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Article

Higher education apprenticeship. Analyzing the impact and essential conditions of workplace resources on apprentices' career satisfaction

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Abstract: This research explores the necessity and the effect of job resources for undergraduates' career satisfaction during work experience in an apprenticeship program. Additionally, we examine the extent to which a supportive environment enhances apprentice career satisfaction by providing access to valuable learning experiences. We propose PLS equation modelling with a sample of 81 students who completed a dual apprenticeship degree in Business Administration and Management at Spanish University. The study finds that all three workplace job resources are necessary for career satisfaction among apprentices. Learning opportunities and social relations have significant effects, while job control contributes only marginally. It highlights that learning opportunities enhance social relations, emphasizing the importance of feedback. The study extends job resource research to university level apprenticeships, showing that without these resources, apprentices lack career satisfaction. It highlights that learning opportunities are crucial for satisfaction through social relations and offers guidance for designing effective workplace training programs.

Keywords: apprenticeship; job resources; necessary conditions; social relations; learning opportunity; job control; career satisfaction

1. Introduction

Apprenticeships are a particular form of training which blend classroom learning with hands on experience at a company to provide a well rounded education. Despite variations in apprenticeship programs from country to country (Muehlemann and Wolter, 2020; Wolter and Ryan, 2011), which makes it challenging to arrive at any universally agreed definition, the academic literature commonly references their dual structure (on the job and off the job). Additionally, research by Jansen and Pineda-Herrero (2019) and Muehlemann and Wolter (2020) shows that a strong pool of companies willing to train apprentices is essential for a successful apprenticeship system. This confirms the critical role of company participation (Schlögl and Mayerl, 2023). In this regard, companies may have several motivations for participating in this type of training (Jansen and Pineda-Herrero, 2019; Schlögl and Mayerl, 2023). Regardless of their reasons, however, they must design and provide an appropriate learning context to ensure apprentices' satisfaction (Lüthi et al., 2021; Messmann and Mulder, 2015). Fischer (2018) provides evidence that the student's learning satisfaction and occupational commitment are considered to be both indicators and outcomes of high quality education and training. Similarly, several studies have shown a positive relationship between the provision of situational resources (e.g. instruction quality, learning opportunity, climate, autonomy and demands) and trainee satisfaction (Lüthi et al., 2021; Messmann and Mulder, 2015; Nägele and Stalder, 2019). Hofmann

et al. (2014) also state that workplace resources are crucial for success in apprenticeship programs and appear to have a greater impact on apprentices' satisfaction than the resources provided in the classroom. Further research is therefore required as to the impact that workplace resources provided by training firms in on the job experience have in ensuring an appropriate learning environment and, consequently, the apprentices' career success.

The positive effect of job resources and educational and personal resources on the career success of employees and VET apprentices is well documented (Elfering et al., 2016; Lüthi et al., 2021; Ng and Feldman, 2014; Spurk et al., 2019; Stalder and Lüthi, 2020). Specifically, the literature shows that job resources such as job control, learning opportunity and social relations appear to affect subjective career satisfaction among VET apprentices (Ng and Feldman, 2014; Rigotti et al., 2014; Stalder, 2019; Stalder and Lüthi, 2020). It is also known that job resources in workplace training impact vocational education and the satisfaction and occupational commitment of apprentices in training. However, evidence for a similar connection in undergraduate apprenticeship programs is sparser. Moreover, it is important to increase our understanding in this area in order to explore the effects on career satisfaction of the three dimensions that make up the concept of Job Resource (learning opportunity, job control and social relations) (Black et al., 2021) and to determine the connections that exist between them. In addition, a more in depth appraisal of the need for the three domains of job resources is required to support their use in undergraduate apprenticeships. Following Self Determination Theory (Ryan and Deci, 2000) and Social Development Theory (Vygotsky, 1978), this quantitative study, therefore seeks to address the following research questions:

R1: From the apprentice's point of view, which job resources in on the job training are necessary conditions in university level apprenticeships for generating career satisfaction?

R2: Do workplace resources in apprenticeships affect the apprentices' career satisfaction?

R3: To what extent does a supportive working environment that offers feedback and networking opportunities enhance an apprentice's career satisfaction through access to valuable learning experiences?

This paper contributes to the literature in several ways. Firstly, it seeks to expand the literature on job resources for workplace learning, particularly in the context of university apprenticeship programs. It develops a framework for workplace learning in university level apprenticeship programs, exploring the situation of higher education beyond vocational education and training. Moreover, by applying Self Determination Theory (Ryan and Deci, 2000) the study also analyzes the connections between job resource dimensions and apprentices' career satisfaction. In particular, it analyzes job resources through the lens of social interaction/relations and their impact (from the apprentices' perspective) on student learning and achievement, since peer feedback affects students' learning and achievements (Black et al., 2021; Voeller, 2024). The findings of this study may also provide insights for those wishing to effectively design workplace experiences with a view to increasing career satisfaction among university apprentices. The study proposes tangible strategies for creating a more enriching experience for university apprentices in the workplace. By identifying

key job resources, the study equips training companies to design and manage high quality learning environments within university apprenticeship programs.

The paper is structured as follows: we begin by describing the framework of job resources in workplace learning during an apprenticeship program and their role in career success, setting out our research hypotheses. Next, we present the details of our research methodology, the empirical research method and the results obtained therefrom. Finally, we set out our discussion and conclusions, followed by limitations and possible directions for future research.

2. Theoretical framework and hypotheses

This section defines career success and workplace resources, while exploring the relationship between them. It also highlights the mediating role of learning opportunities and presents the hypotheses that will be tested in the study (**Figure 1**).

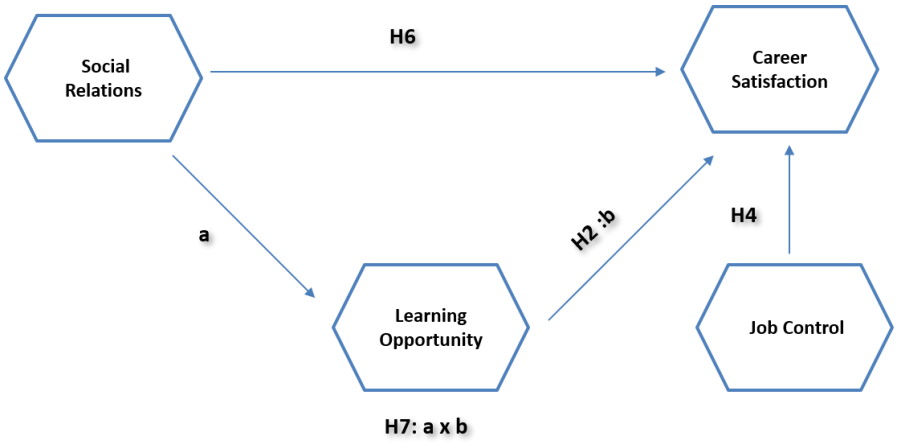

Figure 1. Conceptual model and hypotheses.
Source(s): Figure by author.

2.1. Career success

Career success relates to both the objective and subjective outcomes of an occupational career (Stalder and Lüthi, 2020). Objective career success can be observed by others and quantified using standardized criteria such as salary and job position (Spurk et al., 2019). In contrast, subjective career success refers to an individual's personal experience and own assessment of their career (Shockley et al., 2016). The concept of subjective career success has often been operationalized as job or career satisfaction (Lehtonen et al., 2022).

The positive relation that having resources has on an employee's career success is well documented in the literature (Elfering et al., 2016; Spurk et al., 2019; Stalder and Lüthi, 2020). However, Ng and Feldman (2014) and Rigotti et al. (2014) show that the specific resources of job control, skill utilization, and supervisor support appear to have a greater impact on subjective career outcomes than on objective success. Likewise, Stalder (2019) and Stalder and Lüthi (2020) have demonstrated that graduates in careers with high learning opportunities, job control and potential for career development achieved greater career satisfaction.

In the context of apprenticeship programs, several studies (Messmann and Mulder, 2015; Truxillo et al., 2012) have suggested that apprentices with high levels of resources are more satisfied with their training. Similarly, guaranteeing high resources in both the school and the workplace is crucial for apprentices' satisfaction (Lüthi et al., 2021; Nägele and Stalder, 2019). Nevertheless, Hofmann et al. (2014) show that workplace resources play a key role in educational success during apprenticeship programs, since they affect subjective evaluation more than school based resources do. As Rintala et al. (2019) state, this might be because apprentices identify their role as being that of young workers in training rather than as school students.

Therefore, ensuring the availability of job resources throughout apprenticeship in the workplace appears to be a prerequisite for ensuring the apprentice's career satisfaction in an apprenticeship program.

2.2. Workplace job resources within apprentices' program and career satisfaction

One of the most common characteristics throughout different types of apprenticeship is a combination of in company experience and academic classroom activity (Wolter and Ryan, 2011). This duality reinforces the need for companies to collaborate to ensure the success of the program (Schlögl and Mayerl, 2023) while also requiring that both the academic and work context be suitably designed, since well developed on the job training is just as important as basic classroom work (Helper et al., 2016). Nevertheless, one of the major criticisms of apprenticeship in recent years has been the quality of workplace training (Baker, 2019); this is an important issue that must be addressed by the literature (Böhn and Deutscher, 2021). Similarly, Onstenk (2018) suggests that the quality of workplace learning in terms of content, guidance and assessment is still a major issue of dispute. These factors are relevant in shaping the work based learning environment and need to be considered when learning takes place in the workplace (Kaarby and Lindboe, 2016). Likewise, Messmann and Mulder (2015) and Lüthi et al. (2021) suggest that the company must design and provide an appropriate learning context to ensure apprentices' satisfaction with their learning. Similarly, in a VET context, Keller and Semmer (2013), Stalder (2019) and Stalder and Lüthi (2020) show that job and career satisfaction are greater among apprentices with greater learning opportunities, job control and potential for professional development. In this regard, Kyndt and Baert (2013) argue that job resources contain a high motivational potential, providing conditions that enable workers to learn, advance in their careers, and satisfy their needs for competence, autonomy, and relatedness. Thus, job resources play a crucial role in fulfilling the three basic psychological needs outlined in Self Determination Theory (Ryan and Deci, 2017). This theory proposes that humans are driven by both external and internal factors. However, internal motivators, which stem directly from the work itself (Tamrin et al., 2018) tend to be more powerful than external ones. Self Determination Theory also identifies three core psychological needs: competence (feeling effective and achieving goals), autonomy (control over actions) and relatedness (feeling connected to others) (Karimi and Sotoodeh, 2020). Tjin A Tsoi et al. (2018) suggest

that fulfilling these needs is essential for human growth, development, and overall well-being. In the field of education, researchers have shown that satisfying the Basic Psychological Needs has a positive and significant effect on intrinsic motivation (Buil et al., 2019), increasing students' engagement (Karimi and Sotoodeh, 2020; Leo et al., 2022). Deci et al. (2017) also highlights the importance of job design. When jobs are designed with features that make them easier to do well (facilitating characteristics), employees experience greater fulfilment of their basic needs, increased intrinsic motivation, and ultimately achieve better results, including higher performance and satisfaction with their work. Thus, Stalder and Lüthi (2020) link the three BPNs (competence, autonomy and relatedness) to specific job resources: learning opportunity fulfils the need for competence; job control supports autonomy; and social relations address the need for relatedness.

In these terms, learning opportunities in the workplace represent a job resource that provides employees with the necessary mechanisms to develop skills, feel effective and capable in assigned responsibilities, overcome challenges, and achieve desired outcomes (Karimi and Sotoodeh, 2020). Pylväs et al. (2022) refer to workplace learning opportunity as an environmental and task related factor that contributes to expanding and deepening employees' professional and vocational knowledge. Subjective career success has also been linked to opportunities for the development of new knowledge, skills and professional growth (Koekemoer et al., 2019; Shockley et al., 2016). Thus, there are connections between workplace learning opportunities and career satisfaction (Lehtonen et al., 2022). In light of these arguments, we posit the subsequent hypotheses:

H_1: Learning opportunity is a necessary condition for apprentices' subjective career success.

$H_{2(+)}$: Learning opportunities in the workplace are positively related to apprentices' career satisfaction.

Job control is another resource that is closely related to the design of tasks for the apprentice. In the work context, support for autonomy is crucial because employees who receive such support are able to find ways to satisfy their other needs as well (Deci et al., 2017). Moreover, the literature shows that job satisfaction is affected by increased work pressure when it is not accompanied by greater workplace autonomy (Lopes et al., 2014). Similarly, Elliott et al. (2017) and Bagheri Hossein Abadi et al. (2021) report that amongst healthcare workers, increased job control is linked to higher job satisfaction, although the correlation is only marginally significant. In an apprenticeship context, workplace autonomy is a high priority competence in apprentice training (Barabasch and Briante, 2021). Chong et al. (2021) also indicate that support for autonomy from supervisors facilitates socialization within organizations by contributing to the satisfaction of newcomers' basic psychological needs. Thus, considering the apprentice as a junior worker and based on these arguments, we propose the following hypothesis:

H_3: Job control is a necessary condition for apprentices' subjective career success.

$H_{4(+)}$: Job control in the workplace is positively related to apprentices' career satisfaction.

Relatedness, as a component of social relations, refers to experiencing a sense of closeness and connection with others during daily interactions (Karimi and Sotoodeh,

2020); as a job resource, it is regarded as contributing positively to employees' professional efficacy and personal well-being (Bakker and Demerouti, 2007). There is evidence in the literature of the importance of the guiding role of the mentor (Metso, 2014; Zehr and Korte, 2020) and integration of the apprentice into a supportive peer group (co-workers) (Mikkonen et al., 2017; Voeller, 2024). In this regard, the scientific literature has shown that it has a positive impact on career progression and satisfaction among young individuals (Hooley, 2016; MacQueen and Aiken, 2020). Likewise, interpersonal feedback and social interaction with the mentor and peers are linked to apprentice satisfaction (Black et al., 2021; Koekemoer et al., 2019; MacQueen and Aiken, 2020). Thus, to support positive career satisfaction, it is important for organizations to develop a culture of feedback and foster positive feedback from colleagues and supervisors (Lehtonen et al., 2022). Black et al. (2021) demonstrate that student anxiety is likely to be greater in situations where significant feedback from the instructor is considerably reduced. Sandal et al. (2014) also indicate that the level of apprentice interaction conditions the workplace learning experience, while Ng and Feldman (2014) show that social support in the workplace is related to career satisfaction.

Drawing from these considerations, we therefore posit the following hypothesis:

H_5: Social relations in the workplace are a necessary condition for apprentices' subjective career success.

$H_{6(+)}$: Social relations in the workplace are positively related to apprentices' career satisfaction.

2.3. Mediating role of learning opportunity

The acquisition of knowledge in a workplace setting is intricately shaped by social dynamics, as Zehr and Korte (2020) note. According to Social Development Theory (Vygotsky, 1978), cognitive development and learning abilities are not isolated processes but are guided by social interactions. In this respect, Ceelen et al. (2021) highlight the crucial role played by interactions in students' learning experiences. According to Eun (2019), social interactions facilitate knowledge internalization through mediation with others.

In an apprenticeship context, several studies support the importance of providing a mentor or instructor (Black et al., 2021; Metso, 2014; Mikkonen et al., 2017) as a key condition for workplace learning (Zehr and Korte, 2020). Additionally, Mikkonen et al. (2017) and Voeller (2024) recognize the importance of sharing responsibility for the mentoring role among colleagues, co-workers and experienced employees to ensure the quality of the apprentice's learning opportunity (Black et al., 2021) and learning outcomes (Billett, 2002; Mikkonen et al., 2017; Rausch and Schley, 2011). In addition, interpersonal feedback plays a crucial role, making social interactions self relevant and consequential (Hepper et al., 2011) and thus providing more learning opportunities (Voeller, 2024). Zehr and Korte (2020) and Metso (2014) consider mentors' feedback to be a potential predictor of workplace learning. However, Tee and Ahmed (2014) note that a good feedback system involves multiple sources of information to enhance learning. Apprentices should therefore receive feedback from

several sources, including their manager, subordinates, and peers, in order to have greater opportunities for development and learning (Black et al., 2021).

Ultimately, everyday work activities and interactions between experienced workers and peers contribute to opportunities for participation in learning (Voeller, 2024); this in turn is linked to the apprentice's career satisfaction (Koekemoer et al., 2019; Lehtonen et al., 2022). Based on these arguments, we therefore propose the following hypothesis:

$H_{7(+)}$: Learning opportunities in the workplace serve as a mechanism that enables social relationships to contribute to apprentices' career satisfaction.

3. Materials and methodology

After outlining the theoretical and conceptual framework, as well as the hypotheses to be tested, this section describes the methodology used.

3.1. Data collection and sample

We collected data from graduates from Business School at Mondragon University, (MU), located in the Basque Country (Spain). The university offers a learning experience that blends academic education with personal and professional development through a practical, company focused approach. In 2016, MU became one of the first universities in the Basque Country to be awarded Dual Education accreditation.

In Spain, regulations permitting apprentices to undergo training in a dual system have been in place since 2012. This initiative was established to offer young people an alternative pathway as they transition from higher education to the job market (Muehlemann and Wolter, 2017). All university degree programs with dual accreditation require students to complete mandatory work experience in a company or organization, which constitutes between 25% and 50% of their credits, including the final degree project. An employment contract is established between the organization and the student, clearly outlining that the student will engage in tasks directly related to their field of study, allowing them to effectively balance work and academic commitments. According to Jansen and Pineda-Herrero (2019), the number of companies offering dual apprenticeship programs in Spain increased from 500 in 2012/2013 to 10,000 in 2016/2017.

To ensure that respondents had sufficient knowledge to answer the questions, we targeted students who had completed a four year dual apprenticeship degree in business management. Business Administration and Management is the most highly prized university degree amongst employers in the category of social sciences and law in Spain, accounting for 27.32% of all job offers (The Adecco Group, 2021).

For research, we used a survey method to achieve our research objective. To collect data, a questionnaire was developed, initially in English. It was then translated into Spanish using the most widely used technique of back translation (Brislin, 1970) (See Appendix). To evaluate the effectiveness of our questionnaire, we carried out a pilot test with 14 students and made several modifications based on their input. Next, we contacted potential participants to explain the study's objectives and seek their consent to participate in the survey. After, we sent the questioner via email.

We collected a total of 81 usable data points out of 100 for further analysis. The demographic distribution of the sample comprised 56 (69.14%) females and 25 (30.86%) males (**Table 1**). The respondents had an average age of 23 years.

Table 1. Sample description.

Gender	***n***	**%**
Male	25	30.86
Female	56	69.14
Total	81	100

Source(s): Table by author.

Given that the most complex regression in the proposed research model has three predictors, assuming a medium size of 0.15 and a power of 80, where alpha is 0.05, a minimum sample size of 77 grade students was required. The final sample (n = 81) therefore meets the initial sample size requirements.

3.2. Measures

All measurements of the variables were defined as composites and adopted from scales validated in previous studies (**Table 2**). For instance, the measurement of the endogenous variable career satisfaction (CS) was adopted from Greenhaus et al. (1990). We conducted a confirmatory tetrad analysis (CTA PLS) to verify precise measurement models and distinguish between formative and reflective indicators (Gudergan et al., 2008). The results indicated that a substantial number of tetrads for CS were not significant. Therefore, a reflective measure appears to be most appropriate for CS.

The scale of the three predictors, learning opportunity (LO), social relations (SR) and job control (JC) were adopted from the work of Appel et al. (2017). For the other two, this has not been verified. However, it is expected that the LO indicators are not related, and it is therefore modelled as formative (mode B) while JC is modelled in mode A.

We used a 7 point Likert scale for all the composites ranging from 1 (strongly disagree) to 7 (strongly agree).

Table 2. Descriptive statistics, reliability, average extracted variance form composite and external loadings of the scale items.

Indicator	**loading**	**weight**	**Mean**	**SD**	**Pa**	**Pc**	**AVE**	**VIF**
Career Satisfaction (Composite, Mode A)					0.953	0.945	0.781	nd
CS1	0.948***	0.250***	5.519	1.572				
CS2	0.955***	0.251***	5.457	1.580				
CS3	0.590***	0.140***	4.284	1.847				
CS4	0.924***	0.229***	5.593	1505				
CS5	0.944***	0.243***	5.543	1.572				

Table 2. (*Continued*).

Indicator	loading	weight	Mean	SD	Pa	Pc	AVE	VIF
Career Satisfaction (Composite, Mode A)					0.953	0.945	0.781	nd
Job Control (Composite Mode A)					0.911	0.902	0.756	1.238
JC1	0.895***	0.420***	5.444	1.388				
JC2	0.912***	0.479***	4.741	1.412				
JC3	0.797***	0.235***	5.457	1.334				
Learning Opportunity (Composite Mode B)					nd	nd	nd	2.448
LO1	0.810***	0.240***	4.901	1.675				
LO2	0.895***	0.481***	4.296	1.674				
LO3	0.873***	0.429***	5.444	1.656				
Social Relations (Composite mode A)					0.894	0.916	0.611	2.536
SR1	0.675***	0.185***	6.173	1.225				
SR2	0.823***	0.177***	5.222	1.625				
SR3	0.794***	0.207***	5.420	1.430				
SR4	0.838***	0.184***	5.519	1.540				
SR5	0.759***	0.190***	5.309	1.428				
SR6	0.750***	0.160***	4.753	1.552				
SR7	0.819***	0.179***	5.375	1.536				

Notes: Mean = average score of all the items included in this measure, SD = Standard Deviation, ρc: Jöreskog's composite reliability; ρa: Dijkstra-Henseler's composite reliability, AVE = Average variance extracted. *** $p < 0.0001$ based on percentile bootstrapping (n = 10,000; two tailed test)
Source(s): Table by author.

3.3. Data analysis method

This study used PLS SEM to examine the influence of workplace apprenticeship resources on students' career satisfaction. PLS SEM is suitable for analyzing reflective constructs, which are better represented by a composite model, providing more accurate results by fully accounting for the variance in the indicators (Guenther et al., 2023).

We began by assessing the measurement model, which is valid and reliable. We then employed different robustness checks such as endogeneity and unobserved heterogeneity to assess the consistency and reliability of the results of the model (Sarstedt et al., 2020). To evaluate the significance of the estimated parameters such as loading, weights and path coefficient we used the percentile bootstrapping approach based on 10,000 subsamples to obtain 95% confidence intervals (CI) and p values (Chin, 1998). Bootstrapping is a non parametric resampling procedure that assesses the variability of a statistic by examining the variability of the sample data rather than using parametric assumptions to assess the precision of the estimates (Streukens and Leroi-Werelds, 2016) more detail in Efron and Tibshirani (1994).

In addition to general hypothesis testing using the sufficiency logic, we conducted Necessary Condition Analysis NCA (Richter et al., 2020), which enabled us to understand the must have factors for career satisfaction. The software used was SmartPLS version 4.1.0.0 (Ringle et al., 2022).

3.4. Common method bias

Questionnaire studies can be susceptible to common method bias (CMB) when the same person answers questions about both the independent and dependent variable (Podsakoff et al., 2012). To address this concern, we implemented several strategies: i) separating predictor and criterion variables; and ii) ensuring respondent anonymity. These measures seek to minimize the influence of any systematic bias arising from the research method itself (Podsakoff et al., 2012). Additionally, at the beginning of the questionnaire, we included detailed research purposes and instructions (Jordan and Troth, 2020).

Common method bias was examined by performing a full multicollinearity test for the external model. All the resulting VIFs were less than 3.3, showing that our model was not contaminated by CMB (Kock, 2015) (**Table 2**).

4. Results

The following section presents the obtained results, concentrating specifically on the evaluation of the measurement model, verifying its robustness, and assessing the structural model (hypotheses testing).

4.1. Assessment of the measurement model

As per Hair et al. (2021), we assessed measurement quality trough construct reliability, convergent validity and discriminant validity for composites in mode A. The full results of the measurement model are set out in **Table 2**. All composite reliability values (rho a and rho c) were greater than .7, suggesting good composite reliability. Next, convergent validity was achieved, since the average variance extracted (AVE) was greater than .5. Items with a loading of between .4 and .7 were retained as long as AVE values were greater than .5. In this study, satisfactory discriminant validity was achieved, since all HTMT were less than .85, as suggested by Henseler et al. (2015) (**Table 3**).

Table 3. Discriminant Validity: Heterotrait monotrait ratio (HTMT) of the model.

	Career Satisfaction	**Job Control**	**Social Relation**
Career Satisfaction			
Job Control	0.505 [0.250; 0.715]		
Social Relation	0.822 [0.685; 0.919]	0.463 [0.246; 0.701]	

Note: The brackets indicate the range between the lower and upper bounds of the 95% confidence intervals (two tail test).
Source(s): Table by author.

For composite learning opportunity (LO) estimated in Mode B, we ran a redundancy analysis (Cheah et al., 2018). All measures showed convergent validity, scoring above 0.996 on their respective paths (above the minimum threshold of 0.7); they were also statistically significant at the 0.001 level. Further, we evaluated collinearity using the variance inflation factor (VIF). The values obtained were less than 3, showing that there were no multicollinearity issues. Additionally, we calculated the weights of LO and their significance; all values were significant.

4.2. Assessment of unobserved heterogeneity

Following the systematic procedure developed by Sarstedt et al. (2017) for identifying and if required treating unobserved heterogeneity in PLS path models, we first ran the FIMIX PLS procedure on the data. The results of the fit indices for the one to three segment solutions paint an ambiguous picture (**Table 4**). Sarstedt et al. (2011) have shown that whenever AIC3 and CAIC indicate the same number of segments, this is the correct solution. In our case, whereas CAIC indicated a one segment solution, AIC3 suggested a three segment solution. Sarstedt et al. (2011) further note that AIC4 and Bayesian information criteria (BIC) generally perform well when used to determine the number of segments in FIMIX PLS. Both criteria point to a one segment solution, which appears to be densely clustered according to the EN criterion (Hair, et al., 2016). We therefore assume that unobserved heterogeneity is not at critical level, supporting the results of the entire data set analysis.

Table 4. Unobserved heterogeneity results.

	Number of segments		
Criteria	**1**	**2**	**3**
AIC	289.366	275.793	265.328
AIC3	295.366	288.793	285.328
AIC4	301.366	301.793	305.328
BIC	303.733	306.921	313.217
CAIC	309.733	319.921	333.217
EN	0	0.586	0.716

Notes: AIC: Akaike's information criterion; AIC3: modified AIC with factor 3; AIC4: modified AIC with factor 4; BIC: Bayesian information criteria; CAIC: consistent AIC; EN: entropy statistic.
Source(s): Table by author.

4.3. Endogeneity

We used the procedure suggested by (Hult et al., 2018) to assess endogeneity issues. We explored application of the Gaussian copula (Park and Gupta, 2012) following the guidelines proposed by Becker et al. (2022). Firstly, we normalized the independent latent variables (SR, LO, and JC) using both the Cramer Von Mises and Anderson Darling tests. All the predictors exhibit a non normal distribution (SR; CVM = 0.342, p = 0.000/AD = 2.315, p = 0.000, LO; CVM = 0.333, p = 0.000/AD = 1.893, p = 0.000, and JC; CVM = 0.292, p = 0.000/AD = 1.639, p = 0.000). Therefore, Gaussian copula approach is appropriate for verifying endogeneity. The results in **Table 5** show that none of the Gaussian copulas is significant. We consequently conclude that endogeneity is not present in this study.

Table 5. Assessment of endogeneity test using the Gaussian copula approach.

Test	**Construct**	**Coefficient**	***P* value**
Gaussian copula of model 1 (endogenous; JC)	JC	−0.04	0.852
	LO	0.643	0.000
	SR	0.213	0.079
	CJC	0.155	0.398

Table 5. (*Continued*).

Test	Construct	Coefficient	*P* value
Gaussian copula of model 2 (endogenous; LO)	JC	0,129	0.09
	LO	1,032	0
	SR	0.209	0.068
	CLO	−0.423	0.053
Gaussian copula of model 3 (endogenous; SR)	JC	0.119	0.115
	LO	0.639	0.000
	SR	0.340	0.070
	CSR	0.413	0.413
Gaussian copula of model 4 (endogenous; JC, SR)	JC	−0.07	0.752
	LO	0.656	0.000
	SR	0.355	0.069
	CJC	0.182	0.326
	CSR	−0.168	0.321
Gaussian copula of model 5 (endogenous; SR, LO)	JC	0.129	0.091
	LO	1.035	0.000
	SR	0.205	0.321
	CSR	0.005	0.979
	CLO	−0.426	0.087
Gaussian copula of model 6 (endogenous; JC, LO)	JC	−0.031	0.884
	LO	1.045	0.000
	SR	0.200	0.088
	CLO	−0.423	0.053
	CJC	0.155	0.380
Gaussian copula of model 7 (endogenous; JC, SR, LO)	JC	−0.036	0.867
	LO	1.03	0.000
	SR	0.225	0.288
	CLO	−0.404	0.104
	CJC	0.160	0.377
	CSR	−0.029	0.877

Source(s): Table by author.

4.4. Structural model

Table 6. Summary of results from Partial Least Squares analysis.

	Standardized β	*P* value	CI	f2	Support
H2(+): LO → CS	0.643	0.000	[0.487; 0.808]	0.734**	Yes
H4 (+): JC → CS	0.132	0.031	[0.018; 0.250]	0.056ns	Yes
H6 (+): SR → CS	0.646	0.000	[0.526; 0.758]	0.039ns	Yes
H7 (+): Indirect effect SR → LO → CS	0.493	0.000	[0.375; 0.634]		Yes
Direct effect: SR → LO	0.766	0.000	[0.689; 0.840]	1.419**	
Direct effect: SR → CS	0.153	0.084	[−0.033; 0.330]		
Gender → CS	0.378	0.001	[0.162; 0.615]	0.121ns	

R^2(CS) = 773***; and R^2(LO) =0.587***.
Note: Hypothesized effects are assessed applying one side test. Effects from R2, f2 and control variables are assessed by applying a two tailed test. Bootstrapping based on n = 10,000 samples. ns non significant, *** p < 0.001, ** p < 0.01, * p < 0.05
Source(s): Table by author.

The first three hypotheses are supported by the results generated from a bootstrapping procedure of 10,000 resamples (**Table 6, Figure 2**). Job Control (β = 0.132, P = 0.031) was found to have a significant positive influence on student's career

satisfaction. Furthermore, it was found that learning opportunity ($\beta = 0.643$, $P = 0.000$) and social relations ($\beta = 0.646$, $P = 0.000$) were significant factors in career satisfaction. The results, shown in **Table 6**, indicate that the specific indirect effect of SR on CS through LO was significant ($\beta = 0.493$, $P = 0.000$). Since the direct effect of LO on CS was non significant, this relationship is totally mediated by LO. In addition, gender, the control variable, shows a positive effect on CS.

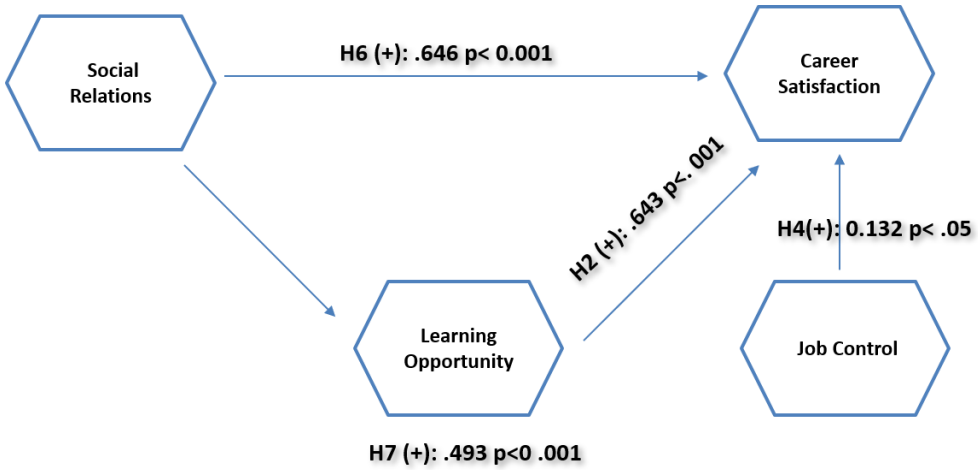

Figure 2. Path coefficient of structural model.
Source(s): Figure by author.

Table 7. NCA Effect size.

	Career Satisfaction	
	CE-FDH	***P* value**
LO (H_1)	0.276	0.000
JC (H_3)	0.156	0.008
SR (H_5)	0.373	0.000

Notes: LO: Learning Opportunity; JC: Job Control; SR: Social Relations; CE-FDH: Ceiling Envelopment-Free Disposal Hull.
Source(s): Table by author.

Table 8. Bottleneck table CE FDH Percentile levels.

Dependent variable		**Dependent Variable**			
Learning opportunity	**Social relation**	**Career Satisfaction**	**Job control**	**Learning opportunity**	**Social relation**
0%	0	0%	0	0	0
10%	2469	10%	1235	2469	2469
20%	3704	20%	1235	2469	2469
30%	3704	30%	1235	2469	2469
40 %	4938	40%	1235	3704	4938
50%	8642	50%	1235	3704	4938
60%	11,111	60%	1235	12,346	11,111
70%	20,988	70%	3704	1358	11,111
80%	20,988	80%	3704	28,395	11,111
90%	45,679	90%	3704	33,333	12,346
100%	96,296	100%	50,617	38,272	22,222

Source(s): Table by author.

Next, we conduct NCA to determine the must have factor on LO and CS (Dul, 2016). **Figure 3** shows the scatter plots for all relevant relations. We used the ceiling envelopment free disposal hull (CE FDH) line to "separate the space with observations from the space without observations" (Richter et al., 2020, *p*. 2246). Based on **Table 7**, the results show that all the apprentices' workplace job resources are a necessary condition for career satisfaction. We also used the bottleneck technique to identify the threshold level of the necessary condition for reaching a certain level of outcome (CS, LO). **Table 8** shows that in order to reach a 60% level of career satisfaction, three necessary conditions must be met: job control of no less than 1.23%, learning opportunity of no less than 12.35% and social relations of no less than 11.11%.

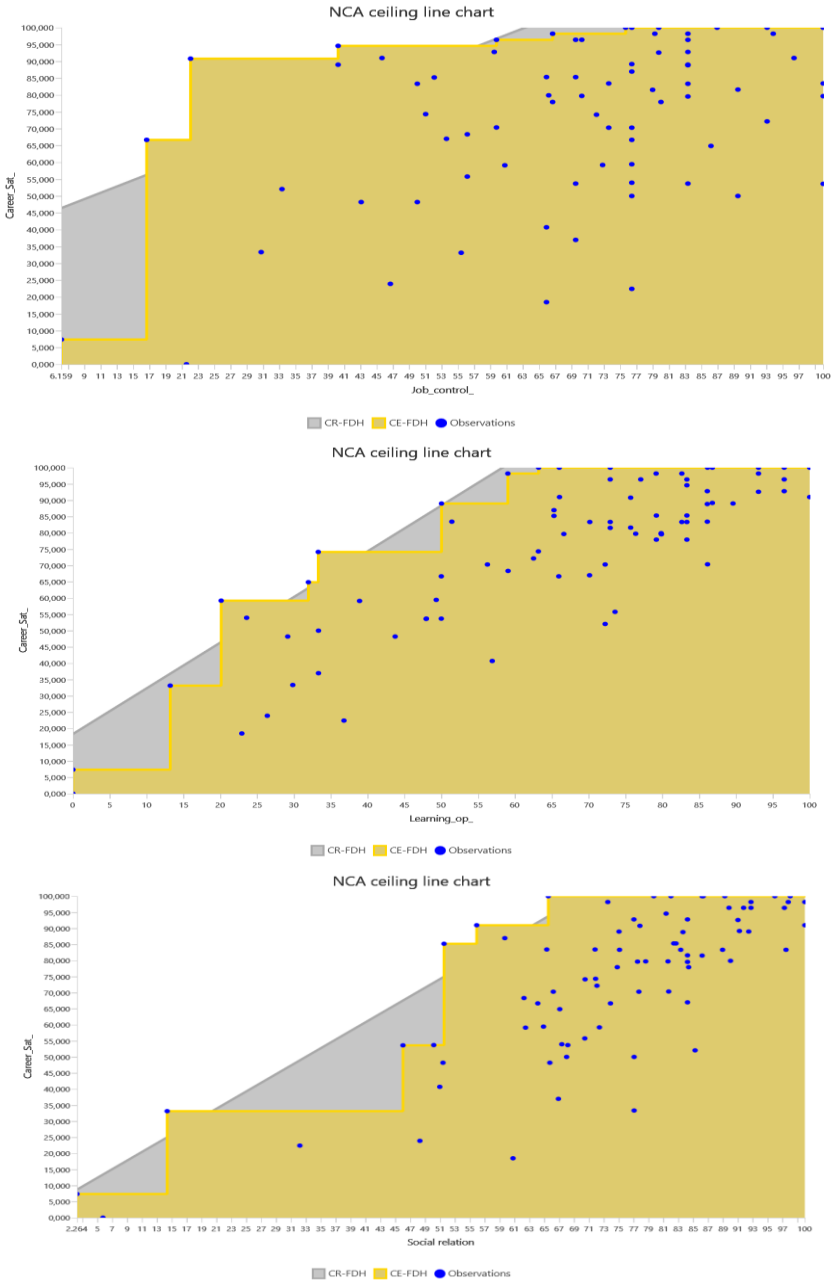

Figure 3. Scatter plot of the necessity analysis conducted between job resources and career satisfaction.
Source(s): Figure by author.

5. Discussion, conclusions and implications

This study examines the conditions of workplace job resources that are necessary and sufficient to achieve career satisfaction among apprentices. Additionally, it offers valuable insights into apprenticeship in higher education, with profound implications for education providers as designers of a satisfactory learning environment. The study finds that workplace apprenticeship job resources were significant determinants and necessary conditions for apprentices' career satisfaction.

The NCA study indicates that learning opportunity, job control and social relations are necessary conditions for achieving apprentices' career satisfaction. However social relations have a greater effect size, meaning that this condition is considered to be more important. Thus, if an apprenticeship program does not ensure these job resources in the workplace, there will be no career satisfaction for apprentices. Our findings therefore corroborate that–from the apprentices' point of view the dimensions established to define the concept of job resources in VET apprenticeship contexts are also appropriate for university level apprenticeship programs.

The model establishes that social relations, learning opportunity and job control affect the apprentices' career satisfaction throughout university level apprenticeship workplace learning. However, the effect of each dimension of job resources on the apprentice's satisfaction differs. This finding is in line with the literature, which postulates that social relations (Black et al., 2021; MacQueen and Aiken, 2020), learning opportunities (Koekemoer et al., 2019; Lehtonen et al., 2022) and job control (Barabasch and Briante, 2021; Chong et al., 2021) positively affect apprentices' career satisfaction. The findings also show that learning opportunity and social relations have a substantial impact on apprentices' career satisfaction. In this regard, in order to achieve social relation/interaction, it would appear to be necessary to ensure the presence of a mentor or instructor in the training company who can assume the role of guiding the apprentice (Black et al., 2021) and providing the relationship between apprentice and mentor (MacQueen and Aiken, 2020). In keeping with the findings of Mikkonen et al. (2017) and Voeller (2024), the role of guiding the apprentice's learning process within the company should also be the shared responsibility of co-workers and colleagues. The possibility of receiving peer feedback can be less intimidating than exclusive feedback from the supervisor (Ranney et al., 2018), while also enabling career satisfaction (Koekemoer et al., 2019; Lehtonen et al., 2022).

However, job control has a smaller effect on apprentices' career satisfaction, making it a necessary factor, but not the most relevant. The effect observed in this analysis is in keeping with the literature (Barabasch and Briante, 2021; Chong et al., 2021), although this effect may vary in other university degree and workplace environments. According to the literature, in healthcare settings, an increase in job control leads to higher employee satisfaction, albeit with a marginal significance in correlation (Bagheri Hossein Abadi et al., 2021).

Moreover, the analysis shows that social relations and career satisfaction among apprentices are linked through learning opportunity, confirming previous findings. For example, Hepper et al. (2011) and Zehr and Korte (2020) show that feedback plays a key role, providing opportunities for improvement and learning. There is also

scientific evidence supporting the importance of the mentor figure, the mentor student relationship, and feedback as predictors of opportunity for the development of apprentice competences in workplace learning (Voeller, 2024; Zehr and Korte, 2020), positively impacting apprentice satisfaction (MacQueen and Aiken, 2020; Preble, 2022; Roberts et al., 2019). Moreover, Black et al. (2021) and Lehtonen et al. (2022) show the necessity of providing apprentices with feedback from various sources, including their managers, subordinates and peers, in order to give them more learning opportunities and career satisfaction throughout their workplace apprenticeship program.

5.1. Theoretical implications

This study has four main theoretical implications. On the one hand, our integrated framework offers a novel lens through which to examine the relationship between learning opportunity, job control and social relations and apprentices' career satisfaction in university level apprenticeship programs. This holistic approach not only enhances our understanding of the way in which the basis of workplace job resources is built in an apprenticeship, but also provides a nuanced perspective of the nature of apprentices' workplace resource management. On the other hand, our study introduces learning opportunities as a mechanism for explaining the relationship between social relationships and apprentices' career satisfaction, providing a nuanced understanding of the way in which social relations affect apprentices' subjective career success. Moreover, by combining PLS SEM and NCA, this research provides evidence that learning opportunity, job control and social relations were necessary conditions for apprentices' career satisfaction. Finally, our study addresses a gap in the literature, allowing for a wider understanding by exploring workplace job resources in apprenticeships in areas of higher education beyond the context of vocational education and training.

5.2. Practical implications

One common feature of several types of apprenticeship is the integration of on the job experience with academic classroom learning (Wolter and Ryan, 2011). This dual approach necessitates the design of both academic and work environments, in the understanding that comprehensive on the job training is just as vital as fundamental classroom work (Helper et al., 2016). However, Baker (2019) have shown that in recent years, significant criticism of apprenticeship programs has centered on the quality of the workplace training provided. In this regard, the literature suggests that the training company must design and provide a conducive learning environment for ensuring the apprentice's career satisfaction (Lüthi et al., 2021; Stalder, 2019; Stalder and Lüthi, 2020), considered as an indicator of high quality education and training (Fischer, 2018). This study provides insights into ways in which education providers should design workplace resources for apprentices to ensure their satisfaction. It is crucial to emphasize the three necessary conditions: learning opportunity, social relations and job control. In this context, it is important that the tasks assigned to students during their workplace experience are varied, providing opportunities for the development and application of professional skills. It's essential to keep in mind that

for learning to be effective, there must be a balance between the complexity and variety of tasks to prevent any negative impact on the learning experience (Froehlich et al., 2019; Nembhard and Osothsilp, 2002). These tasks should also include supervision and feedback from both supervisors and colleagues to create a supportive social environment that promotes student integration. Additionally, this supervision must allow for a certain level of autonomy, enabling students to apply their knowledge and feel a sense of accomplishment. Furthermore, education providers should be aware that the dimension of learning opportunity serves as a mechanism that helps social relations contribute to satisfaction. This means that it is necessary to design and provide workplace environments based on social relations (feedback and networking) that create opportunities for learning, thereby ensuring the apprentice's career satisfaction.

In this respect, it is important to structure and schedule the feedback process, specifying the frequency of feedback from supervisors and peers, and ensuring that the apprentice is offered learning opportunities. It is also crucial for both mentors and experienced co-workers to be involved in this feedback process. In this way, the apprentice will have a satisfying training experience, making it easier for the company providing the learning to retain that talent for its future needs.

Finally, although the findings of the study suggest that the job control dimension has only a minimal impact, it would be advisable for companies to structure tasks to allow apprentices some autonomy in their sequencing, content, and constituent processes.

5.3. Limitations and future directions for research

This study is not without its limitations. Firstly, the population studied is limited to the Basque Country; it would therefore be of interest to repeat the research on a national level or compare it to other countries. The study could also be replicated across different university courses to assess potential variations in results based on the student's degree program. Secondly, this research is cross sectional. Employing a longitudinal research design would offer greater confidence in drawing inferences as to the causal direction of the relationship in our model. Thirdly, although it has been identified through NCA analysis that all workplace job resources provided to the apprentice are necessary conditions for career satisfaction, it would be helpful to conduct a comparative qualitative analysis (QCA). QCA is well suited for studying complex phenomena such as apprentices' career satisfaction. A QCA analysis would thus enable us to understand which combination of workplace job resources for apprentices leads to career satisfaction. This allows individual cases to be identified in which the outcome (career satisfaction) is achieved, thus making it possible to understand the specific reasons leading to career satisfaction among apprentices. One possible direction for future research might therefore be to use a mixed research method to enhance understanding of this complex phenomenon.

5.4. Conclusions

Following Self Determination Theory and Social Development Theory, this study employs advanced PLS SEM procedures to investigate the relationship between the

workplace job resources in apprenticeships (learning opportunity, job control and social relations) and the career satisfaction of apprentices. Additionally, the combined use of PLS SEM and NCA provides a nuanced understanding of the conditional necessity of learning opportunity, job control and social relations for apprentices' career satisfaction. However, the relative impact of each dimension on the apprentices' satisfaction varies. In particular, the model establishes that learning opportunities and social relations do impact apprentices' career satisfaction during university level apprenticeship workplace learning, whereas job control only marginally contributes to their satisfaction. Of particular interest is the finding that learning opportunities serve as a mechanism that reinforces the relationship between social relations and career satisfaction. Finally, this study delivers empirical evidence and practical guidelines for designing and providing workplace learning environments that ensure apprentices' career satisfaction through the management of workplace job resources.

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Appendix

Appendix Questionnaire (English)

Career Satisfaction (Composite, Mode A)
CS1—I am satisfied with the success I have achieved in my career.
CS2—I am satisfied with the progress I have made toward meeting my overall career goals.
CS3—I am satisfied with the progress I have made toward meeting my goals for income.
CS4—I am satisfied with the progress I have made toward meeting my goal for advancement.
CS5—I am satisfied with the progress I have made toward meeting my goals for the development of new skills.
Job Control (Composite Mode A)
JC1—Influence on sequence of activities.
JC2—Influence on work content.
JC3—Influence on work load and procedures.
Learning Opportunity (Composite Mode B)
LO1—Learning new skills.
LO2—Use of knowledge, skills and ability.
LO3—Variety of task.
Social Relations (Composite Mode A)
SR1—Social support by co-workers.
SR2—Social support by supervisors.
SR3—Social cohesion within the department.
SR4—Necessity of cooperation.
SR5—Opportunity for social exchange with co-workers.
SR6—Feedback from supervisors.
SR7—Feedback from co-workers.

Notes: CS = Career Satisfaction, JC = Job Control, LO = Learning Opportunity, SR = Social Relations.