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Teaching in Natural Contexts. Project-based Learning and Perception of Professional Competence of Pre-service Teachers in Spanish Universities

La Docencia en Contextos Naturales. Aprendizaje Basado en Proyectos y Percepción de la Competencia Profesional de los Futuros Docentes Universitarios Españoles

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KEYWORDS:

Professional competence
Training
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ABSTRACT:

This study investigates the impact of project-based learning (PBL) on the perception of professional competence in Early Childhood Education (ECE) among pre-service teachers in Spain. A total of 586 students from four Spanish universities participated in a pre-post test design using the ECPP-FIM scale to measure the impact of the PBL approach on the perception of professional psychomotor intervention skills of ECE. The PBL approach involved close collaboration with preschools, providing students with hands-on experience designing and implementing movement-based activities in natural contexts. Descriptive and inferential statistics, including ANOVA, were used to analyse the data. Results indicate substantial improvements in the perception of professional competence across all five areas of the ECPP-FIM scale. Moreover, students from vocational education backgrounds showed consistently higher pre-and post-test scores than those from other academic pathways. Findings support the effectiveness of PBL in bridging the theory-practice divide and emphasize the importance of integrating real-world experiences in teacher training. To conclude, this study highlights the key characteristics that an ordinary university subject should incorporate to enhance the perception of professional competence.

DESCRIPTORES:

Competencia profesional
Formación
Aprendizaje basado en proyectos
Percepción
Desarrollo académico

RESUMEN:

Este estudio investiga el impacto del aprendizaje basado en proyectos (ABP) en la percepción de la competencia profesional en Educación Infantil (ECE) entre los futuros profesores en España. Un total de 586 estudiantes de cuatro universidades españolas participaron en un diseño de prueba pre-post utilizando la escala ECPP-FIM para medir el impacto del enfoque ABP en la percepción de las habilidades profesionales de intervención psicomotora en ECE. El enfoque ABP implicó una estrecha colaboración con niños en edad preescolar, proporcionando a los estudiantes una experiencia práctica en el diseño e implementación de actividades basadas en el movimiento en contextos naturales. Se utilizaron estadísticas descriptivas e inferenciales, incluido ANOVA, para analizar los datos. Los resultados indican mejoras sustanciales en la percepción de la competencia profesional en las cinco áreas de la escala ECPP-FIM. Además, los estudiantes procedentes de entornos de formación profesional mostraron puntuaciones pre y post-test consistentemente más altas que los de otras trayectorias académicas. Los resultados respaldan la eficacia del aprendizaje basado en problemas para superar la brecha entre teoría y práctica y destacan la importancia de integrar experiencias del mundo real en la formación docente. Para concluir, este estudio destaca las características clave que una asignatura universitaria ordinaria debería incorporar para mejorar la percepción de competencia profesional.

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1. Literatura review

The traditional teaching division between theoretical and practical settings in regular pre-service teacher training courses has been widely debated, as it tends to perpetuate the gap between higher education and the professional sphere. Therefore, there is a need to promote academic development to bridge this gap, which can only be achieved through intentional and systematic changes in subjects designed to this end. In this regard, international agencies advocate for the implementation of induction programmes throughout undergraduate studies, as they have a positive impact on the quality of teaching, the success of education systems, and the development of crucial competences for professional life (European Commission/EACEA/Eurydice, 2015; Paniagua & Sánchez-Martí, 2018; UNESCO, 2019).

Recent years have witnessed efforts to bridge the divide between university and professional spheres through the implementation of competence-based teaching approaches. Consequently, teaching and assessment strategies in teacher training have evolved, but the persistent existence of the gap necessitates the design of improved practices that equip aspiring teachers with essential skills. In this context, project-based learning has emerged as a standard teaching practice to promote the development of the professional competences in pre-service teachers. However, the precise conditions under which project-based learning settings promote specific sets of competences remain unclear.

1.1. Competence-based approaches in higher education

The conceptualization of a profession, being a social and cultural construct, extends beyond its economic and functional aspects. A university degree or a training process on the roles and responsibilities associated with a specific job, and the evidence of having acquired certain competences, provides the legitimacy to undertake such a job (Caride et al., 2017). The curricula designed to make possible the transition from job training to professional practice primarily revolve around knowledge, disciplines, and competences.

Competences, as a concept, remain controversial (Attewell, 2009). While they have become increasingly embedded in educational programs, further research is needed to assess the extent to which the expectations associated with competences are fulfilled (Perrenoud, 2009). López et al. (2018) show a generally unfavourable perception among university teachers regarding the impact of competence-based approaches on enhancing their professional practice. This suggests that the efforts devoted to the structural implementation of competence-based approaches have not yielded fully productive outcomes. It is thus necessary to question the possibilities and limitations of developing such an approach in Early Childhood Education (hereafter ECE) degree programs.

The possibilities and limitations of these structural changes are closely related to methodology and assessment. Engaging and motivating teaching activities have the potential to yield efficient, systematic, profound, functional, and relevant learning outputs, and serve as transformative models. New approaches to pre-service training should prioritize student-centred learning (Navarro et al., 2015), fostering critical, reflexive, active, and responsible thinking, and developing professional competences that cut across the entire degree program (Pallisera et al., 2010). In turn, these competences should be evaluated by means of processes of self-assessment, peer-

assessment and teacher-assessment (Tejada & Ruiz, 2016), the first two being rare in present-day higher education in Spain.

1.2. Perception of professional competence

The perception of professional competence in pre-service university training has been underscored as a significant factor in shaping the future performance of teachers (Tschannen-Moran et al., 1998). A robust body of research supports the notion that such perception results "in students' learning, motivation, and other positive outcomes" (Duffin et al., 2012, p. 827). Tschannen-Moran et al. (1998) and Tschannen-Moran and Hoy (2001) observe that the "teachers' sense of efficacy is an idea that neither researchers nor practitioners can afford to ignore" (p. 803).

Research has identified various factors that influence a strong sense of efficacy. In the context of Turkish pre-service EFL teachers, Yüksel (2014) notes that self-efficacy "depend[s] more on enactive experience and social persuasion than on vicarious experience and affective state as sources of information." (p. 7). Gender differences have also been found to be significant (Köksal, 2013). Additionally, a positive but modest correlation has been detected between pre-service teachers' self-efficacy beliefs and academic year, with senior and junior teachers scoring higher compared to freshmen and sophomore (Şenel & Nazlı, 2016). In contrast, Pendergast et al. (2011) noted that efficacy beliefs decline from the first week to the final semester of university programs. Furthermore, pre-service teachers specializing in ECE demonstrate higher efficacy beliefs compared to those in primary education, who, in turn, ranked higher than their counterparts in secondary education.

The importance of the training activities is thus revealed as crucial since meeting students' educational needs is essential for improving the perception of competence in higher education programs (Mah & Ifenthaler, 2018). At the same time, and in a reverse direction, a stronger sense of efficacy positively impacts teacher candidates' academic performance (White & Bembenutty, 2013). How can university education, then, have an impact on the perception of competence? Research suggests that integrating theoretical courses and practical activities plays a vital role. Ma and Cavanagh (2018), for example, establish that "it is important that those programs link theory to practical activities such as observing classroom teaching (in person and via video) and participating in microteaching or making student presentations" (p. 146). For their part, Virtanen et al. (2017) have noted that "the use of active learning methods, such as goal-oriented and intentional learning as well as autonomous and responsible group work, are strongly and positively related to the achievement of professional competences" (p. 1).

Different studies (Anderson et al., 2009; Berg & Smith, 2018) have revealed significant positive effects of practicum subjects on teachers' perception of professional competence. However, to date, there is not an equivalent volume of evidence (and therefore, academic consensus) on the effects of other types of subjects.

1.3. Theoretical-practical integration for competence-based training

During the first decade of the 21st century, university teaching in Spain has faced criticism from students who perceive lack of connections with the professional or practical spheres (Calvo & Susinos, 2010; Sarceda-Gorgoso & Rodicio-García, 2018). This issue is particularly relevant for university degrees related to integral education and personal growth, such as those of future teachers. Cárdenas-Rodríguez et al. (2015) reveal that the more meaningful learning experiences for students are those that

involve real cases and experiences, and the participation of professionals. However, on occasion, university teaching contributes to a false separation between academic and practical knowledge, hindering the integration of teacher training.

Several studies have corroborated the importance of connecting theory and practice to enhance the students' acquisition of their professional skills (López-Pastor et al., 2016; Martínez-Mínguez, 2016) and establish connections between academic and professional contexts (Martínez Clares et al., 2019). Other researchers have observed increased students' motivation when designing educational activities to be implemented in schools (Pascual-Arias et al., 2019). These types of integrated experiences also contribute to a smoother transition from university to a professional career (García-Aracil et al., 2018).

Various higher education teaching settings have promoted academic development by bridging theory and practice, or by establishing connections between the academic and professional spheres. Experiences of Service-learning (SL), which combine learning processes with service to the community and aim at enhancing the quality of education (Martín et al., 2018), contribute to internalizing university students' education, foster dialogue and communication with in-service teachers, and offers a closer vision to the educational jobs (García García & Cotrina, 2015). SL activities also foster students' personal involvement and commitment, as they have to take part in the analysis of the necessities of a natural context, in decision taking, and in the design of actions to improve or transform such contexts (García García & Cotrina, 2015). Francisco and Moliner (2010) have reported an improvement, via SL, of the reflexive and critical skills and sense of empowering of practitioners, in a similar way as noted by Krus and Pla (2016) on the implementation of SL projects for the professional development of intervention skills in psychomotricity in Germany and Spain. For its part, project Oriented Learning (POL) also connects theory and practice by focusing groups of students on solving problems which they are likely to encounter as practitioners (Nieva et al., 2020).

In this context, the present research explores the effects of four distinct project-based learning settings in Spain, which emphasize close collaboration with schools, on the perception of professional competence. It is worth considering whether the energies devoted to strengthening the ties in ordinary subjects between the university, and schools and preschool institutions are effectively bridging the gap between theory and practice. Thus, the study aims to investigate whether project-based learning subjects that establish close collaboration with preschool institutions enhance the perception of competence in play and movement-based learning settings for pre-service teachers in Early Childhood Education (ECE).

2. Methods

We have designed a pre-post test by means of the ECPP-FIM scale (*Escala de Competencias Profesionales Psicomotrices en la Formación Inicial de Maestros*), which evaluates professional psychomotor intervention skills in the context of the ECE training (Martínez-Mínguez et al., 2022). The significance of these skills arises from the necessity to provide opportunities for the development of psychomotor skills in children (Tsangaridou, 2017) and to enhance children's movement experiences in early childhood education programs (Gehris et al., 2014), which are intrinsic to play and movement-based settings.

The goal of our study is to determine whether there is an improvement in the ECPP-FIM scores of students enrolled in project-based ordinary subjects that establish

connections between university and preschool institutions. Our hypothesis is that, upon completing these courses, students' perception of self-competence in professional psychomotor intervention skills would have improved, as measured by the ECPP-FIM scale, regardless of university, gender, age, academic year, and pathway to university.

Sample

The sample for our study consists of a total of 586 students enrolled in the Degree in Early Childhood Education at four different universities in Spain, all of which promoted induction programs alongside practicum subjects. Despite variations in settings such as assessment criteria, duration of student practice at schools, and subject planning, the subjects were considered a unified study sample due to their shared core elements of project-based learning conditions. These courses focused on imparting the necessary professional skills for educating in ECE play and movement-based learning settings and were taught in close collaboration with a preschool.

The teaching setting for the four university courses shared specific learning conditions: a) active participation of students as educators in play and movement-based learning settings in a preschool, b) collaborative design of the relationship between the institution and student intervention by university and preschool teachers, c) mentoring of students by educators in the preparation and implementation of movement-based learning activities for preschool pupils, and d) involvement of preschool teachers in student assessment, providing regular feedback on their intervention.

The age range of the students in the study was between 18 and 45 (M= 21.68, SD= 2.5), distributed in 533 female (94.4%) and 33 male (5.6%). 38.4% of the students were sophomores, 12.1% were junior, and 49.5% senior. In terms of the pathway to university, 39% of the students accessed university via a vocational studies degree in ECE, while the remaining 61% accessed university by other routes (mainly another bachelor's degree). The distribution of students across universities was as follows: Universitat Autònoma de Barcelona (UAB), n= 290; Universitat de Girona (UdG), n= 145; Universitat de Vic - Universitat Central de Catalunya (UVic-UCC), n= 80, and Universidad de Zaragoza (UniZar), n= 71. Before they participated in the study, participants were provided with informed consent and the legal conditions regarding data safety and storage were strictly adhered to.

Data analysis

We have used descriptive statistics (median, standard deviation, frequency, and percentages) to describe the characteristics of the sample and their scores on the ECPP-FIM scale. We conducted contrast tests pre- and post-test to examine the differences between pre- and post-test results as the dependent variable, while using other variables (university, gender, age, academic year, subject, pathway to university) as independent variables. In particular, we have applied one-way ANOVA for variables with three levels (university and subject) and t-tests for two-level variables (gender, age, academic year, pathway to university). For factors that exhibited significant differences (university and pathway to university), we conducted a mixed ANOVA with an intrasubject factor (time) and two intersubject factors (university, pathway to university), resulting in a 2x2x4 design. We have also calculated the effect size for interpretation, considering .01 as a small size, 0.06 as medium, and 0.14 as large. The analysis was conducted with SPSS version 24.

Instruments

We have used the ECPP-FIM scale, validated by Martínez-Mínguez et al. (2022) within the context of ECE teachers' training, to assess students' perception of the development of professional psychomotor skills. The scale presents a high coefficient of internal consistency for factors (coefficient alpha between .874 and .942) and consists of five areas of competences, encompassing a total of 35 items:

- Area 1. Design of psychomotor intervention sessions
- Area 2. Application of the practitioner attitude system
- Area 3. Observation and assessment of the child and the session
- Area 4. Analysis and reflection on one's own practice and that of others
- Area 5. Relationships with the educational and scientific community

3. Results

3.1. Description of the scores of ECPP-FIM scale for university and pathway to university access

Descriptive statistics show that, in general, scores in the ECPP-FIM scale improve between the pre- and post-tests, both globally and for each university (Table 1).

Table 1

Pre- and post-test median scores in the ECPP-FIM Scale, according to university

	General		UAB		UdG		UVic-UCC		UniZar	
	Pre M(SD)	Post M(SD)	Pre M(SD)	Post M(SD)	Pre M(SD)	Post M(SD)	Pre M(SD)	Post M(SD)	Pre M(SD)	Post M(SD)
Area 1	3.40 (0.99)	4.97 (0.61)	3.40 (0.79)	4.97 (0.56)	3.34 (1.17)	5.12 (0.57)	2.97 (1.04)	4.76 (0.75)	3.69 (1.07)	4.94 (0.68)
Area 2	4.22 (0.93)	5.15 (0.65)	4.14 (0.83)	5.16 (0.61)	4.29 (1.04)	5.27 (0.61)	4.28 (1.03)	5.08 (0.77)	4.31 (1.05)	5.00 (0.71)
Area 3	3.76 (1.07)	4.81 (0.79)	3.66 (0.97)	4.78 (0.78)	3.92 (1.15)	4.84 (0.85)	3.41 (1.13)	4.87 (0.77)	4.22 (1.01)	4.82 (0.75)
Area 4	4.45 (0.91)	5.21 (0.69)	4.48 (0.90)	5.29 (0.61)	4.46 (0.92)	5.30 (0.65)	4.35 (0.97)	4.90 (0.86)	4.15 (0.87)	5.09 (0.77)
Area 5	4.24 (0.95)	4.93 (0.79)	4.15 (0.89)	4.91 (0.79)	4.39 (1.01)	5.03 (0.79)	4.30 (1.03)	4.92 (0.84)	4.29 (0.96)	4.82 (0.77)

In general terms, students demonstrated higher scores post-test than in pre-test across the five competence areas, both globally and within each university. Despite this, some differences were observed in the effect size across institutions.

In the Competence of Design of Psychomotor Intervention Sessions (area 1), the general mean increased from 3.4 to 4.97. Among the universities, UdG showed the greatest improvement (3.34 to 5.12). Also, UVic-UCC, which started with a lower pre-test mean (2.97), showed substantial progress, reaching 4.76. In the Application of Practitioner Attitude System competence (area 2), scores increased from 4.22 to 5.15, with notable gains at UdG (5.27), UniZar (5.00), and UAB (4.14 to 5.16). Despite some variation in pre-test scores, all universities reached similar levels of post-test performance, indicating a good overall level in this competence. Regarding the

Observation and Assessment competence (area 3) scores improved from 3.76 to 4.81, with UVic-UCC showing the greatest change (3.41 to 4.87). These results suggest that the emphasis on observation and assessment is consistent across the four universities and may be particularly effective at UVic-UCC, where students demonstrated the greatest progress in magnitude. In Reflection on Practice competence (area 4), scores went from 4.45 to 5.21, with notable results at UAB (4.48 to 5.29) and UdG (4.46 to 5.30). Finally, with regards to the Relationships with Educational and Scientific Community competence (area 5), there was a mean increase from 4.24 to 4.93, the differences across universities were less pronounced in this area, indicating a more uniform progression in relationships with the scientific community.

If we consider the access to the degree via vocational studies (CFGS) or other vias (mainly bachelor's degree) (Table 2), students improved in all five competence areas, regardless they accessed the program through CFGS (vocational studies) or bachelor's degree and other routes. However, the magnitude of the improvement varied slightly between these groups, indicating that background and prior education might influence the degree of competence development.

Table 2

Pre- and post-test median scores, according to pathway to access university

	Access via CFGS		Access via bachelor's and others	
	Pre M(SD)	Post M (SD)	Pre M (SD)	Post M (SD)
Area 1	3.67(0.97)	5.07(0.57)	3.23(0.96)	4.91(0.63)
Area 2	4.31(0.91)	5.25(0.62)	4.16(0.94)	5.10(0.66)
Area 3	3.94(1.03)	4.88(0.78)	3.65(1.08)	4.77(0.80)
Area 4	4.47(0.92)	5.34(0.62)	4.44(0.91)	5.14(0.72)
Area 5	4.28(0.96)	5.02(0.76)	4.22(0.95)	4.87(0.81)

In general terms, an improvement exists for the five areas of competence, regardless of the students' access pathway to university. However, students entering through vocational studies (CFGS) consistently scored higher in both the pre-test and the post-test.

Regarding Psychomotor Intervention Design competence (area 1), students entering from vocational backgrounds (CFGS) improved significantly, with scores rising from 3.67 to 5.07. Bachelor's degree students also improved, moving from 3.23 to 4.91. As for the Competence Practitioner Attitude System (area 2), both groups showed robust performance. Specifically, CFGS students increased from 4.31 to 5.25, while bachelor's entrants rose from 4.16 to 5.10. With regards to the Competence Child Observation and Assessment (area 3) vocational students improved from 3.94 to 4.88, and bachelor's students from 3.65 to 4.77. Also, in the Practice Analysis and Reflection competence (area 4), the vocational group advanced from 4.47 to 5.34, while bachelor's students improved from 4.44 to 5.14. Finally, in the Professional Community Relationships Competence (area 5), both groups made notable progress, with CFGS students' rising from 4.28 to 5.02 and bachelor's students from 4.22 to 4.87.

3.2. Impact of university and pathway to university access in the improvement of scores in the ECPP-FIM scale

In Table 3 the final results of the mixed ANOVA can be found. A series of successive analyses were conducted in order to identify the relevant variables for an evaluation of the perception of the 5 competence areas. In this process no differences were observed

among gender, age, subject and academic year, thus these results are not presented in Table 3.

As can be seen in Table 3, the only statistically significant differences between the pre- and post-tests referred to university and pathway to university access.

Table 3

Mixed ANOVA for the five areas of the ECPP-FIM scale

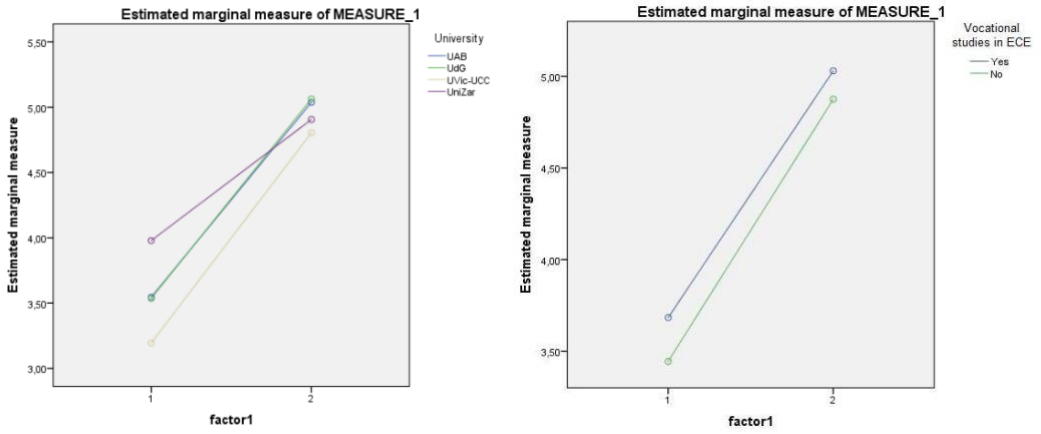
		Area 1		Area 2		Area 3		Area 4		Area 5	
Source	df	F	*p*	F	*p*	F	*p*	F	*p*	F	*p*
Intrasubject											
Factor	1, 545	950.33	<.00	340.52	<.00	309.21	<.00	4.36	.04	130.79	<.00
Factor* University	3, 545	9.47	<.00	3.77	.01	10.27	<.00	2.33	.07	2.89	.03
Factor* CFGM	1,545	1.19	.28	0.22	.64	1.91	.17	1.56	.21	.41	.52
Intersubject											
University	3, 545	8.59	<.00	2.25	0.81	3.21	.01	9.05	<.00	4.14	.01
Pathway CFGM	1, 545	17.54	<.00	19.70	<.00	14.25	<.00	3.04	0.82	6.12	.01

3.2.1. Area 1. Design of psychomotor intervention sessions

In analyzing the effects, there is an interaction between the time factor (pre-post) and the university ($F(3,545)= 9.473$, $p< .001$) for area 1 (Design of psychomotricity sessions) of the ECPP-FIM scale. As seen in Figure 1 left (see also Table 1 for descriptive statistics), scores improved for all universities.

Figure 1

Graphic representation of pretest (1) and posttest (2) scores on the time factor by University and Access Pathway in area 1



Statistical contrasts confirmed significant differences among the four universities under study, in particular in the scores for UAB, UdG and UVic-UCC. UniZar presents statistically significant differences ($p< .05$) compared to UVic-UCC. Although UniZar students present less variation between their pre- and post-test scores, their initial scores were higher, allowing less room for improvement. UVic-UCC had the lowest starting scores, yet the post-test scores were virtually equal to those of the other universities. UAB and UdG followed similar patterns, surpassing the post-test scores of the other universities.

On the other hand, for the pathway to university (Figure 1, right; see Table 2 for descriptive statistics), there is no interaction between Factor (pre-post) and pathway ($F(1,545)= 1.193$, $p= .28$). Despite this, data confirm that, regardless of their university,

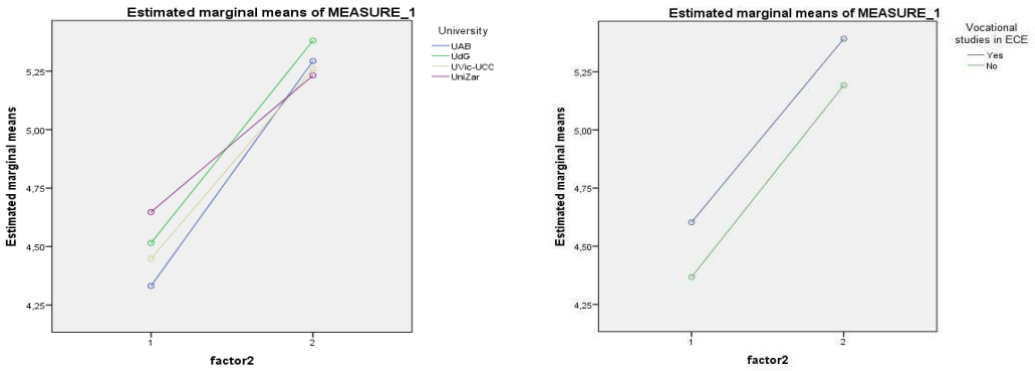
students accessing the degree from vocational studies (CFGS) present higher pre- and post-test scores for area 1 (F(1,545)= 17.537, p< .001).

3.2.2. Area 2. Application of the professional attitude system

As for area 2, we have detected an effect in the interaction between the time factor (pre-post) and university (F(3,545)= 3.773, p= .01). In Figure 2 left (see also Table 1 for descriptives), results of this interaction are depicted. Moreover, we have observed differences between the pre- and post-test scores (F(1,545)= 340.517, p< .001). Post-hoc tests revealed that the higher post-test scores are those for UdG students. UniZar, with the highest pre-test scores, presents the smallest variation between pre- and post-tests. The most relevant improvement is that of UAB, with the lowest pre-test scores and with post-test scores of equal values as those of the other universities. Differences between the universities have been confirmed as not significant by statistical contrast tests.

Figure 2

Graphic representation of pretest (1) and posttest (2) scores on the time factor by University and Access Pathway in area 2



In the case of UAB, which exhibits the highest improvement at a descriptive level, it should be noted that area 2 receives significant attention in the subject. This is evident through the provision of individual feedback on each student's attitudes immediately after the practical session conducted at the university. Similarly, in the case of the UdG, the subject incorporates sessions of bodily exercises that combine practice and reflection on the teacher-psychomotrician's attitudes.

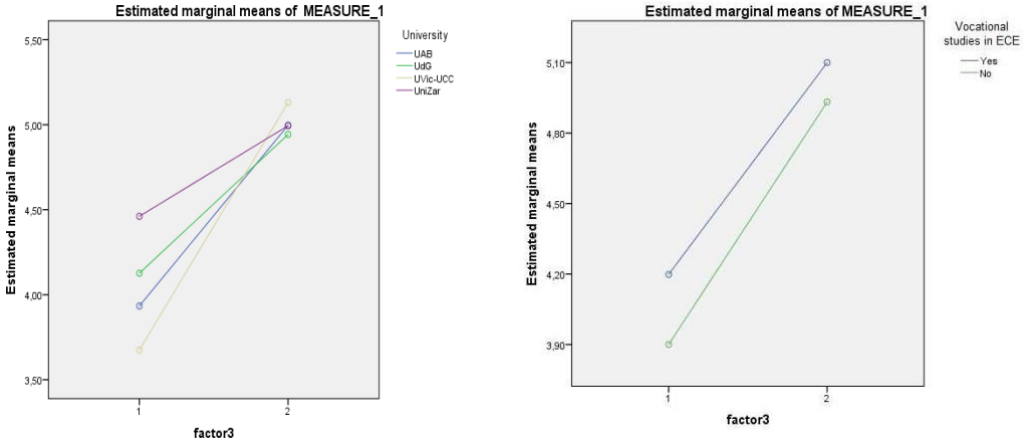
Regarding the access pathway to university, again no interaction was found (see Figure 2, right), but data showed that students who accessed the degree through vocational studies (CFGS) exhibited higher pre-test and post-test scores for area 2, regardless of the university they attended (F(1,545)= 19.695, p< .001).

3.2.3. Area 3. Observation and assessment of the child and the session

For area 3 we have observed an effect in the interaction between the time factor and university (F(3,545)= 10.273, p< .001; see Table 3 and Figure 3 left).

Figure 3

Graphic representation of pretest (1) and posttest (2) scores on the time factor by University and Access Pathway in area 3



Moreover, we have observed differences between the pre- and post-test scores (F(1,545)= 309.213, p< .001). *Post-hoc* contrast analysis posteriorly confirmed an absence of significant differences between UAB and UdG compared to UVic-UCC and UniZar. However, there were statistically significant differences between UVic-UCC and UniZar (p<.05) (see Table 1 for descriptive statistics).

UniZar has the lowest variation for area 3, but its initial scores were higher, leaving less room for improvement. UVic-UCC, which had the lowest initial scores, showed a significant improvement and achieved the highest post-test results for competence 3. A similar evolution exists for UAB and UdG, albeit with a more moderate improvement. The most notable descriptive improvement was observed in UVic-UCC, where this competence played a central role in the subject, as students focused the final task on the observation of two subjects and elaborated on a final report of their evolution. As for the pathway to university, data confirms that, regardless of university, students accessing the degree from vocational studies (CFGS) present higher and statistically relevant pre- and post-test scores for area 3 (F(1,545)= 14.250, p< .001).

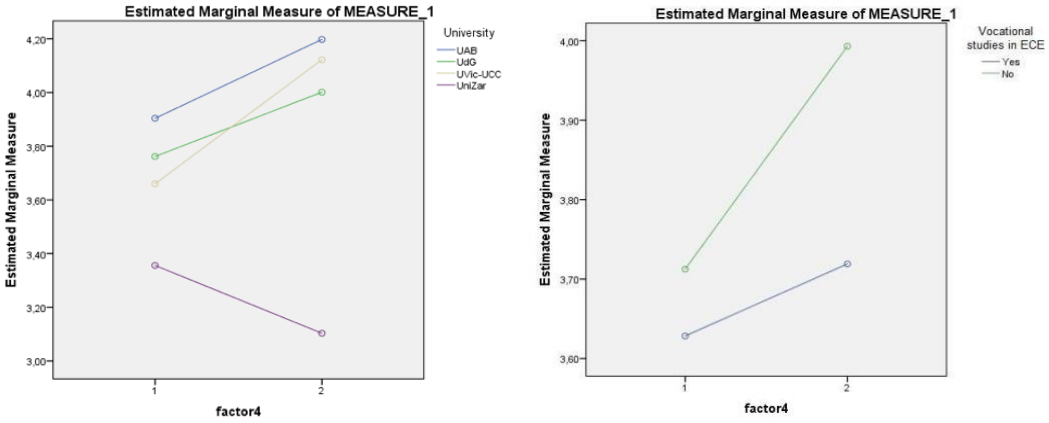
3.2.4. Area 4. Analysis and reflection on one's own practice and that of others

A can be seen in Table 3 and Figure 4, area 4 shows an improvement in the time factor (F(1,545)= 4.361; p= .04); however, no interactions were found between the time factor and university or between time factor and access pathway to university.

The study of intersubject effects does reveal differences among the four universities (F(3,545= 9.048, p< .001). In particular, post-hoc analysis revealed that while there were no differences among UVic-UCC, UAB and UdG, there exist statistically significant differences between these three and UniZar, with much lower scores than the rest both in pre- and post-test scores (p=< .05). UniZar is the only university of the study where the planned practical session did not take place due to COVID-19-related restrictions. UAB, UdG and UVic-UCC showed moderate improvement, with UVic-UCC achieving higher scores despite having lower initial scores. This could be explained because in the UVic-UCC subject, reflection on the intervention is systematically conducted at the end of each session.

Figure 4

Graphic representation of pretest (1) and posttest (2) scores on the time factor by University and Access Pathway in area 4



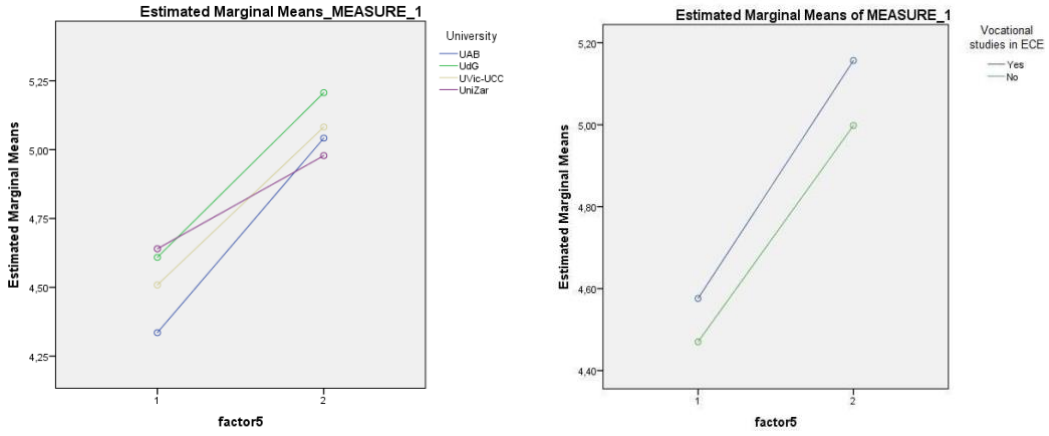
The case of area 4 reversed the tendency by which vocational studies students showed better pre- and post-test scores than those entering via a Bachelor's degree. While there is improvement for both groups at a descriptive level, there are not significant differences at the population level.

3.2.5. Area 5. Relationships with the educational and scientific community

Finally, as shown in Table 3, there was an interaction between time factor and university for area 5 ($F(3,545)= 2.892$, $p= .03$). These results can be also seen in Figure 5 left.

Figure 5

Graphic representation of pretest (1) and posttest (2) scores on the time factor by University and Access Pathway in area 5



Contrast analysis confirmed significant differences between UAB and UdG ($p< .05$), but no significant differences between UVic-UCC/UniZar and UAB/UdG were found. Although UAB students initially had the lowest pre-test scores, their notable improvement resulted in post-test comparable to the other universities. UniZar's improvement, on the other hand, was relatively small. UdG and UVic-UCC exhibited a similar positive trend, starting with high pre-test scores and achieving even higher scores in the post-test compared to the other universities. It is worth mentioning that UAB, which showed the highest improvement at a descriptive level, places special

emphasis on this competence by sharing practical session documents with the academic community in the preschool.

As for the pathway to university, and regardless of university, students coming from vocational studies present higher pre- and post-test scores for area 5 ($F(1,545)= 6.120$, $p= .01$).

4. Discussion

Our research has provided answers to the initial hypothesis. On the one hand, we have observed, at a descriptive level, an improvement in the ECPP-FIM scores on professional psychomotricity competences in the context of different university subjects with different methodological strategies, regardless of sex, age, academic year, pathway to university and subject. Nonetheless, some results stand out over the others. In particular, students arriving at university from vocational studies score higher than the rest in all areas related to different competences. At the same time, the improvement of students from UniZar tends to be more moderate, given that their pretest scores for areas 1, 2, 3, and 5 are higher. The most significant improvements are for UAB in area 2 (Application of the professional attitude system); UVic-UCC in area 3 (Observation and assessment of the child and the session) and UAB in area 5 (Relationships with the educational and scientific community). On the contrary, improvement in area 4 (Analysis and reflection on one's own practice and that of others) is commonly moderate, but it is noteworthy that perception of competence of vocational students diminishes in the post test. In light of these results, there are three important questions to address: the education on competences, the experiences of students and the pedagogical approach.

Firstly, when considered as a whole, this study conveys a positive message regarding the beneficial effects of project-based learning subjects on student training. It particularly confirms the academic expectations concerning on the development of competences (Perrenoud, 2009), at least within the subjects and professional areas examined. It is because they are methodologies that promote spaces for reflection for the student about their own learning process (Saberiego et al., 2019), as a consequence of contact with other professionals, allowing them to better understand the daily complexity of a school (García-Monge et al. 2020; Nieva et al. 2023). By doing so, it also contributes to fostering the formation of university teachers who still harbour reluctance or lack enthusiasm about the impacts of competence-based education (López et al., 2018; Sarceda-Gorgoso & Rodicio-García, 2018).

Secondly, and in relation to the experiences undergone by the students of teaching and the development of their professional competences, our study offers results that depart from those in other studies. In particular, in contrast with the results of Şenel and Nazlı (2016) and Köksal (2013), all students in our study, regardless of university, subject, or gender, exhibit similar perceptions of competences and experience improvements in their perception of professional competence. Moreover, our results reveal higher increases in the perception of competence compared to the findings of Ma and Cavanagh (2018). In contrast, our results align with the findings of Mah and Ifenthaler (2018), suggesting that the subjects in our study have addressed the formative needs of the students. The learning experiences they have undergone could enhance their autonomy and foster a perception of pedagogical empowerment, as reported by García García and Cotrina (2015), thereby promoting an increase in the perception of competences.

Thirdly, we can locate the reason for these positive results on project-based learning projects at the pedagogical level. Regardless of the assessment criteria, duration of student practice at preschool institutions, and subject planning, all these subjects may have benefited from the use of educational experiences that integrate the academic and professional worlds, a factor noted in previous studies (López-Pastor et al., 2016, 2020; Martínez-Mínguez et al., 2016). In this sense, establishing strong links with the schools facilitates a good integration of theory and practice across subjects in a degree, which emerges as a key element in fostering knowledge acquisition, as noted in some studies (Cárdenas-Rodríguez et al., 2015). We anticipated that these connections established in ordinary subjects could bridge the gap between theory and practice and show positive effects on teachers' perception of professional competence. Furthermore, this construction of links with educational environments makes it possible to develop "creative, innovative and inclusive learning ecosystems" necessary in the initial training of teachers (Álvarez-Arregui & Arreguit, 2019, p. 462). This extends beyond the improvements observed solely in practicum subjects, as reported by some authors (Anderson et al., 2009; Berg & Smith, 2018).

This last point appears to be significant in explaining the results and supporting the implementation of induction programs, as suggested by the European Commission/EACEA/Eurydice (2015), Paniagua and Sánchez-Martí (2018) or UNESCO (2019). Based on our findings, it seems that project-based learning subjects that establish close collaboration with educational institutions contribute to the enhancement of teaching quality and play a crucial role in facilitating experiences that improve students' critical teaching skills. This study, along with other international reports (UNESCO, 2019), agrees that the key to developing more effective teachers during initial teacher education may lie in the use of induction programmes that provide personal, social, and professional support, including mentoring, guidance from expert teachers, peer support and self-reflection.

5. Conclusions

Regarding the proposed objective, it is concluded that in subjects where close collaborations are established between university professors and teachers in real environments through PBL during the initial training of Early Childhood Education teachers, students' perception of the acquisition of professional skills improves after carrying out interventions based on play and movement in natural contexts. This improvement is made in each of the five areas analysed: Area 1. Design of psychomotor intervention sessions; Area 2. Application of the practitioner attitude system; Area 3. Observation and assessment of the child and the session; Area 4. Analysis and reflection on one's own practice and that of others; and Area 5. Relationships with the educational and scientific community. The difference is highlighted by the fact that students who come from professional studies perceive a greater improvement than those who come from high school in all areas except for area 4. This result contributes to the ongoing debate on the characteristics and opportunities of vocational studies as a pathway for university degrees, in particular with respect to access from high school.

Furthermore, our research points to the importance of possessing and applying tools for the self-assessment of teaching practice, such as the ECPP-FIM scale, which can stimulate processes of recognition of competence acquisition in higher education. The assessment of students' perception of competence in ordinary subjects, not limited to practicum subjects, fosters a natural contextually situated and authentic acquisition of

professional competences. Considering that ordinary subjects constitute a substantial portion of students' formative workload, the effects of these changes could be significant, complementing the existing effects observed in practicum subjects. If the gap between the academic and professional worlds is to be reduced, the results of this study should be taken into account in the regulatory guidelines for new curricula. Applying these results would contribute to improving the perception that a university degree's competency-based approach really prepares for professional practice in a particular job.

Below we highlight the key aspects to be incorporated into the new regulatory guidelines for ordinary subjects in order to effectively improve the perception of professional competence. We believe that ordinary subjects should include a project of intervention in a real context involving the participation of in-service teachers. This interaction with the professional world should be mentored by the practitioners and encompass a blend of theoretical instruction, practical intervention, and personal development, as professional competence covers various domains. The teaching context should promote the educator's involvement in the assessment process, enabling students to grasp the practical requirements of the setting and acquire practical competences from experts. Lastly, these subjects should generate useful materials and documents for the preschool institution.

As a final remark, we would highlight that this study raises some limitations, such as those caused by the specific context of the pandemic at the time of the intervention in one of the participating universities. The findings suggest the need to continue researching, for example, students who access higher education through professional studies and to clarify why it is the only one of the five areas of competencies analysed that does not show significance.

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