Transversal competences: The (mis)match between graduates' self-assessment and external evaluation

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This study undertook a comparative analysis of the assessment of transversal competences using two methods, one based on self-assessment and the other on external evaluation, to verify whether there was a (mis)match between the two. Self-assessment was based on the scores obtained through a self-report survey, and external evaluation was based on the scores obtained through the adaptation of the Multiple Mini-Interviews method. Descriptive statistics were calculated for the scores of 130 Portuguese graduate students from three public universities in Portugal. A comparative analysis of the differences according to gender and study field was also conducted to determine the existence of a (mis)match. The differences between scores in both exercises were computed. The results suggest varied assessment patterns of transversal competences, highlighting differences depending on the evaluation method and according to gender and study field. This study deepens our understanding of how students' transversal competences are ascertained and sheds light on which transversal competences should be prioritised for development. Findings are particularly relevant for higher education institutions interested in developing and implementing assessment methodologies and intervention strategies to further increase their graduates' transversal competences and, ultimately, improve their employability and career prospects.

Introduction

Higher education institutions face the challenge of transferring knowledge and competences to society (Alcalá et al., 2019). In this context, assessing the acquired knowledge (Bullock & Wilder, 2016) and competences (Nagel et al., 2022; Zlatkin-Troitschanskaia et al., 2021) is critical, particularly for the enhancement of graduates' employability (e.g. Clarke, 2017). Given the relevance of generic or transversal competences (TCs) regarding the challenges of the current volatile market and the need for a successful university-to-work transition, it seems necessary to evaluate students' TCs (Brown et al., 2015).

Self-report surveys (S-RS) regarding competences are commonly used (Alcalá et al., 2019; Radović et al., 2024), yet these are sometimes flawed. Although self-assessment activities contribute to metacognition and learning outcomes (Panadero et al., 2016), there is a recognised tendency for students to inflate their assessments (Carroll et al., 2020), particularly regarding their TCs (Monteiro et al., 2019). Generally, the association between self-ratings and objective performance is weak across different professional domains (Davis et al., 2006; Dunning et al., 2004). Despite the influence of the degree level and the broader area of the course on the accuracy of students' self-assessment (Gehringer, 2018; Jackson, 2012; Pinxten et al., 2018), there is a lack of consistency in the empirical research. Students'

gender also plays a role in their self-assessment. Specifically, female higher education students tend to underestimate their performance, while male students tend to overestimate it (González-Betancor et al., 2019; Madrazo et al., 2018). This trend persists in the transition to the labour market (Monteiro et al., 2016).

Our article derives from a broader project, which aimed to adapt *Multiple Mini-Interviews* (MMI) to assess the TCs of higher education students from different scientific study fields. In this study, our main aim is to compare students' self-assessment of their TCs (S-RS) with an external evaluation of their TCs (MMI performance) and address the lack of comprehensive exploration concerning the interplay between self-assessment and external evaluation. In an area which has been explored minimally in the literature, we seek to contribute to a greater knowledge of different methodologies to assess the graduates' TCs and, ultimately, inform higher education institutions interested in developing and implementing assessment and intervention strategies to increase their graduates' TCs during their academic experience.

Transversal competences

Transversal competences are commonly referred to as transferable skills, generic skills, employability skills, or core academic competences (National Research Council, 2012). The definition of TCs varies in the literature. In the fields of psychology and education, for instance, it has been associated with key attributes required to face the challenges of a more global and changing labour market (European Commission, 2019; Hart et al., 2021). The definition proposed for this paper refers to TCs as skills, attitudes, and knowledge applied appropriately in different contexts (European Commission, 2019). The term "transversal" indicates that these are necessary across different scientific areas, learning and professional activities, and complement technical skills (European Commission, 2019; Hart et al., 2021). The importance of the TCs transcends academic boundaries, underpinning not only the transition to employment and sustained career success, but also fostering lifelong learning, continuous professional growth, and active engagement in a democratic society (Tuononen et al., 2022). For this reason, their development, alongside domain-specific knowledge, is widely recognised as a central goal of higher education (Tuononen et al., 2022), closely aligned with twenty-first-century competences and reflecting their centrality to the mission of higher education (European Commission, 2019). These competences enable students to learn, apply discipline-specific knowledge across diverse contexts, and achieve greater academic success (Hyytinen et al., 2021).

The wide variety of TCs, which encompass, for instance, communication, teamwork, problem-solving, critical thinking, time management, adaptability, digital literacy, self-management, and initiative (Tuononen et al., 2023), seems to converge on a framework with three main categories: cognitive, intrapersonal, and interpersonal competences (National Research Council, 2012). The competences analysed in our study derive from the adaptation of this theoretical framework (Freire & Barbosa, 2023; Santos, Barbosa et al., 2020a; Santos, Freire et al., 2020b), which resulted in four categories:

(1) Cognitive competences: (a) problem solving, i.e., to formulate responses and deciding after critically evaluating situations, ideas and information (World Economic Forum, 2016), and; (b) generation of novelty, i.e., to propose creative ideas, products or approaches (McIntyre et al., 2018).

(2) Intrapersonal competences: (a) open mindset, i.e., to be receptive to others and to new information and experiences (OECD, 2018); (b) learning to learn, i.e., to be mindful of the learning process and its needs, and to manage time and information to pursue and persist in learning opportunities (European Commission, 2019); and (c) positive professional attitude, i.e., being organised and hardworking, and demonstrating initiative and autonomy (National Research Council, 2012).

(3) Interpersonal competences: (a) Teamwork, i.e., to interact with others to meet common goals (Bedwell et al., 2012); (b) Effective communication, i.e., to comprehend the information received and convey verbal/nonverbal information to different audiences, selecting the most appropriate means and mode of communication (World Economic Forum, 2016), and; (c) Leadership, i.e., to succeed in being followed, using mechanisms of influence and persuasion (Hoy & Smith, 2007).

(4) Contextual competences: Market Orientation, i.e, the ability of being an asset to an organisation, revealing a clear understanding of the way it operates, of its customers, and the wider business environment (Sen, 2006).

Self-assessment of transversal competences

Self-assessment is commonly used to gauge students' competences, including transversal ones (Nagel et al., 2022; Zlatkin-Troitschanskaia et al., 2021). It plays an important role in students' self-awareness and allows them to reflect on their abilities and identify strengths and areas for improvement. However, self-assessments seem to depend on individual and contextual factors, such as gender and field of study. A meta-analysis by Huang (2013) on gender differences in academic self-efficacy, defined by Pajares and Miller (1994) as the individual's perceived ability to complete a specific task, identified a large effect size, favouring males. The study by Gómez et al. (2022) also found differences that favoured female students concerning 'planning' and 'teamwork', whereas men were favoured regarding 'leadership', 'initiative' and 'decision making'. Gender differences also seem to vary according to age, with the largest effect size occurring from the beginning of adulthood (Huang, 2013), and study field (Anderman & Young, 1994; Gómez et al., 2022). Regarding the computing field, males presented higher self-perceptions in three courses (Coffin & MacIntyre, 1999). In the area of mathematics, the results seem to vary between no differences (Friedel et al., 2007; Kenney-Benson et al., 2006) or differences favouring male students (Wang, 2003). In science students, no significant gender differences were found (Anderman & Young, 1994).

When analysing the influence of the field of study, studies with engineering undergraduates (Cruz & Saunders-Smits, 2021; Direito et al., 2012) indicated that higher levels of proficiency were reported in more specific competences such as 'cross-cultural understanding', 'active seeking learning' and 'problem solving', while their lowest self-perception levels resided on 'time management', 'creativity' (Direito et al., 2012) and 'entrepreneurship' (Cruz & Saunders-Smits, 2021). In turn, in Jackson's study (2012), business students rated themselves as more proficient in the competences 'developing professionalism' and 'work with others', and the lower proficiency levels occurred in 'critical thinking', 'initiative' and 'self-awareness'. A study comparing engineering and business students' perceived level of competence in a set of generic skills found substantial differences only in the case of 'IT skills', favouring engineering students (Chan et al., 2018).

Additionally, a comparative study from Barros (2019) of the TCs of students from three fields of study – social sciences, commerce and law (SSCL), sciences, mathematics and informatics (SMI), and engineering, manufacturing and construction (EMC) – revealed that every student reported a higher level of confidence for 'teamwork' and 'lifelong learning'. 'Flexibility and adaptation' was also rated with high confidence levels among the SMI and EMC students. 'Creativity and innovation' and 'leadership' were two of the competencies where students from every group showed lower confidence levels. Lastly, Gómez et al. (2022) compared the transversal competences of students from three areas: social sciences, health sciences and technical degrees. Their results evidenced that social sciences students were less proficient than students from the other fields in every competence (teamwork, planning, leadership, problem solving, communication and decision-making), except in 'adaptation', where they scored lower than the technical degrees' but higher than the health sciences' students.

External evaluation of transversal competences

The external evaluation of TCs in higher education institutions would contribute to consistent assessments across students. However, validated methods for external evaluation are lacking (Alcalá et al., 2019; Verdecho et al., 2021). In this regard, an innovative method – *Multiple Mini-Interviews* (MMI) – has been used, specifically in health education, showing reliability in assessing medical students' TCs (Knorr et al., 2018) and validity, due to its ability to predict performance during medical training experience (e.g. Husbands & Dowell, 2013) and in the workplace (e.g. Bindal et al., 2007). The MMI method consists of short-term interviews, each performed in a different station, carried out in a timed circuit, during which each candidate is evaluated in multiple standardised situations, simulating professional scenarios (e.g., for a doctor, one scenario is to give someone bad news). Each MMI station has a trained rater who follows the guidelines for the performance assessment of each competence. A standardised character may also play a fundamental role in students' assessment (e.g., a patient's relative waiting for news).

The MMI method has only recently been used in teacher education admission (Metsäpelto et al., 2022), and comparative studies in other fields are lacking.

The present study

Our study aimed to compare students' self-assessment (S-RS) and external evaluation (MMI) of TCs, examining potential mismatches and gender/study field differences. Specifically, the research questions are as follows:

RQ1: How do students self-assess their TCs? Does self-assessment vary according to gender and study fields?
RQ2: How are students evaluated in MMI in terms of TCs? Does external evaluation vary according to gender and study fields?
RQ3: Is there a (mis)match between the student's self-assessment and external evaluation regarding TCs? Does this (mis)match vary according to gender and study fields?

The combined analysis of self-assessment with external evaluation is expected to contribute to a comprehensive understanding of students' competences, highlighting how they perceive themselves in comparison to other students from other gender and different study fields and comparing to experts' evaluation of their competences in contexts similar to the ones they will integrate in the labour market. It has the potential to inform students and higher education institutions about the competences that need to be fostered to meet personal and professional goals and reassure employers of their readiness for professional roles.

Materials and methods

Participants

A convenience sample was used in this study. The sample included 130 higher education students (73.8% female; 26.2% male), most of whom (93.1%) were between the ages of 21 and 25 (mean age = 23.63, SD = 3.95, age range = 21-47 years), and attended three northern Portuguese higher education institutions. The number of students assessed at each university was similar. Students were enrolled in the first (46.2%) and second year (53.8%) of masters degree programs that were similar among the three universities. They were enrolled in courses in the following education and training areas (Ministério das Actividades Económicas e do Trabalho, 2005): (1) Arts (n=13); (2) Social sciences – Business sciences (n=40); (3) Social sciences - Social and behavioural sciences (n=31); (4) Science, mathematics and computing (n=15); (5) Engineering and processing industries (n=31).

Instruments

Sociodemographic questionnaire
This questionnaire was constructed by the authors to collect information on students' gender, university, academic grade and study field.

Transversal Competences' Self-Report Survey (S-RS)
This is an instrument constructed to assess students' perceived level of TCs on a scale ranging from 1 (highly incompetent) to 5 (highly competent) (see Appendix 1). It includes nine items, each describing one of the following competences: Problem solving, Generation of novelty, Open mindset, Learning to learn, Positive professional attitude, Teamwork, Effective communication, Leadership, and Market orientation. To help students evaluate themselves, a comprehensive explanation of each competence was provided, based on a thorough literature review. This explanation was consistent with the descriptions of the competences that were used as the foundation for creating the MMI method. This was done to ensure that the evaluations performed by the students were similar to what the MMI raters would observe. No time limit was set for this questionnaire. An acceptable Cronbach alpha (.75) between these items was found.

Multiple Mini-Interviews (MMI)
The MMI method aims to assess the TCs of higher education students (Freire & Barbosa, 2023; Santos, Barbosa, et al., 2020a; Santos, Freire, et al., 2020b). We used the MMI's remote application, which was undertaken using the *Zoom* platform. The method includes six assessment stations designed to evaluate the set of nine general TCs, which were also assessed through the S-RS (see Table 1 and Appendix 2). This selection was based on the national and international competence frameworks in the field of education and training and on conducting two focus groups with 12 researchers from different scientific areas that analysed the relevance of these competences for the adjustment in the job market (Santos, Freire, et al., 2020b).

A scenario is proposed to students at each station, built by a multidisciplinary team, to evaluate three of those competences. To accurately assess complex constructs, such as TCs, researchers ensured that the proposed scenarios did not require specific scientific content knowledge or prior knowledge. One of them implies the involvement of a previously trained standardised character who plays the role of the interviewer. In each station, students have two minutes to read the scenario, which is shared on the computer screen for that duration, and, immediately afterwards, they are given eight minutes to perform the task or solve the problem, except in the case of station 6 (12 minutes). Expected performance rubrics were provided for students' assessment. For each scenario, what is considered evidence of proficiency of the target TCs was described.

Students' TCs were classified by two raters, using a 10-point Likert style scale that aims to differentiate performances across the following ability levels: 1 (Very weak); 2 and 3 (Weak); 4 and 5 (Satisfactory (-)); 6 and 7 (Satisfactory (+)); 8 and 9 (Good); 10 (Excellent). Inter-rater reliability measurement was performed for each competence as scored in real-time and upon retrospective review by another rater computing the intraclass correlation coefficient. A significant degree of inter-rater reliability assessment was found for every competence, ranging from 0.53 to 0.78, except for the competence Teamwork, which is below the acceptable values. The MMI method presented good reliability, with a Cronbach alpha of .91.

Table 1: Features of the MMI stations

Station	Type	Format	Std charac.	Competences
1	Discussion of a topic	Individual	No	PS, GN, OM
2	Standardised questions	Individual	No	LL, PPA, MO
3	Oral presentation	Individual	No	GN, OM, EC
4	Standardised questions	Individual	Yes	LL, PPA, MO
5	Collaborative task	Group	No	T, EC, L
6	Collaborative task	Group	No	T, L, MO

Notes. Std charac.=Standardised character; PS=Problem solving; GN=Generation of novelty; OM=Open mindset; LL=Learning to learn; PPA=Positive professional attitude; T=Teamwork; EC=Effective communication; L=Leadership; MO=Market orientation.

Procedures

The Ethics and Deontology Committees from the participating universities approved this study (32-CED-2019; CEICSH 076/2019; 87/CEUP/2019). Student recruitment was conducted in collaboration with the course directors across the universities, from October to December 2020. The project's objectives, the format of the MMI method, the rules for participation and data protection regulations were explained by the researchers to every student in their respective classrooms or remotely, in pre-scheduled sessions. The participation was voluntary after students received all the information and provided informed consent. Data from the SR-S and the MMI were collected between January and June 2021. Students filled in the sociodemographic questionnaire online when they volunteered for the study, and completed the SR-S, also online, prior to the MMI method.

The MMI method was applied in small group circuits, conducted online, via *Zoom*, each with three or four students, and a duration of approximately 90 minutes. It began with a briefing session, conducted by the data collection coordinator, to help participants recall the assessment procedures and clarify their doubts, followed by the individual stations (each student started in a different one) and, finally, the collaborative stations (all the students in the circuit). Two researchers were trained to facilitate tasks and rate students' performance in each station, even though only two were assigned to each circuit. Those two rated students synchronously, and an additional rater assessed students' performance asynchronously, based on the recordings. For training purposes, before the MMI assessment, the videos of the pilot test (Santos, Barbosa et al., 2020a) were used as training material for raters to practice their assessments, discuss the reasons behind their rates and clear any doubts regarding the checklists with evidence of proficiency of the target TCs in each station.

Data analysis

Considering that the instruments were on a different scale and the objective implied comparing students' results obtained through the S-RS and MMI methods, the S-RS scale was altered accordingly. As such, it was converted from a scale of 1 to 5 to a scale of 1 to 10 (similar to the MMI) so that both scales would have the same lower and upper levels. For this purpose, two methods were followed:

(1) allocation of the intermediate point between every two scores (1 was converted to 1.5; 2 to 3.5; 3 to 5.5; 4 to 7.5; 5 to 9.5);

(2) computation of the rescaling formula $Y = \left(\frac{X - Xmin}{X\ range}\right) n$

where Y is the variable to adjust, X is the original variable, X_{min} corresponds, on the original variable, to the minimum value observed, X_{range} represents the difference between the maximum possible score and the minimum possible score on the original variable, and *n* is the upper limit of the rescaled variable.

Data analysis to compare the scores was performed using the self-assessment variables resulting from the conversion of both methods. Since no differences were found, the reported results were based on the self-assessment variables rescaled through the computing formula (from now on referred to as the "adjusted score").

To address RQ1 and RQ2, descriptive statistics were calculated to describe students' self-assessment (adjusted score - scale 1 to 10) and performance in the MMI method. Independent sample t-tests were run to examine gender differences; to analyse study field differences, one-way ANOVAs were computed. Games-Howell post-hoc tests were used due to unequal group sizes (Field, 2013). For all significant group comparisons, effect sizes (Cohen's *d)* were calculated and interpreted after Field (2013) (.10 = small effect; .30 = medium effect; .80 = large effect).

The score differences were calculated to address RQ3 and compare self-assessment with the external evaluation. Frequencies were computed for matching estimation, underestimation, and overestimation. Similar to previous studies (e.g. Baartman & Ruijs, 2011), the criteria for data interpretation were: (a) matching estimation scores – when the difference between scores was lower or equal to 1 standard deviation (SD); (b) underestimation – when the difference between scores was positive and higher than 1 SD; (c) overestimation – when the difference between scores was negative and higher than 1 SD. Independent sample t-tests were used to examine gender differences. Study field differences were analysed using one-way ANOVAs. Games-Howell post-hoc tests and effect sizes (Cohen's *d*) were computed.

Results

How do students self-assess their TCs? Does self-assessment vary according to gender and study fields?

Self-assessment results (RQ1) evidenced that higher scores were obtained for Open mindset and Teamwork, followed by Positive professional attitude. Lower scores were found for Generation of novelty, Leadership, and Learning to learn (Table 2).

Table 2: Descriptive statistics for global competences' results in self-assessment and the external evaluation

Competences	Self-assessment			External evaluation		
	M	SD	Range	M	SD	Range
Problem solving	6.63	1.67	2.5-10	6.27	1.30	1.5-9
Generation of novelty	5.37	2.27	0-10	6.29	1.35	1.5-9.5
Open mindset	7.94	1.77	2.5-10	6.39	1.29	2-9
Learning to learn	6.29	1.74	2.5-10	7.55	0.93	4.75-9.25
Positive professional attitude	7.33	1.87	2.5-10	7.67	0.98	4-9.75
Market orientation	6.40	1.92	2.5-10	7.23	0.80	4.25-8.67
Effective communication	6.81	1.62	2.5-10	6.84	1.14	3.25-9
Teamwork	7.90	1.64	5-10	7.22	0.78	5-9
Leadership	5.62	2.07	2.5-10	6.88	1.03	4.5-9

Notes. M=Mean; SD=Standard deviation.

Gender differences are displayed in Table 3. Female students reported higher levels of competence for Teamwork and Open mindset; male students reported higher levels for Open mindset and Positive professional attitude. Both male and female students perceived the competences Generation of novelty and Leadership as being the least developed, as well as Learning to learn, perceived by male students. Gender differences were found, favouring female students, in the competences Open mindset ($t(128) = -1.99$, $p < .05$; Cohen's $d = .40$) and Teamwork ($t(128) = -3.66$, $p < .001$; Cohen's $d = .68$). No additional statistically significant differences were found.

Table 3: Descriptive statistics for competences by gender in the self-assessment and in the external evaluation

Competences	Self-assessment				External evaluation			
	Male (n=34)		Female (n=96)		Male (n=34)		Female (n=96)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Problem solving	7.06	1.57	6.48	1.69	6.13	1.46	6.32	1.25
Generation of novelty	5.51	2.37	5.31	2.24	6.18	1.26	6.34	1.39
Open mindset	7.43	1.79	8.13	1.74	6.12	1.30	6.48	1.28
Learning to learn	6.03	1.96	6.38	1.66	7.42	0.81	7.60	0.97
Positive professional attitude	7.43	1.90	7.29	1.87	7.56	0.79	7.71	1.04
Market orientation	6.91	1.95	6.22	1.88	7.14	0.70	7.26	0.83
Effective communication	6.76	1.45	6.82	1.68	6.51	1.17	6.95	1.11
Teamwork	7.06	1.89	8.20	1.44	7.04	0.95	7.28	0.70
Leadership	6.03	2.31	5.47	1.96	6.70	1.07	6.95	1.01

Notes. M=Mean; *SD*=Standard deviation.

The S-RS results, according to the study field (see Table 4), highlight the scores obtained in the competences of Teamwork and Open mindset, where students from every study field reached the highest values. The competences of Leadership and Generation of novelty were the least developed by students in four of the five study fields (Arts

excluded). Arts students assessed all their competences more favourably than those from the remaining study fields.

Table 4: Descriptive statistics for competences by study field in the self-assessment

Study fields	Arts (n=13)		Business sciences (n=40)		Social and behavioural sciences (n=31)		Sciences, maths and computing (n=15)		Eng. and proc. industries (n=31)	
Scores	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
PS	7.31	1.60	7.19	1.52	6.37	1.69	6.17	1.86	6.13	1.56
GN	7.88	1.72	5.31	2.35	4.52	2.08	5.50	2.15	5.16	1.93
OM	8.65	1.65	7.88	1.75	8.23	1.47	7.17	1.86	7.82	2.01
LL	6.73	1.58	6.31	1.79	6.37	1.92	5.83	1.54	6.21	1.69
PPA	7.88	1.72	7.81	1.81	6.69	2.08	7.67	1.76	6.94	1.67
MO	7.50	1.77	6.50	2.18	6.45	1.68	6.33	1.60	5.81	1.87
EC	7.12	1.39	6.63	1.75	6.94	1.67	7.00	1.69	6.69	1.50
T	8.85	1.30	8.00	1.72	7.50	1.44	7.67	2.21	7.90	1.46
L	7.12	2.00	5.81	2.43	5.08	1.88	5.33	0.88	5.40	1.95

Notes. M=Mean; SD=Standard Deviation; PS=Problem solving; GN=Generation of novelty; OM=Open mindset; LL=Learning to learn; PPA=Positive professional attitude; MO=Market orientation; EC=Effective Communication; T=Teamwork; L=Leadership. Eng. and proc. industries=Engineering and processing industries.

Statistically significant differences were found in the self-assessment results for the competences Problem solving ($F(4,125) = 3.01$, $p <. 05$), Generation of novelty ($F(4,125) = 5.97$, $p < .001$), and Leadership ($F(4,125) = 2.60$, $p < .05$). The Games–Howell post hoc tests revealed that students enrolled in Business sciences assessed their Problem solving competence as being better developed than that of students from the Engineering and processing industries ($p < .05$, Cohen's $d = .69$). Concerning the competence Generation of novelty, statistically significant differences and very large effect sizes were obtained for the comparison between Arts students and all the other students. Arts students reported higher levels of Generation of novelty than students from Business sciences (Cohen's $d = 1.25$, $p < .01$), Social and behavioural sciences (Cohen's $d = 1.76$, $p < .001$), Sciences, maths and computing (Cohen's $d = 1.22$, $p < .05$), and Engineering and processing industries (Cohen's $d = 1.49$, $p < .01$). For the Leadership competence, statistically significant differences were found between Arts and Social and behavioural sciences ($p < .05$), with a very large effect size of 1.05. This suggests that Arts students assessed their Leadership competence as significantly more developed than those from Social and behavioural sciences.

How are students evaluated in MMI in terms of TCs? Does external evaluation vary according to gender and study fields?

In the external evaluation (RQ2), higher scores were found for Positive professional attitude and Learning to learn, followed by the Market orientation and Teamwork competences. Lower scores were obtained for Problem solving, Generation of novelty and Open mindset (see Table 2).

Similar results were observed for both genders: the lowest scores were obtained for Problem solving, Generation of novelty, and Open mindset; the highest scores were attributed to Learning to learn and Positive professional attitude (see Table 3). Data analysis by gender revealed that there was a significant and medium effect of this variable in the Effective communication results, with female students achieving higher scores than male students ($t(128) = -1.980$, $p < .05$; Cohen's $d = .39$). No other statistically significant differences were found.

In this evaluation, the lowest results in all competences, except for Leadership, were obtained by students from the Arts courses (see Table 5). The highest scores in Learning to learn, Positive professional attitude and Market orientation were found in students enrolled in Business sciences. The students of Social and behavioural sciences scored the best results in Problem solving, Generation of novelty, and Open mindset. Additionally, the highest scores in Effective communication, Teamwork and Leadership were obtained by the students of Engineering and processing industries.

Table 5: Descriptive statistics for competences by study field in the external evaluation

Study fields	Arts (n=13)		Business sciences (n=40)		Social and behavioural sciences (n=31)		Sciences, maths and computing (n=15)		Eng. and proc. industries (n=31)	
Scores	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
PS	5.31	1.41	6.41	1.37	6.65	1.02	6.40	1.53	6.06	1.15
GN	5.42	1.83	6.32	1.20	6.61	1.25	6.42	1.64	6.25	1.19
OM	5.63	1.53	6.46	1.15	6.73	1.24	6.17	1.56	6.38	1.20
LL	7.06	0.88	7.81	0.80	7.64	0.85	7.48	0.87	7.36	1.13
PPA	7.31	0.90	7.98	0.78	7.71	0.84	7.57	0.99	7.43	1.26
MO	6.91	0.71	7.40	0.58	7.23	0.67	7.25	0.85	7.13	1.11
EC	6.29	1.38	6.89	0.98	6.90	1.29	6.75	1.17	6.98	1.05
T	7.04	0.71	7.12	0.79	7.23	0.71	7.17	0.97	7.43	0.75
L	6.84	1.16	6.80	1.10	6.83	0.96	6.55	0.96	7.22	0.95

Notes. M=Mean; SD=Standard Deviation; PS=Problem solving; GN=Generation of novelty; OM=Open mindset; LL=Learning to learn; PPA=Positive professional attitude; MO=Market orientation; EC=Effective communication; T=Teamwork; L=Leadership. Eng. and proc. industries=Engineering and processing industries.

Statistically significant differences according to the study field were only found in the Problem solving competence ($F(4,125) = 2.94$, $p < .05$). The Games–Howell post hoc tests revealed that students of Social and behavioural sciences scored significantly higher than Arts students in the external evaluation of Problem solving ($p < .05$), with a very large effect size (Cohen's $d = 1.09$).

Is there a (mis)match between the student's self-assessment and external evaluation regarding TCs? Does this (mis)match vary according to gender and study fields?

The comparison between the perceived competences and those observed using the MMI method (RQ3) indicated areas of alignment, with students' self-assessments matching external evaluations for some competences. However, they also underestimated or overestimated others (see Table 6). The results highlight that more than half of the students overestimated their Open mindset competence (57.7%) and underestimated the competences of Learning to learn (55.4%) and Leadership (54.6%). Half of the students' (50%) estimated their Effective communication competence in alignment with external evaluations.

Table 6: Percentage of students overestimating, congruently estimating and underestimating their competences

Competence	Over-estimation		Conguent estimation		Under-estimation	
	N	%	N	%	N	%
Problem solving	42	32.3	59	45.4	29	22.3
Generation of novelty	26	20.0	46	35.4	58	44.6
Open mindset	75	57.7	44	33.8	11	8.5
Learning to learn	18	13.8	40	30.8	72	55.4
Positive professional attitude	34	26.2	48	36.9	48	36.9
Market orientation	23	17.7	46	35.4	61	46.9
Effective communication	35	26.9	65	50.0	30	23.1
Teamwork	51	39.2	59	45.4	20	15.4
Leadership	15	11.5	44	33.8	71	54.6

Gender differences were observed in the underestimation of the competences Problem solving ($t(128) = -2.733$, $p < .01$), Teamwork ($t(128) = 3.298$, $p < .01$) and Leadership ($t(128) = -2.259$, $p < .05$). Data analysis suggests that a higher proportion of female students underestimated their competences of Problem solving (Cohen's $d = .62$) and Leadership (Cohen's $d = .45$). On the other hand, a larger proportion of male students tended to underestimate their Teamwork competence (Cohen's $d = .59$). The differences in fields of study pointed to an overestimation in the competences of Problem solving ($F(4,125) = 3.53$, $p < .01$) and Generation of novelty ($F(4,125) = 7.86$, $p < .001$). The Games-Howell post-hoc tests revealed significant differences in the overestimation of the Problem solving competence between Arts and Engineering and processing industries students ($p < .05$), with a very large effect size (Cohen's $d = 1.12$). This suggests that a more significant number of Arts students are likely to overestimate this competence.

Students from the Arts courses also tended to overestimate their Generation of novelty competence, when compared to students from sciences, maths and computing (Cohen's $d = 1.58$, $p < .01$), Engineering and processing industries (Cohen's $d = 1.48$, $p < .01$) and Social and behavioural sciences (Cohen's $d = 1.48$, $p < .01$). Significant differences were also found between fields of study, more specifically with regard to the underestimation of

the competence Generation of novelty ($F(4,125) = 2.90$, $p < .05$). In comparison with Arts, there seemed to be a tendency for an underestimation of this competence in students attending courses in Business sciences (Cohen's $d = .86$, $p < .05$), Social and behavioural sciences (Cohen's $d = 1.34$, $p < .001$), and Engineering and processing industries (Cohen's $d = .99$, $p < .05$). Considering conguent estimation, no statistically significant differences were observed between study fields, suggesting that the number of students who estimate their TCs in alignment with the external evaluation does not differ when the study field is considered.

Discussion

This study aimed to compare students' self-assessment with an external evaluation of TCs and analyse gender and study field differences. Globally, the results suggest varied assessment patterns of TCs, highlighting differences depending on the evaluation method and according to gender and study field. Previous studies have reflected on the accuracy of competence assessment methods (Davis et al., 2006; Dunning et al., 2004), pointing to biases resulting mainly from self-assessment (Brown et al., 2015; Panadero et al., 2016). Our study's findings emphasise the contrasts between the two TCs assessment methods adopted.

Overall, the results showed variations in scores across different TCs and evaluation methods. The competences Positive professional attitude and Teamwork obtained the highest global scores in self-assessment and external evaluation, demonstrating students' ability to demonstrate competence and tackle challenges confidently. It is possible that this alignment between methods may be related to student's academic experiences that foster the development of these competencies, which include being organised and hardworking, demonstrating initiative and autonomy, and being able to work in a team. Regardless of the evaluation method, the Generation of novelty was the least scored competence, reflecting a limited capacity for innovation and generating new ideas, aligning with previous research (Cruz & Saunders-Smits, 2021; Direito et al., 2012).

Gender differences were observed only in the S-RS, with female students scoring significantly higher than males in Open mindset and Teamwork, contradicting previous studies favouring male students (e.g. Huang, 2013), but aligning with more recent findings from Gómez et al. (2022) regarding 'teamwork'. Results from the MMI method showed that female students performed better than males in Effective communication. These findings align with the mixed results reported in previous research on gender differences in MMI performances, where some studies showed female students outperforming male ones (Knorr et al., 2018), while others found no significant differences (e.g. Reiter & Eva, 2018).

The study field also played a significant role in TCs' assessment. Arts students reported in the S-RS the highest level of proficiency in all TCs, particularly Teamwork, Open mindset and Generation of novelty. This may be a result of both individual and curriculum characteristics: on the one hand, students who consider themselves to be more creative

and more receptive to novel experiences might be attracted to this study field while, on the other hand, the content and curriculum plan of Arts courses favours the generation of new ideas and the interaction with students who cultivate divergent thinking skills. Nevertheless, in the MMI method, Arts students scored the least in the Generation of novelty. Similarly to the study by Barros (2019), students from the other fields of study reported the lowest levels of competence concerning creativity and leadership and the highest levels of competence regarding Teamwork. These results strengthen the literature that evidences the influence of the field of study on students' perception of TCs (e.g. Gómez et al., 2022).

In the MMI method, Business sciences students were evaluated more positively in intrapersonal competences such as Learning to learn, and Positive professional attitude, Social and behavioural sciences students excelled in more cognitive competences, including Problem solving and Generation of novelty, and Engineering and processing industries students demonstrated stronger interpersonal competences, namely Effective communication, Teamwork, and Leadership. Group comparisons with both evaluation methods revealed statistically significant differences according to the field of study in Problem solving competence.

The results of both assessments showed agreement in the evaluation of Effective communication competence. However, there were discrepancies in assessing the Open mindset, Learning to learn, and Leadership competences, with students overestimating the Open mindset and underestimating Learning to learn and Leadership. The results suggest that some competences may be more prone to accurate assessment than others. Effective communication, for instance, stands out as a competence developed and valued by graduates throughout their academic journey. These findings align with previous studies highlighting the limitations of self-assessment methods (Brown et al., 2015; Panadero et al., 2016; Radović et al., 2024) and the challenge of achieving perfect alignment between self-assessments and external evaluations (Davis et al., 2006; Dunning et al., 2004). Results concerning differences according to gender indicated that female students are likely to underestimate their Problem solving and Leadership competences, while male students tended to underestimate their Teamwork competence. These findings align with previous literature, suggesting that male students tend to overrate themselves in competences associated with professional success, while female students underrate themselves (González-Betancor et al., 2019; Madrazo et al., 2018). Additionally, differences in underestimation and overestimation were found across study fields. However, the congruent estimation of students' TCs with the external evaluation was not influenced by their field of study

Limitations and future studies

This study has some limitations. Firstly, while the analysis provided meaningful insights, the sample size for some fields of study was relatively small, which may limit the representativeness of the findings. Future research should explore these differences further by including larger and more diverse samples representing different study fields and institutions to enhance the generalisability of the findings. Secondly, an analysis of the

existing differences in self- and external assessment, depending on the year of the course, should be explored in future research. Additionally, examining additional factors that could impact competence assessment, such as personality traits, cultural backgrounds, or educational experiences (e.g. frequency of training courses or workshops for the development of TCs) would provide a more holistic perspective on the TCs assessment.

Research, practical and social implications

This study contributes to the literature that is still somewhat contradictory, particularly concerning differences in self-assessment and external assessment in the context of higher education. Moreover, the application of the MMI method is a novelty in the assessment of graduates' TCs, as is the comparison of this method with more traditional ones, such as self-report measures. Additionally, this study highlights the need for a comprehensive and multifaceted approach to competence assessment in the context of TCs to obtain a more accurate and holistic understanding of students' TCs.

Practical implications for higher education can also be identified from this study. Improving TCs assessment methodologies may enhance graduates' awareness of their readiness for the labour market and may provide information on the TCs that students should improve. Our study emphasises, for instance, the importance of enhancing specific TCs, such as Generation of novelty, which scored lower in both self-assessment and external evaluation. This study can also contribute to the definition of educational interventions and strategies that target TCs across the curriculum to prepare graduates for better careers and employability prospects in the labour market, which corresponds to a current concern for most higher education institutions.

From a social perspective, the gender differences observed in TCs assessment call attention to the need to address these gender discrepancies as a way to create more equitable and inclusive environments. Additionally, the study highlights the influence of the study field on TCs assessment, suggesting the need to provide diverse educational opportunities that foster the development of different competences across disciplines.

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Appendix 1: Transversal competences' self-report survey

In this survey, we ask you to make a self-assessment of your transversal competences. On a scale from 1 (highly incompetent) to 5 (Highly competent), please indicate to what extent you think you master the following competences.

Competences	1 Highly in-competent	2 Minimally competent	3 Moderately competent	4 Competent	5 Highly competent
Identifying, discovering or creating strategies to deal with a problem.					
Creating new products, new ideas or approaches.					
Being receptive to others and to new information, ideas and experiences.					
Managing one's own learning experiences and career progression.					
Demonstrating autonomy, initiative and resilience.					
Working with other people to achieve a common goal.					
Receiving and transmitting information considering different perspectives and the impact of the message and adapting the way of communicating.					
Influencing and persuading others to achieve certain goals.					
Understanding the client, the organisation and the wider context or area of work.					

Appendix 2: Multiple mini-interviews

Station 1: President of the Students' Association

Imagine that in the next academic year, you are elected to the student association board at the university you attend. In this context, you are asked to support the university's Rectorate in developing an action strategy on campus to meet the sustainable

development goals defined by the United Nations, as represented in the figure below. You are asked to choose three measures from different domains and to:

1. explain the action plan for each measure with a visible impact still during the management's mandate;
2. mention the priorities, and the human and material resources you would mobilise;
3. anticipate potential obstacles and propose ways of overcoming them; and
4. explain how you would evaluate the impact of these measures.

Source: https://www.logos.aiesec.org/sdgs

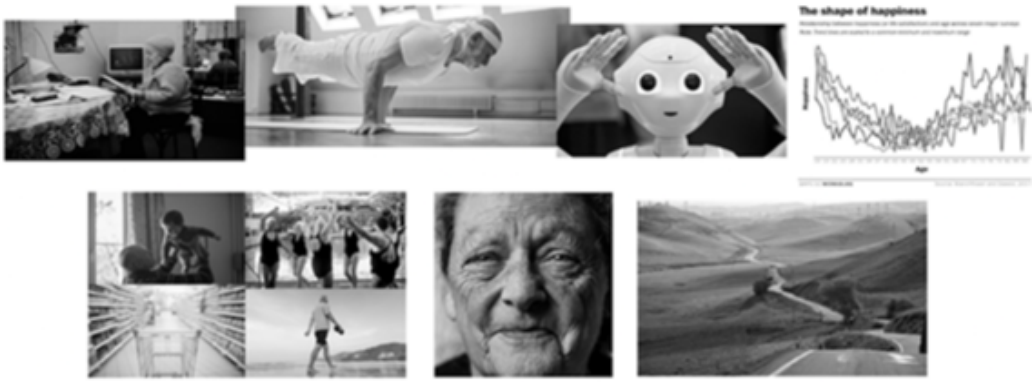
Station 2: A promising future

Imagine that you have recently completed your master's degree. You have sent your CV to a recruitment company and have been called in for an interview to assess your professional interests and analyse potential employers. In this interview, you should indicate what job you would like to have and why you think you have the ideal profile for it. You should mention how the job meets your short- and long-term personal and professional goals, as well as how you plan to achieve these goals and develop your professional career. You will meet the recruitment company employee in the room, who will interview you.

Station 3: A surprising presentation

Imagine that you have to replace a colleague of yours who works in the commercial department of an innovative company and give a presentation via videoconference. Your aim will be to show the company's commercial director, from eight images that your colleague has selected, what the company's commercial strategy would be to attract consumers over 65 to buy a particular product. In a few moments, the assessor will begin the presentation, with the first slide showing the product being marketed and the

following slides showing the images below. Each image will be visible for 1 minute, and you can preview the next image in the bottom right-hand corner of your screen. After this time, you will automatically move on to the next image.



Sources: (1) https://www.gettyimages.pt/; (2) Graph The shape of happiness: Blanchflower & Oswald, 2017 (World Economic Forum).

Product displayed in the presentation: Self-driving car

Source: https://www.gettyimages.pt/

Station 4: "Dream" interview

The recruitment agency to which you sent your CV when you finished your master's degree has found a potential top company in your field that might be interested in your profile. You have now been called for an interview to assess your skills and the suitability of your profile for the company in more detail. This is a unique opportunity for your career. In the room, you will meet the human resources director of the company in question.

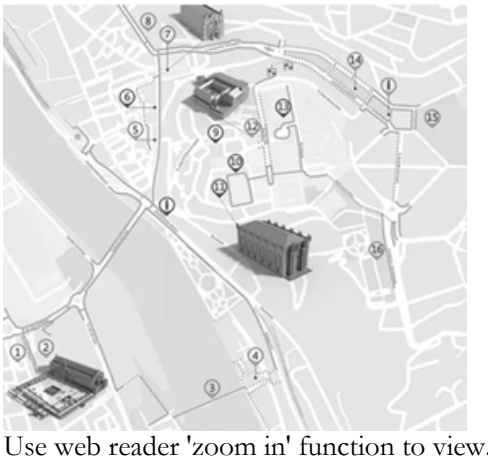
Station 5: Only 1 more to go!

You will carry out an activity with three other participants. Each participant will receive six pictures from a set of 25 pictures via Chat. You have two minutes to assess these figures individually. Then the team's task is to find the missing figure in the set. To do this, you can only communicate verbally with each other, but you can never project the figures you have been given.

Station 6: Culture is also a business

A municipal company in an urban area wants to create a cultural tour of the spaces and facilities of the municipality of Coimbra. It will be a service for children aged between 8 and 12, lasting a maximum of one day, with the aim of creating a positive experience and generating as much profit as possible, but without neglecting children from disadvantaged families.

Assuming you are part of the company's Education and Culture team, you have to create a route proposal and discuss it with other team members you'll meet in the room, trying to reach a consensus. You can consult the map below and/or other sources of information. You will have 10 minutes to organise the proposal and 2 minutes to communicate it to the company director.



Use web reader 'zoom in' function to view.

1. Portugal dos Pequenitos
2. Mosteiro de Santa Clara-a-Velha
3. Ponte Pedro e Inês
4. Parque Mondego
5. Praça do Comércio
6. Igreja de São Tiago
7. Igreja de Santa Cruz
8. Rua Sofia
9. Sé Velha
10. Reitoria da Universidade de Coimbra
11. Biblioteca Joanina
12. Museu Nacional Machado de Castro
13. Sé Nova
14. Jardim da Av. Sá da Bandeira
15. Jardim da Sereia
16. Jardim Botânico

i. Posto de turismo

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