

WHEN ENOUGH IS NOT ENOUGH! EVALUATING THE MINIMUM ENTRY REQUIREMENTS FOR APPRENTICESHIPS IN IRELAND

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In Ireland, enrolment in built environment apprenticeships requires the satisfaction of minimum entry criteria of at least five pass grades in the Junior Certificate examinations or equivalent. This study looks at the correlation between the academic performance in these examinations and successful completion of the apprenticeship process. It concerns 60 randomly selected carpentry and joinery, electrical and plumbing apprentices, registered between 2010 and 2016 with an expected completion date between 2014 and 2020. This paper presents a dataset for evaluating apprenticeship entry requirements and assessing the influence of STEM subjects on apprenticeship completion. The study found on average, 55% of candidates presenting with Junior Certificate completed their apprenticeship, growing to 100% as the candidates' prior academic achievement increased. Additionally, the impact of mathematics entry level was significant, with completion rates increasing to 100% when higher level mathematics was undertaken. Because of the lack of readily available data, limited research exists evaluating entry requirements and as such the key contribution of this research will be to provide a base for further investigations and increase eventual apprenticeship completion rates.

Keywords: Apprenticeship; barriers; learning analytics; vocational; education

INTRODUCTION

An apprenticeship is a structured further education and training (FET) programme which formally combines learning and training in the workplace and an educational setting (Education and Skills, 2013). Apprenticeship addresses the demands of the economy and prepares the apprentice for their future career. Under the Industrial Training Act 1967, An Seirbhísí Oideachais Leanúnaigh agus Scileanna (SOLAS) is the national authority with statutory responsibility for apprenticeships. There are eight built environment apprenticeships available within a total of 67 programmes. These are brick and stone laying, plastering, electrical, stonecutting and masonry, wood manufacturing and finishing, painting, and decorating, plumbing and carpentry and joinery. These adhere to a seven-phase, standards-based, on-the-job, and off-the-job strategy to achieve QQI (Quality and Qualifications Ireland) Level 6 certification (O'Connor, 2006) which is equivalent to Level 5 on the European Qualifications

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Framework. The minimum duration of an Irish apprenticeship is 208 weeks, a reasonable completion cut-off date of 234 weeks was selected to account for examination board approval and certificate issuance. Neuber Pohl (2021) acknowledged the possibility of taking the final exam after the apprenticeship contract concludes and permitted updates to the education variable within 183 days following the end of the apprenticeship period.

As with any system or programme, it is prudent to examine the model and learn from findings. Completion rates are one way of indicating success and can determine the fundamental health of the curriculum and delivery of the programme. Gaining an understanding of this process is critical in assisting government agencies and training providers to determine whether and when to implement specific measures to increase apprenticeship completion. From a purely financial point of view, the 2019 Review of Participation and Costs of Apprenticeship reported that the costs of an apprenticeship to Irish government was €7,159 to €9,877 annually (Moran, 2019). The academic achievement of apprentices is one of the primary goals of the Irish government (Department of Further and Higher Education, 2021). The Action Plan for Apprenticeships 2021-2025 has set a target to increase the number of apprentice registrations to 10,000 annually by 2025 (Department of Further and Higher Education, 2021) which represents a 18% increase from registrations in 2022. This is in addition to the 17,000 construction employees who will be required to achieve the national retrofitting of 500,000 houses (SOLAS, 2022). However, high completion and retention rates were found to be as important as increased registrations in order to address skills shortages (McMahon, 2022).

This study specifically examines carpentry, electrical, and plumbing trades, which collectively represent around 94% of registered apprentices within the built environment sector (SOLAS, 2023). These trades are crucial in addressing the shortage of qualified workers in the construction industry as outlined in government publications (Phulphagar, 2022). According to the findings of the research report titled "Construction in Ireland 2022: Building a Workforce for the Future," construction companies are facing significant challenges due to skills shortages, with 63% encountering difficulties in their endeavours to acquire the skilled talent they require (Autodesk, 2022). The primary factor cited by industry professionals for this is the scarcity of skilled labour, which either encompasses a general lack of skilled workers or the inability to identify individuals possessing the required skill set.

Carpenters and joiners contribute significantly to residential and commercial construction projects with their expertise in woodworking, framing, and finishing work. However, the shortage of qualified carpenters leads to increased competition and challenges in meeting construction timelines and quality standards. Electrical apprenticeships are vital in bridging the gap for qualified electricians responsible for electrical installations, maintenance, and repairs. With the growing reliance on technology and electricity demands, well-trained electricians are essential for the safe functioning of buildings and electrical systems. Similarly, plumbing apprenticeships address the need for skilled plumbers specialising in plumbing system installation, maintenance, and repair. Plumbers ensure proper water supply, sanitation, and drainage in various settings. The shortage of qualified plumbers can result in project delays and compromised plumbing systems. To alleviate the shortage, it is crucial to improve completion rates and produce more skilled carpenters, electricians, and plumbers which will ensure a sustainable workforce, contribute to the development of the construction industry, and meet the evolving needs of the built environment.

Various Irish Acts were implemented to attempt to control the entry requirements for apprenticeship including the 1931 and 1959 Apprenticeship Act and more recently the Labour Services Act 1987-Apprenticeship Rules 1993 which stated that an apprentice should have minimum five grade Ds in the Junior Certificate on entry or approved equivalent. The Department of Education's Junior Certificate is a set of examinations taken typically after three years in secondary school. STEM (Science, Technology, Engineering, and Mathematics) subjects were not statutory requirements to undertake an apprenticeship, a fact that remains to this day.

The goal of this study is to examine the completion rates of apprentices who come from the lowest academic entry pathway. The findings may be used to guide the creation of new policies and procedures targeted at improving apprenticeship standards, offering more direction to apprentices, and raising completion rates. By recognising the difficulties apprentices encounter and emphasising the need for more research to discover prevention and early warning techniques, this study will also add to the body of knowledge already in existence.

Apprenticeship Completion Factors

There exists evidence on the factors influencing apprenticeship completion in other countries, including United Kingdom (Daniel *et al.*, 2020, Gambin and Hogarth, 2016, Greig, 2019), Australia (Harris and Simons, 2005), Canada, (Laporte and Mueller, 2013), and Germany (Bessey and Backes-Gellner, 2015, Greilinger and Sandner, 2021). In a recent systematic literature review, McMahon *et al.* (2022) found that factors influencing completion included fundamental apprentice attributes, features of the apprenticeship programme and employer considerations, however, it is reasonable to suggest that non-completion can be because of multiple factors.

Studies have shown that apprentices who enter a programme with better scores in secondary school achieve higher grades and higher completion rates in their apprenticeship (Laporte and Mueller, 2013). Non-completion rates are higher for apprentices who arrive from the lowest secondary school track (Neuber-Pohl, 2021). In Germany, it was found that when an apprentice's educational background and current performance matched the training provider requirements, the apprenticeship was less likely to be terminated quickly due to poor fit, and the probability of a fast termination reduced by 11.5 percentage points (Greilinger and Sandner, 2021). A study in University of Limerick found that the basic educational entry level was too low with up to 70% of apprentices with Junior Cert unable to complete theoretical exams (Buckley, 2008). While O'Connor (2006) reports that over 66% of registered apprentices complete their apprenticeship in Ireland, a later Oireachtas report declared trade completion rates of 65% in carpentry, 73% in electrical and 69% in plumbing (Oireachtas Report, 2019) however, these did not take in to account the entry pathway.

Hence, it is conceivable that there exists an increased risk of non-completion among apprentices entering at the lowest level of academic achievement. Building upon these observations, this study aims to investigate the potential association between the academic level of apprentices at the time of registration and their subsequent completion rates. In achieving this aim, the following research questions are posed:

1. What is the completion rate for carpentry and joinery, electrical and plumbing apprentices presenting with the Junior Cert alone?
2. Is there correlation between completion and the number of STEM subjects on registration?

3. Is there a relationship between academic performance in the Junior Cert and apprenticeship completion rates?

METHOD

This study utilised an ex post facto research design, which examines events that have already occurred. The data for this investigation was collected from applications and learner records in the SOLAS Apprenticeship Client Services System (ACSS), the national apprenticeship register. The study is part of a broader research project that has undergone review by an independent ethics committee.

In terms of academic entry levels, 22% of registered apprentices have completed the Junior Cert, 66% have completed the Leaving Cert, and the remaining entrants have gained access through alternative pathways (SOLAS, 2023). In the specific research area, 102 electricians, 33 carpentry, and 35 plumbing apprentices registered between 2010 and 2016 with only the Junior Cert qualification. For this study, 60 apprentices were randomly selected from this group. To minimise the potential impact of the COVID-19 pandemic, registrations made before March 2016 were considered, as colleges were mandated to close in March 2020.

Points were assigned to Junior Cert grades using the 2016 Leaving Cert points conversion table (Central Applications Office, 2023), as shown in Table 1. The conversion involved considering the eight best subjects, like the six best subjects in the Leaving Cert system. In this research, CSPE (Civic, Social and Political Education) results were assigned the same points as Higher Level, as there is no Common Level equivalent in the Leaving Cert. Furthermore, higher level mathematics received additional points in accordance with the Leaving Cert grading.

Table 1: Points Calculator for Leaving Cert (Central Applications Office, 2023)

Grade Achieved →	A1	B1	C1	D1	E
Subject and Level ↓					
Mathematics Higher Level	125	113	91	81	33
Mathematics Ordinary Level	56	46	28	20	0
Mathematics Foundation Level	20	12	0	0	0
Other Subjects Higher Level	100	88	66	56	33
Other Subjects Ordinary Level	56	46	28	20	0

Table 2 provides a comprehensive overview of the range of STEM subjects pursued by apprentices at the Junior Cert level. Among all apprentices, mathematics was universally taken, followed by science and wood technology as the subsequent popular choices. Notably, 85% of plumbers and 65% of carpenters enrolled in three or four STEM subjects. It is worth mentioning that a sole electrical apprentice undertook all six available STEM subjects at the Junior Cert level.

Table 2: Number taking each individual STEM subject at Junior Cert Level from a sample size of 20

Subject →	Maths	Technical Graphics	Science	Wood Technology	Metalwork	Technology
Trade ↓						
Plumbing	20	7	17	15	7	5
Electrical	20	11	12	16	6	2
Carpentry	20	7	18	16	9	0

Table 3 displays the breakdown of mathematical levels and grades undertaken by apprentices while completing their Junior Cert prior to registering for their apprenticeship. This shows that 5% of apprentices took higher level mathematics, 80% took ordinary level and 15% undertook foundation level mathematics.

Table 3: Mathematics Level and Award for each trade

Number in Each Trade				→ ↘	Electrical	Plumbing	Carpentry
Subject and Level and Points				↓			
Higher	Ordinary	Foundation	Points				
A			125				
B			113	1			
C			91	1			
D			81	1			
	A		56				1
	B		46	7	2	4	
	C		28	7	7	7	
	D		20	1	6	4	
	E		0		1	1	
		A	20				1
		B	12	2	1	2	
		C	0		3		

FINDINGS

Table 4 presents the average Junior Cert points achieved, the number of apprentices achieving above average, and the range of points for each trade. Electrical apprentices demonstrated higher Junior Cert scores and a wider range of points compared to other trades. On the other hand, carpentry and joinery apprentices had the lowest average score, but their overall range of points was wider than that of the plumbing sector. The lowest set of calculated points observed was 178 in carpentry and joinery, while the highest was 780 in electrical.

Table 4: Average, number above average and range calculated Junior Certificate points for plumbing, electrical and carpentry and joinery

Junior Cert calculated Points →	Average Points	Number presenting >average	JC Points range
Trade ↓			
Plumbing	363	11	199-562
Electrical	438	13	220-780
Carpentry and joinery	359	9	178-618

The findings indicate that the completion rate within 234 weeks for electrical apprentices with Junior Cert only is 65%, whereas the rates are 55% for plumbing and 45% for carpentry and joinery. The completion rates align with the average points, indicating a positive relationship between higher points and completion rates in all trades. There is a notable increase in completions with higher academic entry levels. For apprentices with entry levels below 300 points, only one-third successfully complete their apprenticeship, whereas those with over 500 points have a completion rate of 96%. This trend is observed across all trades, although carpentry apprentices with entry levels below 300 points face the highest risk of non-completion.

No significant correlation was observed between the number of STEM subjects taken and apprenticeship completions, as shown in Table 5. Taking more than four STEM subjects did not increase the likelihood of completing apprenticeship.

Table 5: Percentage of Completions in relation to number of STEM Subjects undertaken in the Junior Certificate

Number of STEM Subjects →	2	3	4	5	6
Trade ↓					
Plumbing	100	33	55	100	N/A
Electrical	80	75	50	0	100
Carpentry	50	40	50	33	N/A

The analysis revealed a distinct correlation between the academic performance in mathematics and the successful completion of apprenticeships, as illustrated. Specifically, individuals who attained a grade below E in Ordinary Mathematics or failed to achieve an A grade in Foundation Mathematics exhibited an inability to complete their carpentry apprenticeships. Conversely, all electrical apprentices who undertook Higher Mathematics demonstrated a high rate of apprenticeship completion.

DISCUSSION

The initial inquiry focused on the rate of completion for apprenticeships among those who only possess a Junior Cert qualification. The research reveals that starting a plumbing, electrical or carpentry apprenticeship with only a Junior Cert result in completion rates of approximately 55%, 65%, and 45%, respectively. These figures are notably lower than those reported by O'Connor (2006), which indicated that over 66% of registered apprentices completed their training, and the more recent Oireachtas report that declared completion rates of 65% in carpentry, 73% in electrical, and 69% in plumbing (Oireachtas Report, 2019). However, it is important to note that these reports included those entering from all pathways.

The second research inquiry aimed to explore the possible connection between completion rates of apprenticeships and the number of STEM subjects taken by apprentices during their secondary education. Nevertheless, this study did not identify any substantial correlation between completion rates and STEM subjects, other than mathematics levels and outcomes. Apprentices presenting with foundation maths were of particular concern with only 22% completing their apprenticeship.

The numbers found with various STEM subjects prior to apprenticeship were comparative to those taking them in the general population. In 2016, there were 60,248 Junior Cert candidates. 27% of those undertook wood technology, 20% technical graphics, 13% metalwork and 6% technology (NCCA, 2017). These four subjects are elective and are collectively described as the T4 subjects (Seery *et al.*, 2022). Additionally, in 2016, 99% undertook mathematics and 92% undertook science 55% of those undertaking mathematics did so at higher level (Department of Education and Skills, 2019). Choosing a subject is frequently influenced by the school and the options provided (Ryan *et al.*, 2022). One-third of secondary schools in Ireland are single-sex, and thus may not offer a full range of subjects (Clavel and Flannery, 2022). Single-sex schools may not provide metalwork or wood technology (Doris *et al.*, 2013). Apart from mathematics, STEM subjects are generally elective at junior cycle resulting in substantial participation differences across STEM subjects in Ireland (Seery *et al.*, 2022) who also state 80% of students undertaking T4 subjects are male. In 2021, the number of boys schools offering a STEM subject other than maths or science was 94.8%, compared to girls schools at 68.3% or mixed schools at 87.4% (Maxwell, 2023). In this sense, subject selection may be influenced by the institution,

rather than being a personal decision. Maxwell also reports that only 26.9% of third year girls undertook a STEM subject outside science or maths as opposed to 73.4% of boys.

The third question looked at academic performance within Junior Cert, this also found that those with elevated Junior Cert results had higher levels of apprenticeship completion, suggesting that the apprentice has more foundational knowledge and skills, necessary to succeed in the program. Our research showed that there was a clear relationship between mathematics level and result and apprenticeship completion. We also found that for the 60 randomly selected apprentices only 7% undertook higher mathematics. This could be indicative of previous negative experiences with maths or not seeing the relevance of higher maths to their trade. However, mathematics teaches critical thinking which is essential in any trade e.g., measurement, quantiles, calculation of voltage, current resistance etc. It is worth noting that 97% of the apprentices passed their chosen level of mathematics. Also interestingly, the only apprentices undertaking higher level mathematics were those from the electrical cohort with all completing their apprenticeship.

Outside of entry pathways, there may be differences in completion rates between the three trades included in an apprenticeship program, due to differences in the nature of the work, the availability of employment opportunities, and other factors. However, it's important to note that completion rates can vary widely depending on a range of individual and contextual factors. It is also possible that completion rates may be influenced by the nature of the trade itself. For example, the electrical trade may require a different set of skills or aptitudes compared to plumbing or carpentry, which could affect completion rates among Junior Cert holders.

CONCLUSION

The completion rates of apprenticeships in the construction trades pose a significant concern that demands attention, bearing substantial implications for the sector's workforce development and sustainability. The findings of this study hold the potential to inform policy makers in their decision-making processes regarding planning, funding routes, and policy adjustments, thereby fostering improved completion rates. By comprehending the intricate relationship between apprentices' academic entry levels and their apprenticeship outcomes, policy makers can formulate targeted strategies to enhance completion rates and effectively address the challenges encountered within the apprenticeship system. The research underscores the crucial significance of fostering collaboration between educational institutions and the construction industry. By recognising the profound impact of academic entry levels on apprenticeship outcomes, institutions can strategically align their curricula and entry requirements to precisely cater to the evolving needs of the industry, thereby ensuring that apprentices are equipped with the essential education and training imperative for their success. This collaborative endeavour effectively bridges prevailing skill gaps and satisfactorily addresses the burgeoning demands of the industry.

Identifying the factors influencing apprenticeship completion, particularly the role of academic entry levels, industry stakeholders can allocate resources more efficiently, ensuring the provision of essential support and training for apprentices. This focused allocation of resources can greatly enhance the learning experiences of apprentices and heighten their likelihood of successfully completing their apprenticeships.

To increase completion rates in apprenticeships, alternative strategies beyond increasing entry requirements can be explored for example apprentice support, educational preparation and flexible and sympathetic training and education models. Enhanced support systems, including individual academic and emotional assistance and resources for addressing challenges, can provide crucial support during apprenticeships. Pre-apprenticeship programs offer foundational training, skill development, and industry exposure, aiding prospective apprentices in making informed decisions and navigating their journey. Flexible training models, like blended learning or part-time apprenticeships, accommodate diverse learner needs and reduce barriers to completion. Strengthening collaboration between educational institutions, employers, and industry associations promotes seamless transitions, aligns curricula with industry standards, and ensures practical, on-the-job experience for apprentices. By implementing these strategies collectively, stakeholders can improve completion rates, foster equitable opportunities, and support apprentices throughout their training. A comprehensive approach that considers both entry requirements and additional measures is vital for success.

This study contributes to the existing body of knowledge by shedding light on the challenges faced by apprenticeships in the construction sector, highlighting the imperative for further research aimed at identifying prevention and early warning strategies. The research underscores the necessity for in-depth exploration into these strategies, enabling industry stakeholders to proactively implement measures that curtail apprentice dropouts and provide timely support to those at risk. By doing so, higher completion rates can be achieved, fostering the cultivation of a more competent and proficient workforce within the construction industry. Future research can explore the probability of completion by comparing apprenticeship performances across different entry pathways, strengthening the apprenticeship system and improving outcomes for both apprentices and employers.

Overall, this research provides a foundation for evidence-based decision-making, resource allocation, collaboration, and the development of strategies to improve completion rates and enhance the overall quality of apprenticeships in the construction industry. By implementing the insights gained from this study, the industry can foster a stronger and more sustainable workforce, ultimately benefiting all stakeholders within the construction sector.

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