysis (PCA) with Varimax rotation revealed six underlying factors corresponding to the original structure of the instrument, providing evidence of structural validity. The minimum variance threshold for factor analysis was achieved with six factors, as shown in Figure 3, which suggested the division of the dimension "Teamwork" into "Team Collaboration" and "Team

Moderation” in the survey. Also, question 7 showed low suitability (0.37) according to the communality’s criterion (see Appendix B) and was subsequently excluded from the survey.

Then, factor analysis was applied to the new survey structure, and the results are shown in Table 1. Within this new survey, reliability scores for individual dimensions were as follows: 0.82 for Creativity, 0.81 for Critical Thinking, 0.82 for Initiative, 0.76 for Teamwork Subdimension 1 (referred to as Team Moderation), 0.76 for Teamwork Subdimension 2 (referred to as Team Collaboration), and 0.83 for Networking, indicating high internal consistency across all dimensions.

Table 13. Factor loadings and communalities for the final survey

Question	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
1			0,845				0,797
2			0,676				0,557
3			0,601				0,563
4	0,583						0,476
5	0,687						0,584
6	0,691						0,666
8	0,589						0,497
9		0,679					0,624
10		0,619					0,554
11		0,408					0,427
12		0,514					0,511
13					0,639		0,503
14					0,767		0,720
15					0,511		0,574
16		0,466					0,518
17						0,680	0,574
18						0,760	0,674
19				0,814			0,786
20				0,503			0,552
21				0,733			0,730

Survey Designed for Deployment

Due to the lack of clarity observed in the pre-pilot stage, two brief attention check questions were included within the intermediate sections of the survey. Abbey and Meloy (2017) state that multiple attention checks increase inattentive respondents' capture rate. Therefore, these questions aimed to improve response quality without compromising deliberate response behaviour (Kung et al., 2018). The questions were one directed type, and one instructed manipulation type. These were: “The following question is simple, and you must answer by selecting the 'Strongly Disagree' option: my work team for this semester's course has 20 members. It is noted that the composition of teams in Level 1 innovation courses has a maximum of 6 members, without exception.

Finally, a closing question section was included at the end of the survey to collect additional information that respondents may wish to provide. The definitive version of the survey is presented in Appendix D.

Subsequent Survey Deployments

The results of the t-tests revealed statistically significant improvements in students' perceptions of their innovation competence. Significant improvements were detected in several dimensions, particularly creativity, teamwork, and critical thinking. However, the students did not perceive changes in Team Collaboration.

Detailed results of the power analysis are provided in Appendix E. The power analysis results allow the identification of medium-sized effects (0.5) with a power of 0.54 and 0.98 in the pre-pilot and pilot stages, respectively, and large-sized effects (0.8) with a power of 0.91 and 1.0, respectively.

These findings suggest that the tool is validated and can detect meaningful changes in self-perceived innovation competence over time.

DISCUSSION

This study presents a validated tool for measuring self-perception aspects of innovation competence among first-year engineering students, providing a framework for assessing and enhancing critical skills such as creativity, critical thinking, initiative, teamwork, and networking. The tool's development and implementation align with the CDIO Standards, ensuring relevance to academic and professional contexts.

The iterative design process, supported by expert reviews and pilot testing, enabled the creation of a culturally and contextually relevant instrument. Based on the findings from the pre-pilot, the definition of terms was essential to ensure a proper understanding of the survey questions. Some questions were often characterised by their generic nature, ambiguity, lack of clarity, and unfamiliar terminology for the first-year students, making them challenging to comprehend and answer accurately. Mainly, concepts like "networking" were unknown to respondents, which triggered the final survey to be organised into sections.

Each section represents a dimension of the innovation survey to be implemented. To facilitate comprehension, definitions for each dimension were included within the survey to contextualise the questions and clarify what each dimension seeks to measure.

In addition, the pilot stage revealed the tool's validation for efficacy in measuring the self-perception of innovation competencies of the target population. Factor analysis during this stage required subdivision of the teamwork dimension into “Team Collaboration” and “Team Moderation” for a better assessment. This adjustment was based on the results of the minimum variance threshold that indicated six factors.

Results from the large-scale implementation phase demonstrated the tool's capacity to evaluate the dimensions within self-perception innovation competencies. These results offer actionable insights for targeted curricular improvements. For example, incorporating project-based learning experiences for improving the Team Collaboration aspects.

So, combining qualitative-expert judgment and quantitative measurements allowed to define an appropriate survey for self-perception of the innovation competency. Additionally, integrating project-based and challenge-based learning methodologies provides a robust foundation for fostering innovation within the curriculum. Future iterations could expand on these practices by incorporating digital platforms for real-time data collection and analytics, enhancing both instructional strategies and student engagement (Hélice, 2022). Additionally, exploring interdisciplinary applications of the tool in engineering and other domains will contribute to the broader understanding of innovation competence in higher education. Future research underscores the importance of embedding systematic evaluation frameworks within engineering curricula to cultivate graduates capable of addressing complex challenges in a rapidly evolving world.

CONCLUSIONS

The statistical methods for validating the survey at different stages show that the procedure was sufficiently robust to produce a context-aligned tool for evaluating self-perception innovation competencies among early-year engineering students at the University of Chile. The study also highlights the efficacy of the adapted ICB tool in offering actionable insights for curriculum development, offering a basis for curricular adjustments that can better align training with desired learning outcomes. By considering the particularities of the local context, this study contributes to the continuous improvement of innovation education and aligns academic training with the demands of the labour market and global challenges.

Future work will further analyse the results of the deployment stage to evaluate the progression of innovation competence over time in order to adjust education programs in the short term. Also, this study will look forward to combining students' self-perception with cognitive outcome measurements and behavioural outcomes to deeply understand the learning process of innovation in an engineering environment that allows the development of a robust but context-specific tool for measuring students' learning process and improving innovation courses.

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enabled the integration of the tool into the Common Curriculum Plan courses and facilitated the dissemination of findings through academic conferences and publications.

BIOGRAPHICAL INFORMATION

Ignacio González-Aravena is currently the coordinator of the Engineering and Innovation Area (HÉLICE) at the School of Engineering and Sciences of the Faculty of Physical and Mathematical Sciences at the University of Chile in Santiago. He holds an industrial engineering degree, a master's in technology and innovation management, and a professional doctorate in sustainability. He has 8 years of experience in technology transfer and developing innovation strategies in the tech, manufacturing, and education sectors. His research and development interests focus on educating future engineers and scientists using active methodologies that enhance innovation, entrepreneurship, and sustainability competencies.

Gerardo Baro is an engineering graduate student at the University of Chile with research interests in competency-based education and innovation.

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APPENDIX A: PRE-PILOT SURVEY

Creativity

1. I make proposals that meet the demands of the task.

2. I suggest new or original ideas to solve problems.

3. I propose new ways to materialise ideas.

11. I make bold but justified decisions.

15. I actively participate to ensure the group achieves its goals.

Critical Thinking

4. I critically evaluate what is required for tasks.

5. I understand the causal relationships between the different aspects of the task.

6. I am able to view a task from different perspectives.

7. I use available resources skilfully.

8. I am able to anticipate upcoming events.

18. I can resolve conflicts within a group to achieve a common goal.

Initiative

9. I show enthusiasm for what I do.

10. I work persistently to achieve goals.

12. I orient the task towards the final objectives.

16. I am capable of taking the initiative without being prompted.

Teamwork

13. I consider the viewpoints of group members.

14. I am capable of collaborating.

17. I am capable of motivating others to act.

Networking

19. I can use external communication networks.

20. I am capable of working in multidisciplinary environments.

21. I am capable of networking (establishing contact networks).

APPENDIX B: COMMUNALITIES FOR SURVEY ANALYSIS WITH 21 QUESTIONS.

Table 14. Communalities for survey analysis with 21 questions

Question	Communality
1	0,843
2	0,525
3	0,557
4	0,435
5	0,565
6	0,685
7	0,374
8	0,530
9	0,649
10	0,543
11	0,426
12	0,513
13	0,473
14	0,735
15	0,580
16	0,528
17	0,572
18	0,677
19	0,788
20	0,546
21	0,718

APPENDIX C: FACTOR LOADINGS AND COMMUNALITIES FOR THE FINAL SURVEY

Table 15. Factor loadings and communalities for the final survey (complete)

Question	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Communality
1	0,178	0,155	0,845	0,134	0,041	0,075	0,797
2	0,150	0,120	0,676	0,203	0,097	0,106	0,557
3	0,283	0,198	0,601	0,162	0,153	0,179	0,563
4	0,583	0,277	0,114	-0,039	0,023	0,205	0,476
5	0,687	0,197	0,156	0,107	0,189	0,009	0,584
6	0,691	0,266	0,201	0,216	0,172	0,005	0,666
8	0,589	0,086	0,201	0,246	0,158	0,122	0,497
9	0,204	0,679	0,158	0,262	0,095	0,129	0,624
10	0,289	0,619	0,152	0,141	0,161	0,130	0,554
11	0,258	0,408	0,220	0,220	0,300	0,075	0,427
12	0,360	0,514	0,202	0,056	0,152	0,221	0,511
13	0,241	0,065	0,067	0,156	0,639	0,050	0,503
14	0,038	0,207	0,080	0,125	0,767	0,253	0,720
15	0,240	0,409	0,156	0,049	0,511	0,246	0,574
16	0,127	0,466	0,073	0,131	0,272	0,432	0,518
17	0,044	0,141	0,104	0,215	0,175	0,680	0,574
18	0,144	0,157	0,149	0,121	0,113	0,760	0,674
19	0,156	0,114	0,164	0,814	0,157	0,180	0,786
20	0,294	0,206	0,197	0,503	0,345	0,104	0,552
21	0,099	0,248	0,261	0,733	0,083	0,212	0,730

APPENDIX D: FINAL SURVEY DESIGN

Introduction Text to the Survey

Broadly speaking, innovation refers to a new or improved product or process that significantly differs from what existed before. To innovate, an individual must use their competence or capacity to innovate, which is fundamental to their development in the context of the Engineering and Sciences program and plays a pivotal role in society.

To complete this self-assessment, you will evaluate how you perceive your ability to innovate in response to different statements. You can position your answer anywhere on a scale ranging from Strongly Disagree to Strongly Agree.

The honesty of your responses will provide important information for the continuous improvement of the Common Plan innovation courses, as this instrument is designed to measure the progress of innovation competence development throughout the study program.

Control Questions

- Have you participated in any innovation or entrepreneurship courses or activities outside the faculty? (Yes / No)
- Are you participating in any innovation or entrepreneurship courses or activities outside the faculty this semester? (Yes / No)
- Do you feel that your personal environment, outside of your studies, encourages learning or creativity? (Yes / No)
- Do you have access to technological resources such as the internet, a computer, or a smartphone? (Yes / No)
- Have you used online platforms to learn something on your own? (Yes / No)
- The following questions are simple, and you must respond by selecting the "Strongly Disagree" option.

Creativity

Understanding creativity as the ability to think beyond existing ideas, rules, patterns, or relationships, please answer the following questions:

1. I propose novel ideas that meet the demands of the task.
2. I suggest new or original ideas to solve problems.
3. I propose creative ways to implement ideas.

Critical Thinking

Defining critical thinking as the ability to analyse problems, evaluate advantages and disadvantages, and assess the risks involved for a purpose, please answer:

4. I critically analyse and evaluate what tasks require.
5. I understand how the different aspects of a task interact and relate.
6. I can view a task from different perspectives.
8. I can anticipate the impacts and scope of decisions.

Initiative

Understanding initiative as the ability to make decisions or take action without receiving an external order or instruction:

9. I show initiative to act.
10. I work persistently to achieve goals.
11. I dare to make decisions but base them on sound reasoning.
12. I execute tasks oriented towards final objectives.
13. I am capable of taking the initiative without being prompted.

Team Collaboration

By team collaboration, we refer to the ability to work effectively with others within your team.

14. I consider the viewpoints of group members.
15. I am capable of collaborating.
16. I actively participate to ensure the group achieves its goals.

Team Moderation

By team moderation, we refer to the ability to guide and facilitate the team's internal dynamics.

17. I am capable of motivating others to act.
18. I can resolve conflicts within a group to achieve a common goal.
19. My team for this semester’s course consists of 20 members.

Networking

Understanding networking as establishing connections with people beyond your team who are willing to contribute information, resources, or opportunities for a purpose, please answer the following questions:

20. I can use networks beyond the team.
21. I can interact and work in multidisciplinary environments.
22. I am capable of building networks beyond the team.

Closing Questions

- In your opinion, what is innovation useful for? (Open Response)
- How have the innovation courses helped you? (Open Response)

Feedback

- What did you think of the survey? (Open Response)

APPENDIX E: SAMPLE SIZE DETERMINATION

Given the broad universe of students and the unknown expected response rate with the deployment methods applied, the sample size was not determined ex-ante. However, the responses obtained were sufficient to achieve significant statistical power for the expected effect sizes under study.

As each stage was deployed, Table 4 shows that the statistical power test (alpha = 5%) allows the identification of medium-sized effects (0.5) with a power of 0.54 and 0.98 in the pre-pilot and pilot stages, respectively, and large-sized effects (0.8) with a power of 0.91 and 1.0, respectively. The pre-pilot stage was designed to identify significant issues related to the clarity of the wording, and the review process was considered adequate—meanwhile, the pilot stage aimed to detect more minor effects.

For subsequent semester deployments, the most relevant factor is the number of respondents in both instances, which is similar to the number of respondents in the pilot stage. Therefore, it allows for identifying effects of similar magnitude, particularly with a power of 0.99 for medium-sized effects and 1.0 for large-sized effects.

Table 16. Statistical power for different effect sizes across deployment stages

Effect size	Pre-pilot (n=35)	Pilot (n=135)	First application (n=284)	Second application (n=721)	Change in answers (n=139)
0.1	0.070	0.130	0.221	0.475	0.132
0.2	0.131	0.374	0.662	0.967	0.383
0.3	0.236	0.690	0.946	1.000	0.703
0.4	0.378	0.906	0.997	1.000	0.914
0.5	0.541	0.984	1.000	1.000	0.986
0.6	0.697	0.998	1.000	1.000	0.999
0.7	0.823	1.000	1.000	1.000	1.000
0.8	0.910	1.000	1.000	1.000	1.000
0.9	0.960	1.000	1.000	1.000	1.000
1.0	0.985	1.000	1.000	1.000	1.000