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Developing a proof-of-concept curriculum foundation model for industry 5.0: A primary data survey of built environment academics

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Abstract

Purpose: Higher education curriculum development in the construction industry has historically received scant academic attention and often, courses/programmes are largely developed using the tacit knowledge of individual tutors. This research investigates the core interpersonal and technical skills and competencies required of a contemporary construction management graduate. Specifically, the work culminates in the development of a proof-of-concept model that could be incorporated into higher education curriculum development. **Methodology:** A mixed philosophical stance is implemented using both postpositivism and interpretivism together with inductive and abductive reasoning to examine built environment academics' perceptions of the phenomena under investigation. Descriptive and inferential statistics (i.e., weighted average, relative importance index, one sample *t* test, Chi-square test and Kruskal-Wallis test) are utilised to formulate a foundational set of core interpersonal skills for construction management curricula. Such knowledge provides a strong foundation for building an optimised course curriculum. **Findings:** Research findings demonstrate that, whilst technical skills are relatively important for the construction manager's role, they significantly pale in comparison to interpersonal skills. Furthermore, an aggregate ranking of skills and competencies suggests that a substantial number of interpersonal skills and competencies out-rank numerous technical skills and competencies. Surprisingly, digital-esque themes rank towards the bottom of the table, with 'traditional' skills competencies (i.e., workflow, budgeting and costing) ranking higher. **Originality:** This research constitutes the first attempt to: understand the core interpersonal and technical skills and competencies required of a contemporary construction manager; and premised upon this, generate a construction management education curriculum foundation model. Nascent findings pinpoint the core interpersonal skills and competencies that serve as the curriculum's foundation and expose the inadequacies of digital technical skills in core construction management teaching.

Keywords

Construction management, curriculum development, industry 5.0, proof-of-concept model, statistical analysis, technical and interpersonal skills

Introduction

His Majesty's Government (cf. Rhodes, 2019) states that the United Kingdom (UK) construction sector comprises around 343,000 companies (13% of UK businesses) which employs approximately 2.4 million individuals (7% of UK jobs). These companies and individuals are responsible for approximately £117 billion or 6% of the UK's economic output (Rhodes, 2019). Moreover, the sector provides important socio-economic infrastructure (e.g., housing, roads, factories, amenities) that facilitates future economic growth and prosperity (Owusu-Manu et al., 2020). To augment sector performance, a drive towards digital innovations under the auspices of Industry 4.0 has dominated the contemporary discourse (cf. Newman et al., 2020). Notable and prominent digital innovations such as building

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information modelling (BIM) have been heralded as a panacea via which to streamline project management processes and procedures (cf. Chan et al., 2019; Yin et al., 2019). Yet despite these technological advancements, construction managers remain in the vanguard of this national economic engine – ultimately responsible for a project's success (typically measured in terms of financial, safety, quality and schedule aspects) (Walker, 2015). Metaphorically, a construction manager constitutes the glue that holds construction team and project together (Fewings, 2013; Harris et al., 2021). Without the proper management and leadership of the complex teams responsible for project delivery, a project's success is severely jeopardised (Nicholas and Steyn, 2021) – hence, the educational provision for construction managers can also be one of the requisite requirements to bolstering a nation's economy.

Posillico et al. (2022a) highlighted that, whilst the current construction management curricula environment is largely fragmented and non-cohesive, there does remain a consensus that both interpersonal and technical skills are vital to a healthy curriculum that provides employable graduates. Furthermore, arguments supporting an industry-infused curriculum have been overwhelmingly supported by construction management courses that strive to engender a practice-based curriculum (cf. Goulart et al., 2022). This desire for training future generations of construction management practitioners has been bolstered by the UK government's modern apprentices programme which supports graduates to acquire a degree whilst in full-time employment (Mulkeen et al., 2017). A combination of governmental education initiatives, private financial initiatives (PFI) and public private partnerships (PPP) (such as the delivery of English hospitals procured under a PFI contract with a capital cost exceeding £50 million cf. Adamou et al. (2021)) and a strong focus on increasing student employability have inevitably shaped the ensuing discourse within higher education institutions (HEIs) (Doherty and Stephens, 2020; Okolie et al., 2020).

Against this prevailing landscape of a rapidly evolving and technologically advanced construction sector (and inextricably linked economic machinations that govern it), this research investigates the relevance and currency of modern construction management courses. Specifically, the research conducts descriptive and inferential statistical analyses of primary questionnaire data sourced from built environment academics to develop a proof-of-concept model of construction management curriculum foundation. Associated objectives are to: investigate the core interpersonal and technical skills and competencies required of a contemporary construction management graduate; formulate a foundational set of core interpersonal and technical skills for construction management curricula; and stimulate pathways for industry and academic informed, contemporary curriculum development research that augments graduate employability.

Technology and the curriculum

Industry 4.0 can be characterised as a heighted presence and infiltration of digital technology, tools and information within the workplace (Javaid et al., 2022). Whilst the limelight of Industry 4.0 has traditionally been placed squarely in the manufacturing, engineering and computing realms, all industries have been impacted albeit to varying degrees. Higher education has also responded to Industry 4.0 by adjusting, modifying and rethinking how to incorporate the requisite skills into relevant educational provisions (González-Pérez and Ramírez-Montoya, 2022; Moraes et al., 2022). Currently, Industry 5.0, which in response to the full throttle digital nature of Industry 4.0, has realised and reaffirmed the unwavering presence and interaction of people within industry (Alves et al., 2023; Golovianko et al., 2023; Hein-Pensel et al., 2023). At the cusp of Industry 5.0 is the expectation that higher education's response to facilitate proper educational provision of students would be holistic in nature (Broo et al., 2022; Carayannis and Morawska-Jancelewicz, 2022). That is, technological advancements are a tool that assist and enable construction stakeholders (e.g., designers, engineers, construction managers) to optimise the co-operative management of increasingly complex mega projects (Ahuja et al., 2009). For example, at the forefront of recent prominent UK projects is the HS2 high speed rail infrastructure project which cost circa £115 billion (Sergeeva and Zanello, 2018). Towards the latter half of 2023, considerable modifications in the reduction of scope for the HS2 project were pursued due to cost and schedule overruns (His Majesty's Government, 2023). For such projects, interpersonal skills and competencies remain quintessentially important in the management process (Azim et al., 2010) and managers must remain the 'masters of technology' and not become enslaved by it (cf. Edwards et al., 2017).

Given this rapid transition into a technologically advanced construction sector, curriculum development within HEIs has received increasing scrutiny and attention to ensure modernity and relevance of provisions (cf. Co et al., 2023; Luo and Chan, 2022; Shen et al., 2020; Upsher et al., 2022; Xu et al., 2022). Yet, this scrutiny remains at the institutional level and across the HEI sector a notable lack of connectivity between research conducted also exists (Posillico et al., 2021). This lack of a cohesive nucleus in the prevailing body of knowledge is further intensified by the strong prevailing academic notion of 'individualism and self' – where bespoke curriculum development prevails within an 'every person for themselves' mentality (Hrivnak, 2019; Trinter and Hughes, 2021). The same dispersed and detached sentiment is even more evident within a construction management curriculum development context (cf. Posillico et al., 2022b).

The successful delivery of curriculum rests firmly on the collective teaching expertise of academic staff. The scholarship of teaching and learning (SoTL) has increased its foothold in a wide range of academic disciplines as a valid and convincing form of scholarly work for educators (Van Dijk et al., 2020; Weimer, 2006; Zeng, 2020). This work has explored questions about teaching strategies; student engagement, growth and learning; and other aspects of the teaching and learning process (Hutchings et al., 2011; Spooren et al., 2017). Akin to Industry 5.0, SoTL is a disruptive force in higher education by, at its very core, making clearer how to support and enhance students' learning (Tagg, 2003). Higher education has witnessed a new SoTL biome, one characterised by new venues for making the work public – including journals and conferences – tools for doing SoTL and a vibrant community of scholars (Steiner and Hakala, 2021). No longer was SoTL the purview of faculty in schools of education. Rather, faculty from any discipline were invited to and recognised for their investigations into questions about teaching and students' learning – questions they could examine using the tools of inquiry of both disciplinary and interdisciplinary traditions (Boyer, 2016). Despite the prominence of and increasing attention to SoTL in higher education, its presence across the spectrum of academic disciplines and professions is uneven, particularly in construction management education (Posillico et al., 2022b). Any discipline disengaged from SoTL, risks utilising significantly outdated or ineffective educational theories and/or teaching strategies in the classroom (Neubauer et al., 2022). Doing so would, in turn, leave a student with a grossly inadequate educational experience and lack of development in the skills needed to successfully navigate a career industry (Forrest et al., 2022).

Cumulatively, the rapid technological developments within the construction industry and the drive towards SoTL across the HEI sector are shaping current curricular development. However, in a construction sector context the expansion of technology has been largely uncontrolled and construction schools and departments (notably in the UK but potentially globally) lack the finer nuances of a credible SoTL. In turn, this raises questions about the validity and appropriateness of current provisions and raises the need for a thorough review and introspection of courses for construction management graduates.

Methodological approach

A mixed philosophical stance (using postpositivism and interpretivism) was implemented and abductive reasoning used to examine built environment academics' perceptions of professional skills required by construction management students. The purpose being to identify specific educational skills and competencies for incorporation into the higher education curriculum (cf. Hughes et al., 2021). Interpretivism was used to ascertain the key development skills noted in construction management advertisements, whilst postpositivism was used to statistically analyse the results from a structured questionnaire survey. Abductive reasoning, which is a semi-hybrid approach where the researcher moves between inductive and deductive in a pragmatic way to establish a structure of how a phenomenon occurred (Saunders et al., 2016).

A three-tiered waterfall research approach is adopted (Figure 1). First, a structured questionnaire survey instrument was developed from the key professional development skills noted within UK construction/project manager job advertisements (Han et al., 2021; Rakowska and De Juana-Espinosa, 2021). Specifically, referencing construction industry publication company's rating and ranking indices (e.g., *The Construction Index, Construction News, Construction Global and Construction Review Online*), construction companies with a noteworthy impact (minimum construction revenue of £700 million, minimum of 1600 UK employees) were identified (frequency (f) = 10). The 10 companies in aggregate, according to their 2020/2021 Annual Reports, are responsible for £34.3 billion in global revenue and employ over 56,000 employees in the UK. Complete job advertisements for the role of 'Construction Manager' or 'Project Manager' were located within each of the companies' career/Human Resources portal. Questions posed utilised a closed Likert scale of 1 (not at all important) to 5 (very important) to collate primary quantitative data; the survey also included open-ended questions to collate primary qualitative data on the reasons for selections made. Second, the survey instrument was distributed to built environment academics (cf. Ayodele and Olaleye, 2021; Wang et al., 2021). Finally, through a postpositivist lens, the results of the Likert-scale survey instrument were statistically analysed to develop a proof-of-concept model of construction management curriculum development (CMCD) (cf. Adepoju and Aigbavboa, 2020; Dharmapalan et al., 2021).

Questionnaire design

The questionnaire was divided into three key sections. Section one presented preliminary information such as the research background (to secure informed consent) and ethical statements. Specifically, participants were assured that: their information would remain strictly confidential (published in aggregate form) and not divulged or disseminated to any third party willingly or otherwise; all data would be securely stored and securely disposed of post publication; and participants could access the findings post publication (cf. Fisher et al., 2018; Law et al., 2021). Section

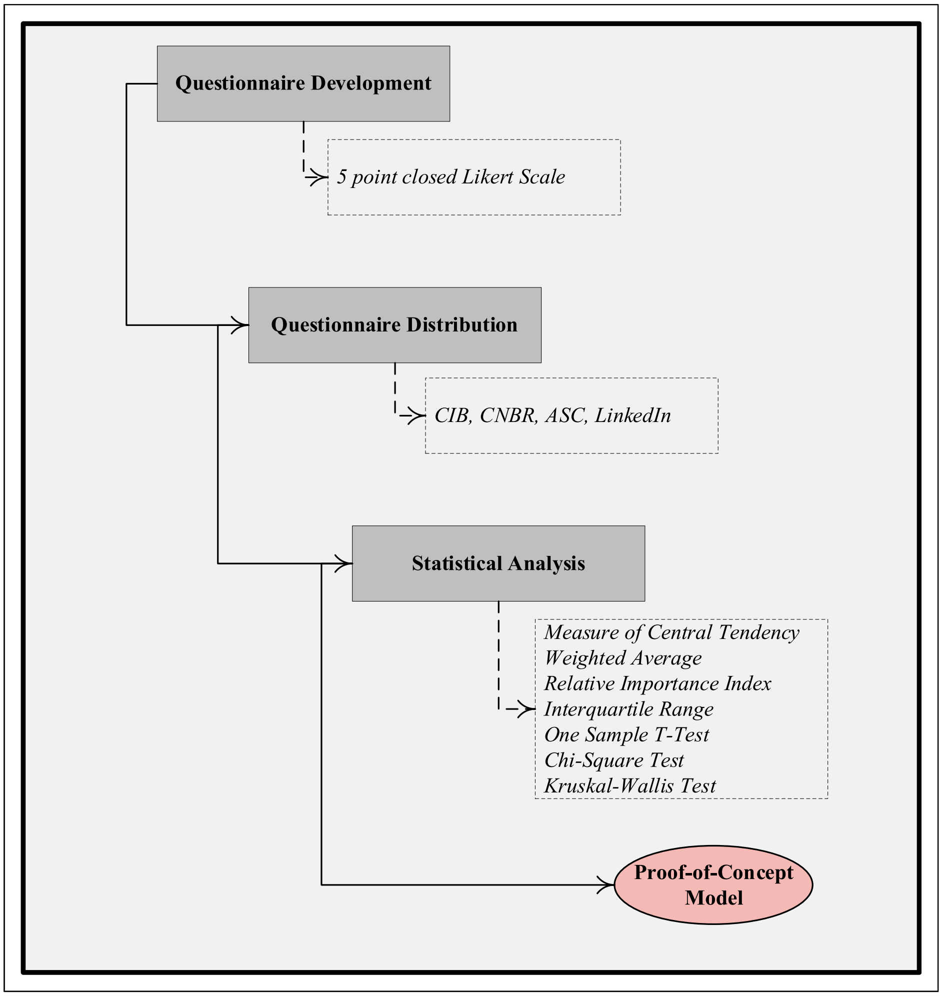


Figure 1. Three-tier waterfall research process flow diagram.

two requested demographic information from participants (i.e., age range, role, years in academia, built environment course affiliation and years in industry), to ensure that only participants who were sufficiently knowledgeable and experienced, regards the phenomenon under investigation (i.e., selection criteria), participated in the research. Section three contained overall skill and competency ranking and ratings, as well as open-ended questions to elucidate further upon the rationale for their choices. The questions were based upon the aggregate analysis of extant literature (cf. Posillico et al., 2021; Posillico et al., 2022a) and secondary data (i.e., UK construction management curriculum data and UK construction manager job advertisements). Cumulatively, this produced a list of core professional skills and competencies. The questionnaire comprised a total of frequency (f) = 28 questions (f = 5 demographic, f = 18 Likert, f = 1 ranking and f = 4 open-ended).

The question limit was primarily based upon ease of use relative to the high-paced and high-demand nature of academia which, in turn, would help with obtaining a healthy response rate (Yan et al., 2011). The style and user interface of the questions was also considered, primarily rating and ranking with open-ended question opportunities. This again, was utilised to dovetail with an academics' daily work constraints so that the survey could be completed quickly, easily and/or on a mobile device (Harrison et al., 2019). This strategy has been utilised by other researchers (cf. Hassanain et al., 2022; Pidgeon and Dawood, 2022; Saleh and Bista, 2017) – thus justifying this selection and method.

Sample size determination, questionnaire administration and survey reliability

Utilising Cochran's Formula (n_0): With an unknown population (p = .5), a confidence level of 95% (Z = z-score = 1.960) and a margin of error of 5% (e = 0.05), the needed sample size for the Likert-scale survey instrument is 385 construction professionals. Purposive sampling was utilised to identify academics in built environment disciplines who had sufficient knowledge and experience to comment upon curriculum design and development (Adabre et al., 2022; Jupp, 2006). Specifically, the Co-operative Network of Building Researchers (CNBR), the Associated Schools of Construction (ASC), International Council for Research and Innovation in Building and Construction (CIB) and LinkedIn were utilised as the main platforms for the questionnaire's distribution due to their high membership concentrations of built environment academics. Electronic and online distribution of the survey was utilised to help reach a large population of knowledgeable respondents (Harrison et al., 2019) and increase the likelihood of a higher response rate due to its user-friendliness and reliability (Saleh and Bista, 2017). The online survey was open from 9 April 2022 to 25 May 2022.

At the time the questionnaire closed for responses, a total of 99 academic professionals had provided a response. After reviewing the responses for completeness, six were identified as incomplete and were removed from analysis. A final total of 93 surveys was noted. There is a discrepancy between the sample size goal (f = 385) and the actual number of respondents. However, recent literature published does support similar research with a smaller sample size than the intended goal (cf. Al Mawli et al., 2021; Fatayer et al., 2021; Shaharuddin et al., 2021). Moreover, a sample size of 93 is reflective of similar research conducted within construction management literature (cf. Chithambo et al., 2022; Folorunso, 2021; Matin et al., 2021). Hence, it was decided that although imperfect, sufficient data had been collected via which to draw inference from the wider population of practicing construction management academics.

A survey scale is generally noted as reliable if the Cronbach's alpha value is >0.700 (Al-Emran and Shaalan, 2021; Belkhamza and Wafa, 2012). The Cronbach's alpha value, as calculated via IBM® SPSS Statistics v.28 (SPSS), for the present survey is 0.839, which is > 0.700. It can therefore be noted that the present survey is considered reliable. Both descriptive [e.g., mean, median and weighted average (WA)] and inferential statistical analyses were utilised on the data collected. Inferential statistics included: Relative Importance Index (RII); Interquartile Range; One Sample t test; Kruskal-Wallis Test; and Chi-Square Test.

Results and analysis of Likert-scale survey instrument

The completed survey results were formatted from Jisc Online Surveys files to both Microsoft Excel and SPSS compatible files for statistical analysis.

Demographics – overall

Table 1 displays the aggregate demographic data for the survey respondents and illustrates a good span of age ranges (not one age range dominates), breadth of academic standing (entry level to senior leadership), extensive industry experience (77.42% with more six plus years of experience) and strong focus on the construction management discipline (73.12% of respondents).

Specifically, 73.21% (f = 68) of the survey respondents were aged between 35 and 64 years, with a similar spread between the three age-group bands: 35–44 years (f = 20 or 21.51%), 45–54 years (f = 24 or 25.81%) and 55–64 years (f = 24 or 25.81%). Respondents aged 65 and over accounted for 11.83% (f = 11) whilst respondents aged between 25 and 34 years accounted for 15.05% (f = 14). These summary statistics demonstrate a sufficient respondent age range to complete the questionnaire and add informed knowledge. From an academic role standpoint (refer to Table 1), the respondents predominately were in an Associate Professors/Professors role with 46.24% (f = 43) with Assistant Lecturer/Lecturer the second most categorised with 29.03% (f = 27). Senior Lecturers and Senior Leadership/Department Heads were a distant third and fourth with 17.20% (f = 16) and 7.53% (f = 7) respectively. The demographic profiles within this sample demonstrate a good breadth of academic standing, discipline knowledge and understanding; consequently, this strengthens confidence that knowledge imparted will be of value and use.

Figure 2 examines respondents' career background both from their time in academia and the construction industry. Slicing the questionnaire year range in half, a comparison of the percentages of respondents can occur. A 60%–40% split regarding years in academia is visible, with 60.22% (f = 56) of the respondents falling within the first half of the year spectrum (0–14 years). For years in industry, a 23%–77% split is viable, with 77.42% (f = 72) of the respondents falling within the second half of the year spectrum (6–10+). There is a strong industry practice tenure with a slightly less robust academic tenure within the respondents. From a broad view, this does appear reasonable as construction industry experience usually precedes academic experience.

Demographics – specific academic role

Looking specifically at the 27 Assistant Lecturer/Lecturer respondents, the most frequently occurring age range was 25–34 years (f = 11 or 40.74%) followed closely by 45–54 years (f = 8 or 29.63%). Around half of the respondents have spent 5 to 9 years in academia (f = 13 or 48.15%) and 10+ years in the construction industry (f = 14 or 51.85%). The construction management course of study is by far the most associated course with 70.37% (f = 19) of respondents indicating such. For the 16 Senior Lecturers, the 45–54 and

Table 1. Aggregate demographics of survey respondents.

Keyword (root)	Options					
Age range	18–24 0 *(0.00%)*	25–34 14 *(15.05%)*	35–44 20 *(21.51%)*	45–54 24 *(25.81%)*	55–64 24 *(25.81%)*	65+ 11 *(11.83%)*
Current role	Assist. Lecturer/Lecturer 27 *(29.03%)*		Senior lecturer 16 *(17.20%)*	Assoc. Professor/Professor 43 *(46.24%)*		Senior leadership/ Department head 7 *(7.53%)*
Years worked in academia	0–4 13 *(13.98%)*	5–9 27 *(29.03%)*	10–14 16 *(17.20%)*	15–19 12 *(12.90%)*	20–24 8 *(8.60%)*	25+ 17 *(18.28%)*
Course/ Programme affiliation	Construction management 68 *(73.12%)*	Quantity surveying 14 *(15.05%)*	Building surveying 2 *(2.15%)*	Civil engineering 6 *(6.45%)*	Architectural technology 2 *(2.15%)*	Other 1 *(1.08%)*
Years works in industry	0–2 9 *(9.68%)*		3–5 12 *(12.90%)*	6–9 10 *(10.75%)*		10+ 62 *(66.67%)*

The italics represents the frequency percentage.

55–64 years age ranges were both equally represented as the most frequent (*f* = 5 or 31.25%). Likewise, the 25–34, 35–44 and 65+ years age ranges were equally represented (*f* = 2 or 12.50%). A total of six respondents have spent 5 to 9 years in academia (*f* = 6 or 37.50%) with a quarter of the respondents (*f* = 4 or 25.00%) spending <4 years. Six respondents (*f* = 6 or 37.50%) had between 10 and 25+ years of academic experience. Three quarters (*f* = 12 or 75.00%) had over 10 years of industry experience with all but one respondent indicating between 6 and 9 years of industry experience. Half of the respondents (*f* = 8 or 50.00%) identified most closely with the construction management course of study with a fairly equal distribution spread throughout the remaining five course options (*f* = 2 for Quantity Survey, Building Surveying and Architectural Technology; *f* = 1 for Civil Engineering and Other). Almost half (*f* = 43 or 46.24%) of all survey respondents identified their role as either Associate Professor or Professor. Close to 80% (79.07% or *f* = 34) were within the 35–44, 45–54 and 55–64 years age bands. From time spent in academia, a very even spread across year ranges is evident. Specifically, 25+ years (*f* = 11 or 25.58%), 10 to 14 and 15 to 19 (*f* = 9 or 20.93%) each and 5 to 9 years (*f* = 8 or 18.60%). In contrast, most respondents (*f* = 30 or 69.77%) indicated 10+ years of construction industry experience. Likewise, the course which the respondents identified with (in terms their role within an academic institution) was 'construction management' (*f* = 34 or 79.07%). Regards the Senior Leadership/Department Head role, this ranked as the lowest frequency of respondent identification (*f* = 7). The age range for these respondents focused on 45–54 years and 55–65 years bands (*f* = 3 or 42.86%) each. All respondents identified with the construction management course of study. Similarly, all respondents had over 10+ years in academia and all but one respondent had over 10+ years in the construction industry. From the above demographic statistical analysis, the respondents are very reflective of both academic and industry practice. The balance and spread of roles, ages and experiences of the respondents indicate a good distribution of knowledgeable academics at all levels of academia.

Descriptive statistics for survey

Descriptive statistics are utilised to describe, contextualise and provide a high-level summary of basic features (e.g., measure of central tendency, frequency distribution) of the dataset (Holcomb, 2017; Lacort, 2014). This type of analysis forms the basis for more advance inferential statistical analysis because it provides a general, broad-brush understanding of the dataset (Holcomb, 2017). For this research the mean, median and WA, along with general mathematics, such as variance and proportion, were the descriptive statistic methods utilised.

Interpersonal skills and competencies

The mean and median values for each of the nine interpersonal skills and competencies questions were calculated and plotted in Figure 3. All nine skills and competencies were within the 5.00 (very important) to 4.00 (important) mean and median range. Furthermore, 'very important' (5.00) and 'important' (4.00) ratings, in total, comprised 93.31% of the ratings given by the 93 respondents. Only 5.50% and 1.19% were given to ratings of 'neutral' (3.00) and 'low importance' (2.00). This suggests that overall, the spectrum of interpersonal skill and competencies was identified as being important to the role of construction management graduate.

Analysis of the interpersonal skills and competencies can also occur based on the respondents' current academic roles. Figure 4 illustrates that there is very little difference between the ratings given for each skill and competency based on the role of the respondent; all four roles appear to agree on the

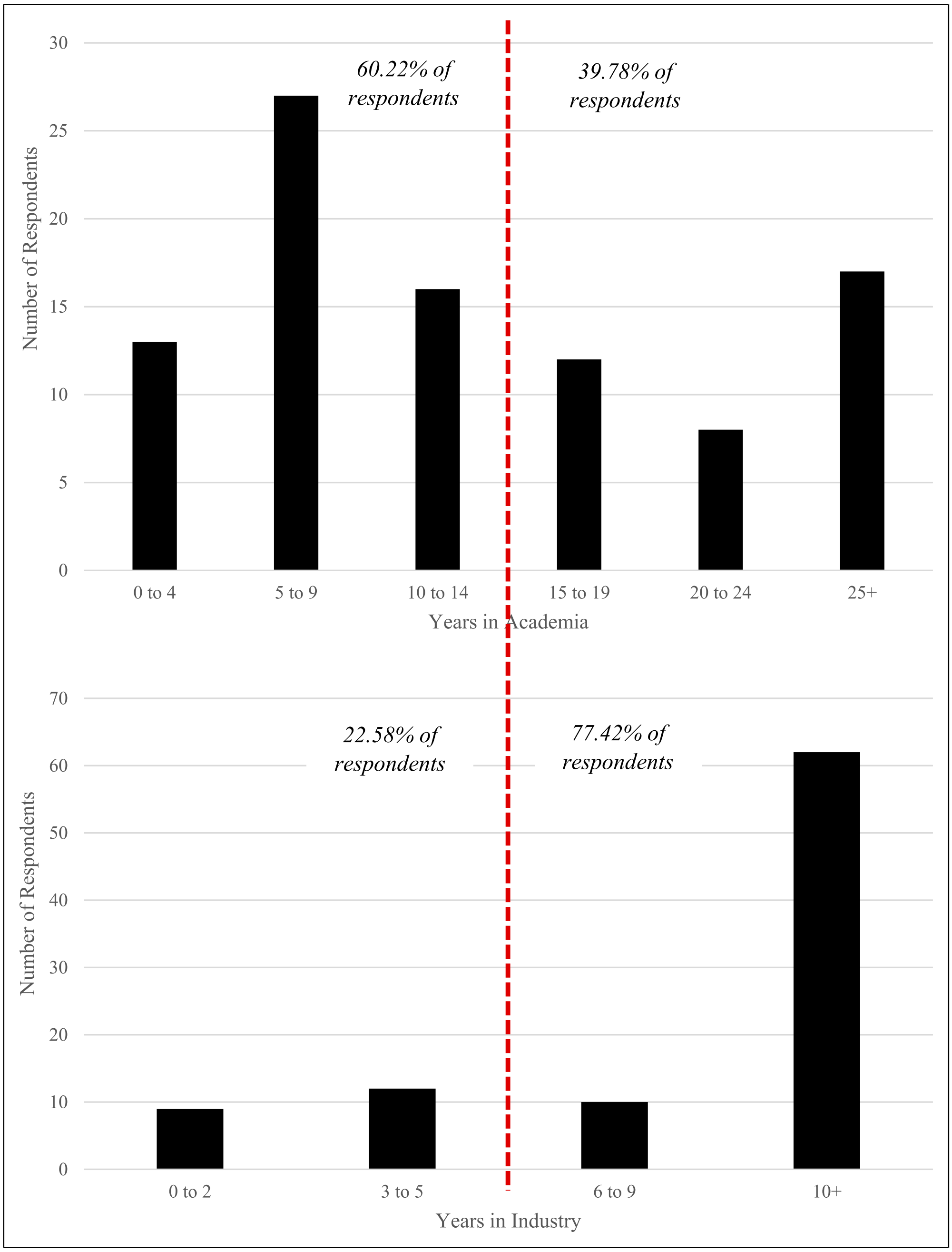


Figure 2. Respondents time in academia and industry.

level of importance for the interpersonal skills and competencies. Specifically, the two largest rating differences, based on the four role categories for a skill/competency was 0.30 ('*verbal communication*') and 0.29 ('*listening and understanding*'), or just less than one third of a rating score. Elaborating further, this indicates that throughout academic positions/standings in HEIs, there is general agreement as to the level of importance of the interpersonal skills and competencies.

Utilising a WA, where the rating score is multiplied by the frequency of respondents selecting that specific rating score, a level of importance ranking can be visualised. As noted in Table 2, the top-rated interpersonal skill was '*verbal communication*' (WA total = 449) with '*team management*' an extremely close second (WA total = 448). The difference in WA totals between the top-rated skill to the sixth-rated skill was only 21 points. This indicates that the top six (66.67%) skills and competencies are closely knit

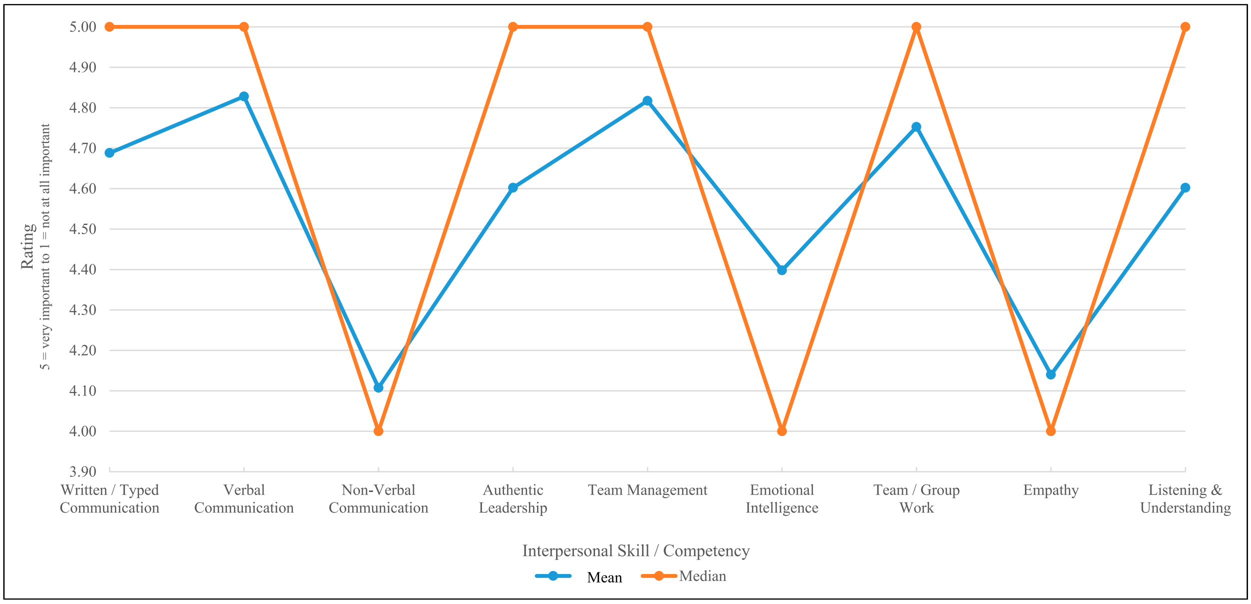


Figure 3. Mean and median values for interpersonal skills and competencies.

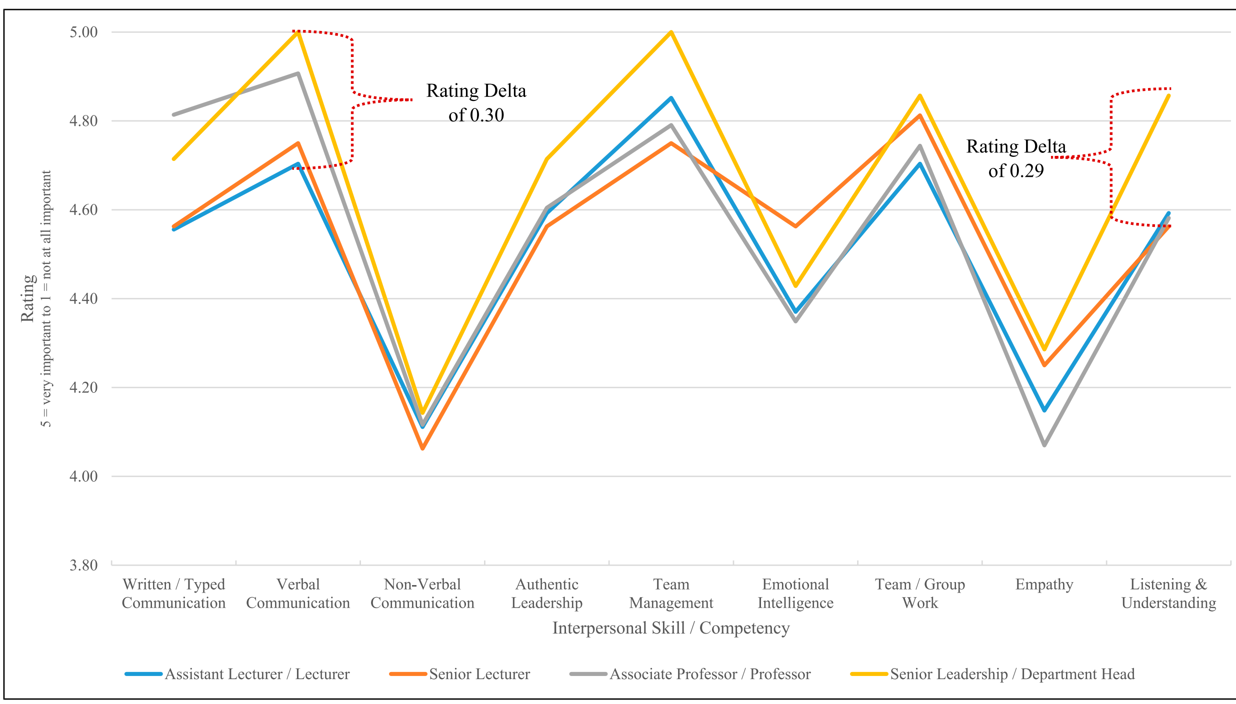


Figure 4. Ratings of interpersonal skills and competencies based on respondent role.

in terms of importance. There is a large void between the top six skills and competencies and the bottom three – 19 points from 6th (‘*authentic leadership’* and ‘*listening and understanding’)* to 7th (‘*emotional intelligence*’), 24 points from 7th (‘*emotional intelligence*’) to 8th (‘*empathy*’) and three points from 8th (‘*empathy*’) to 9th (‘*non-verbal communication*’). It can be inferred that there is a general consensus of opinion regarding the importance and relevance of the top six interpersonal skills and competencies.

Technical skills and competencies

The mean and median values for each of the nine technical skills and competencies questions were calculated and

Table 2. Weighted averages of interpersonal skills and competencies.

	Verbal communication		Team management		Team/Group work		Written/Typed communication		Authentic leadership		Listening and understanding		Emotional intelligence		Empathy		Non-verbal communication	
Rating	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA
5	81	405	76	380	71	355	66	330	60	300	60	300	43	215	33	165	35	175
4	9	36	17	68	21	84	25	100	29	116	29	116	44	176	43	172	39	156
3	2	6	0	0	1	3	2	6	4	12	4	12	6	18	14	42	13	39
2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3	6	6	12
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		449		448		442		436		428		428		409		385		382
Difference between			1		6		6		8		0		19		24		3	

plotted in Figure 5. All nine skills and competencies were within the 5.00 to 3.00 mean and median. Corresponding the quantitative value to the indicated qualitative description, this ranged from 'neutral' to 'very important.' Just under 85% ($f = 79$ or 84.95%) of the ratings for all nine skills and competencies range from 'neutral' to 'very important' (3.00 to 5.00). A rating of 'low importance' (2.00) comprised 12.31% and the lowest rating (1.00) which signifies no importance was noted 2.75%.

Analysis of the technical skills and competencies can also occur based on the respondents' role. As depicted in Figure 6, there is a wide range of difference between the ratings given for some skills and competencies based on the respondents' role. Specifically, the two largest rating differences, based on the four role categories for a skill/competency was 1.21 ('*structural engineering*') and 1.05 ('*civil engineering*'). Similarly, four additional skills and competencies depicted a smaller, yet still large, rating difference – 0.87 ('*creating BIM*'), 0.63 ('*work sequence*'), 0.57 ('*interpreting BIM*') and 0.40 ('*digital technologies*'). However, the four roles do appear to agree on the level of importance for some of the technical skills and competencies. Specifically, the three smallest rating differences, based on the four role categories for a skill/competency was 0.15 ('*critical path method*'), 0.30 ('*estimating*') and 0.34 ('*budgeting and cost control*'). This agreement may be because those three skills and competencies could be considered traditional, non-digital technical construction management aptitudes which suggests a possible preference for tenured skills rather than entrant skills. As noted in Table 3, the top-rated technical skill was '*budgeting/cost control*' (WA total = 420) with '*work sequence*' a close second (WA total = 416). The difference in WA totals between the five technical skills is around 13 – 15 points. However, there is an extremely large void between the fifth-rated skill ('*interpreting BIM*') and the sixth-rated skill ('*civil engineering*') – 81 points. In summary, the top five skills are fairly dispersed in terms of importance and the respondents are in agreement regarding the bottom four technical skills.

Inferential statistics

Table 4 notes the relative importance for each survey question. Of the 18 questions noting skills and competencies, 22.22% ($f = 4$) fall below the threshold of 0.700 relative importance. Interestingly, the four skills and competencies that do not meet the RII threshold are all from the technical skills section of the questionnaire: *'creating BIM,' 'digital technologies,' 'structural engineering'* and *'civil engineering.'* This suggests that the spectrum of interpersonal skills have been deemed relatively important whilst some of the technical skills, as noted above, are considered less important to their counterparts.

Table 5 places the skills and competencies in order of relative importance. Only viewing the 14 skills and competencies that have a RII >0.700, two bands or groupings can be assigned. Specifically, Band 001 are the are seven skills and competencies that have a RII >0.900 (i.e., *verbal communication, team management, team/group work, written/typed communication, authentic leadership, listening and understanding and budgeting/cost control*).

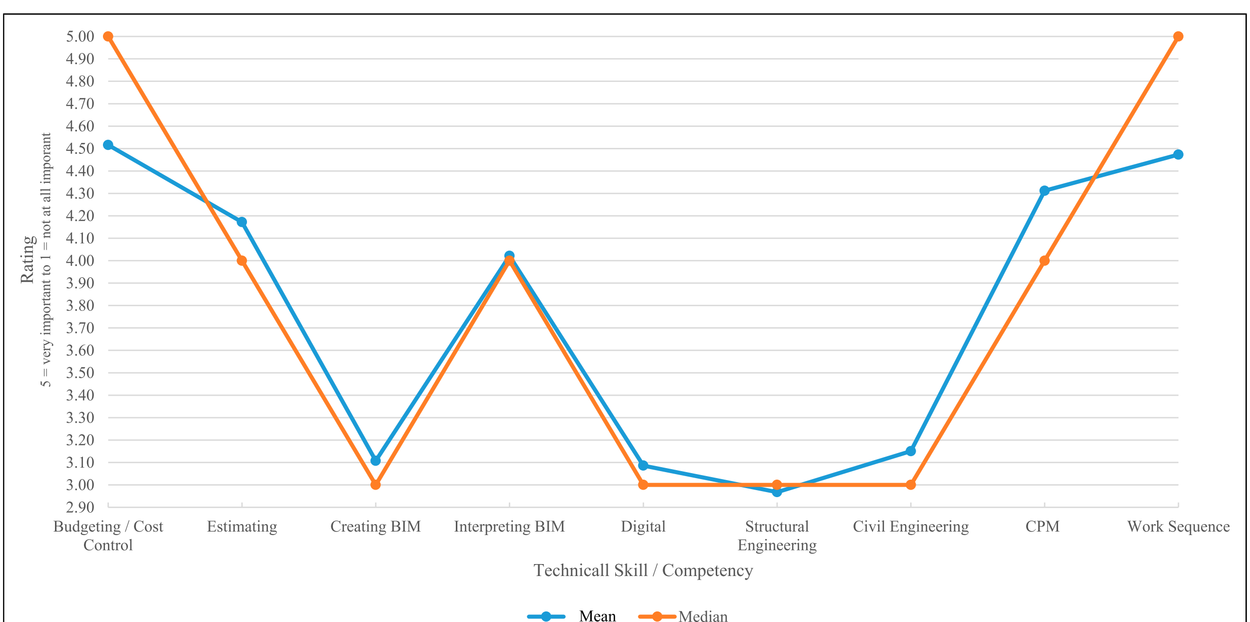


Figure 5. Mean and median values for technical skills and competencies.

Figure 6. Ratings of technical skills and competencies based on respondent role.

Table 3. Weighted averages of technical skills and competencies.

	Budgeting/ Cost control		Work sequence		Critical path method		Estimating		Interpreting BIM		Civil engineering		Creating BIM		Digital technologies		Structural engineering	
Rating	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA	*f*	WA
5	51	255	51	255	44	220	30	150	27	135	9	45	6	30	8	40	8	40
4	39	156	36	144	38	152	50	200	44	176	31	124	26	104	27	108	23	92
3	3	9	5	15	7	21	12	36	19	57	23	69	36	108	30	90	28	84
2	0	0	1	2	4	8	1	2	3	6	25	50	22	44	21	42	26	52
1	0	0	0	0	0	0	0	0	0	0	5	5	3	3	7	7	8	8
Total		420		416		401		388		374		293		289		287		276
Difference between			4		15		13		14		81		4		2		11	

Band 002 are the remaining seven skills and competencies where their RIIs happen to fall between 0.900 and 0.800 (i.e., *work sequencing, emotional intelligence, critical path method schedule, estimating, empathy, non-verbal communication and interpreting BIM*). Similarly, the mean value for Band 001 falls above a score of 4.5 out of 5.0, while the mean rating value of Band 002 is from 4.5 to 4.0 out of 5.0. Furthermore, looking at the standard deviation (SD) values for each skill/competency, Band 001's SD values are below 0.6 and Band 002's SD values are from 0.6 to 0.88. The SD values of both Bands indicate, to a degree, that the ranking values are more bunched around the mean ranking value – with Band 001 having a better SD spread. Specifically, there are greater levels of agreement with less variability amongst the survey respondents, particularly regarding Band 001.

The interquartile range was also calculated for the mean rating scores for each question to give a deeper and richer summary statistical analysis of the data. The interquartile range was determined to be 0.58 ($Q_3 = 4.60$ and $Q_1 = 4.02$), which indicates that half of the rating scores fall with the range of 4.02 to 4.60. From this analysis, it can benoted that the data are skewed towards a higher rating of importance. Examining the entire set of 14 skills and competencies, there are nine interpersonal skills (100% of interpersonal skills) and five technical skills (55.56% of technical skills). Of

Table 4. Relative importance index for survey questions.

Question	Number of respondents selecting… 5	4	3	2	1	Total [ΣW]	*N*	*A* * *N*	RII
6_i – Written/Typed communication	66	25	2	0	0	436	93	465	0.938
7_i – Verbal communication	81	9	2	1	0	449	93	465	0.966
8_i – Non-verbal communication	35	39	13	6	0	382	93	465	0.822
9_i – Authentic leadership	60	29	4	0	0	428	93	465	0.920
10_i – Team management	76	17	0	0	0	448	93	465	0.963
11_i – Emotional intelligence	43	44	6	0	0	409	93	465	0.880
12_i – Team/Group work	71	21	1	0	0	442	93	465	0.951
13_i – Empathy	33	43	14	3	0	385	93	465	0.828
14_i – Listening and understanding	60	29	4	0	0	428	93	465	0.920
16_t – Budgeting/Cost control	51	39	3	0	0	420	93	465	0.903
17_t – Estimating	30	50	12	1	0	388	93	465	0.834
18_t – Creating BIM	6	26	36	22	3	289	93	465	0.622
19_t – Interpreting BIM	27	44	19	3	0	374	93	465	0.804
20_t – Digital technologies	8	27	30	21	7	287	93	465	0.617
21_t – Structural engineering	8	23	28	26	8	276	93	465	0.594
22_t – Civil engineering	9	31	23	25	5	293	93	465	0.630
23_t – Critical path method schedule	44	38	7	4	0	401	93	465	0.862
24_t – Work sequencing	51	36	5	1	0	416	93	465	0.895

$_i$ = interpersonal, $_t$ = technical.

Table 5. Relative importance index for survey questions – ranked.

Question	Number of respondents selecting… 5	4	3	2	1	Total [ΣW]	*N*	*A* * *N*	RII	Mean	SD
7_i – Verbal communication	81	9	2	1	0	449	93	465	0.966	4.83	0.503
10_i – Team management	76	17	0	0	0	448	93	465	0.963	4.82	0.389
12_i – Team/Group work	71	21	1	0	0	442	93	465	0.951	4.75	0.458
6_i – Written/Typed communication	66	25	2	0	0	436	93	465	0.938	4.69	0.510
9_i – Authentic leadership	60	29	4	0	0	428	93	465	0.920	4.60	0.574
14_i – Listening and understanding	60	29	4	0	0	428	93	465	0.920	4.60	0.574
16_t – Budgeting/Cost control	51	39	3	0	0	420	93	465	0.903	4.52	0.564
24_t – Work sequencing	51	36	5	1	0	416	93	465	0.895	4.47	0.653
11_i – Emotional intelligence	43	44	6	0	0	409	93	465	0.880	4.40	0.610
23_t – Critical path method schedule	44	38	7	4	0	401	93	465	0.862	4.31	0.794
17_t – Estimating	30	50	12	1	0	388	93	465	0.834	4.17	0.686
13_i – Empathy	33	43	14	3	0	385	93	465	0.828	4.14	0.788
8_i – Non-verbal communication	35	39	13	6	0	382	93	465	0.822	4.11	0.878
19_t – Interpreting BIM	27	44	19	3	0	374	93	465	0.804	4.02	0.794
22_t – Civil engineering	9	31	23	25	5	293	93	465	0.630	3.15	1.093
18_t – Creating BIM	6	26	36	22	3	289	93	465	0.622	3.11	0.949
20_t – Digital technologies	8	27	30	21	7	287	93	465	0.617	3.09	1.080
21_t – Structural engineering	8	23	28	26	8	276	93	465	0.594	2.97	1.108

$_i$ = interpersonal, $_t$ = technical.

Band 001s seven skills and competencies all but one (85.71%) are interpersonal skills and of Band 002s seven skills and competencies, three (42.86%) are interpersonal skills.

One sample t *test and chi-square test*

One Sample t tests were conducted on the 18 interpersonal and technical skills and competencies using a hypothesised mean (or test statistic) set to 3.50 (Ahmed et al., 2021). The null hypothesis states that *'the mean value is not a statistically important skill/competency (H_0: $U = U_0$)'* and the alternative hypothesis states that *'the mean value is a statistically important skill/competency (H_a: $U > U_0$).'* The One Sample t test results for the nine interpersonal skills and competencies are depicted in Table 6. All nine skills had mean values > the hypothesised mean (3.50) and the p-values for all skills/competencies is < 0.001 [indicating the probability of a set of observations would occur by random change (cf. Hayter, 2012)]. The null hypothesis (H_0) is disproven for the nine interpersonal skills and competencies indicating that these are statistically significant. Furthermore, the One Sample t test results for the eight technical skills and competencies are noted in Table 7. Five (55.56%) of the nine technical skills and competencies had mean values > the hypothesised mean (3.50). The remaining four (44.44%) skills and competencies had mean values < the hypothesised mean. The p-values for each skill/competency were indicate a value of .001 to < .001. For the technical skills and competencies, the null hypothesis (H_0) is disproven, indicating that these are statistically significant.

Because the data are non-parametric in distribution, that is, it is skewed rather than normally distributed, the parametric One Sample t test may not provide a suitable method of statistical analysis alone. Hence, a non-parametric Chi-Square Test was conducted on the 18 skills and competencies and the results are noted in Table 8. As depicted, the asymptotic significance, or p-value, for all 18 skills and competencies is < .001. This, in conjunction with the One Sample T-Tests confirms a statistical significance in the skills and competencies analysed.

Kruskal-Wallis test

A non-parametric Kruskal-Wallis Test was conducted to determine if there was a difference in ratings of interpersonal and technical skills across several respondent variables. Table 9 reveals that there is not a significant difference in rating of interpersonal and technical skills and competencies across the respondents as regards: age, academic role, number of years in academia, number of years in industry and/or course affiliation. This signifies that the rating distribution for the interpersonal and technical skills and competencies are not significantly impacted by respondents' variables – the ratings are collectively aligned.

Comparison between interpersonal and technical

Figure 7 overlayed the mean and median values for the 18 interpersonal and technical skills and competencies and clearly depicts a higher rating trend for interpersonal skills and competencies rather than technical skills and competencies.

Table 10 depicts the WAs for the 18 skills and competencies were placed in order from highest to lowest. Looking at the top 10 skills and competencies, based on WA, which also correspond to a weight average total of >400, seven are interpersonal skills (70.00%). The three technical skills and competencies within the top 10 fall into two categories: cost control and time control. Specifically, '*budgeting/cost control*', '*work sequencing*' and '*critical path method*

Table 6. One sample t test for interpersonal skills.

	Test value = 3.50						99% confidence interval of the difference	
Question and skill/Competency	t	Df	One-sided p	Two-sided p	Mean	Mean difference	Lower	Upper
6 – Written/Typed communication	22.454	92	< .001	< .001	4.69	1.188	1.05	1.33
7 – Verbal communication	25.476	92	< .001	< .001	4.83	1.328	1.19	1.47
8 – Non-verbal communication	6.673	92	< .001	< .001	4.11	0.608	0.37	0.85
9 – Authentic leadership	18.527	92	< .001	< .001	4.60	1.102	0.95	1.26
10 – Team management	32.689	92	< .001	< .001	4.82	1.317	1.21	1.42
11 – Emotional intelligence	14.185	92	< .001	< .001	4.40	0.898	0.73	1.06
12 – Team/Group work	26.367	92	< .001	< .001	4.75	1.253	1.13	1.38
13 – Empathy	7.826	92	< .001	< .001	4.14	0.640	0.42	0.85
14 – Listening and understanding	18.527	92	< .001	< .001	4.60	1.102	0.95	1.26

Table 7. One sample *t* test for technical skills.

Question and skill/Competency	Test value = 3.50						99% confidence interval of the difference	
	t	Df	One-sided *p*	Two-sided *p*	Mean	Mean difference	Lower	Upper
16 – Budget/Cost control	17.386	92	< .001	< .001	4.52	1.016	0.86	1.17
17 – Estimating	9.453	92	< .001	< .001	4.17	0.672	0.49	0.86
18 – Creating BIM	−3.987	92	< .001	< .001	3.11	−0.392	−0.65	−0.13
19 – Interpreting BIM	6.336	92	< .001	< .001	4.02	0.522	0.31	0.74
20 – Digital technologies	−3.696	92	< .001	< .001	3.09	−0.414	−0.71	−0.12
21 – Structural engineering	−4.633	92	< .001	< .001	2.97	−0.532	−0.83	−0.23
22 – Civil engineering	−3.084	92	.001	.003	3.15	−0.349	−0.65	−0.05
23 – Critical path method schedule	9.864	92	< .001	< .001	4.31	0.812	0.60	1.03
24 – Work sequencing	14.380	92	< .001	< .001	4.47	0.973	0.80	1.15

Table 8. Chi-square test for interpersonal and technical skills.

Question and skill/Competency	Chi-square	Df	Asymp. Sig. (*p*-value)
6_i – Written/Typed communication	67.806[a]	2	< .001
7_i – Verbal communication	192.892[b]	3	< .001
8_i – Non-verbal communication	33.925[b]	3	< .001
9_i – Authentic leadership	50.774[a]	2	< .001
10_i – Team management	37.430[c]	1	< .001
11_i – Emotional intelligence	30.258[a]	2	< .001
12_i – Team/Group work	83.871[a]	2	< .001
13_i – Empathy	42.183[b]	3	< .001
14_i – Listening and understanding	50.744[a]	2	< .001
16_t – Budget/Cost control	40.258[a]	2	< .001
17_t – Estimating	59.473[b]	3	< .001
18_t – Creating BIM	41.462[d]	4	< .001
19_t – Interpreting BIM	37.538[b]	3	< .001
20_t – Digital technologies	24.366[d]	4	< .001
21_t – Structural engineering	20.817[d]	4	< .001
22_t – Civil engineering	26.409[d]	4	< .001
23_t – Critical path method schedule	55.172[b]	3	< .001
24_t – Work sequencing	75.731[b]	3	< .001

$_i$ = interpersonal, $_t$ = technical.
[a]0 cells (0.00%) have expected frequencies less than 5. The minimum expected cell frequency is 31.0.
[b]0 cells (0.00%) have expected frequencies less than 5. The minimum expected cell frequency is 23.3.
[c]0 cells (0.00%) have expected frequencies less than 5. The minimum expected cell frequency is 46.5.
[d]0 cells (0.00%) have expected frequencies less than 5. The minimum expected cell frequency is 18.6.

schedule' are the three technical skills. Conversely, only two interpersonal skills and competencies are in the bottom eight – '*empathy*' and '*non-verbal communication'*. However, six (66.67%) of the technical skills and competencies are located within the bottom eight when ranked based on WA. This clearly demonstrates that interpersonal skills and competencies have a far greater level of importance to the role of the construction management student than technical skills and competencies. Furthermore, the skills and competencies, when ranked, provide a clear hierarchy of aptitudes that can be used during module and course curricula development.

Proof-of-concept curriculum foundation model

The HEI and CMCD landscapes were previously conceptualised by Posillico et al. (2023); this aforementioned research work illustrated that the CMCD lacks a cohesive

Table 9. Kruskal-Wallis test results.

Group	Null hypothesis	Test statistic	Degree of freedom	Asymptotic sig.[a, b] (p-value)	Decision on the null hypothesis
Academic role	The distribution of interpersonal skills is the same	1.334[a, b]	3	0.721	Retain
	The distribution of technical skills is the same	4.203[a, b]	3	0.240	Retain
Age	The distribution of interpersonal skills is the same	7.814[a, b]	4	0.099	Retain
	The distribution of technical skills is the same	7.198[a, b]	4	0.126	Retain
Years in academia	The distribution of interpersonal skills is the same	7.459[a, b]	5	0.189	Retain
	The distribution of technical skills is the same	5.283[a, b]	5	0.382	Retain
Years in industry	The distribution of interpersonal skills is the same	2.562[a, b]	3	0.464	Retain
	The distribution of technical skills is the same	6.286[a, b]	3	0.098	Retain
Course affiliation	The distribution of interpersonal skills is the same	5.337[a, b]	5	0.376	Retain
	The distribution of technical skills is the same	9.659[a, b]	5	0.086	Retain

[a]The test statistic is adjusted for ties.
[b]Multiple comparisons are not performed because the overall test does not show significant differences across samples.

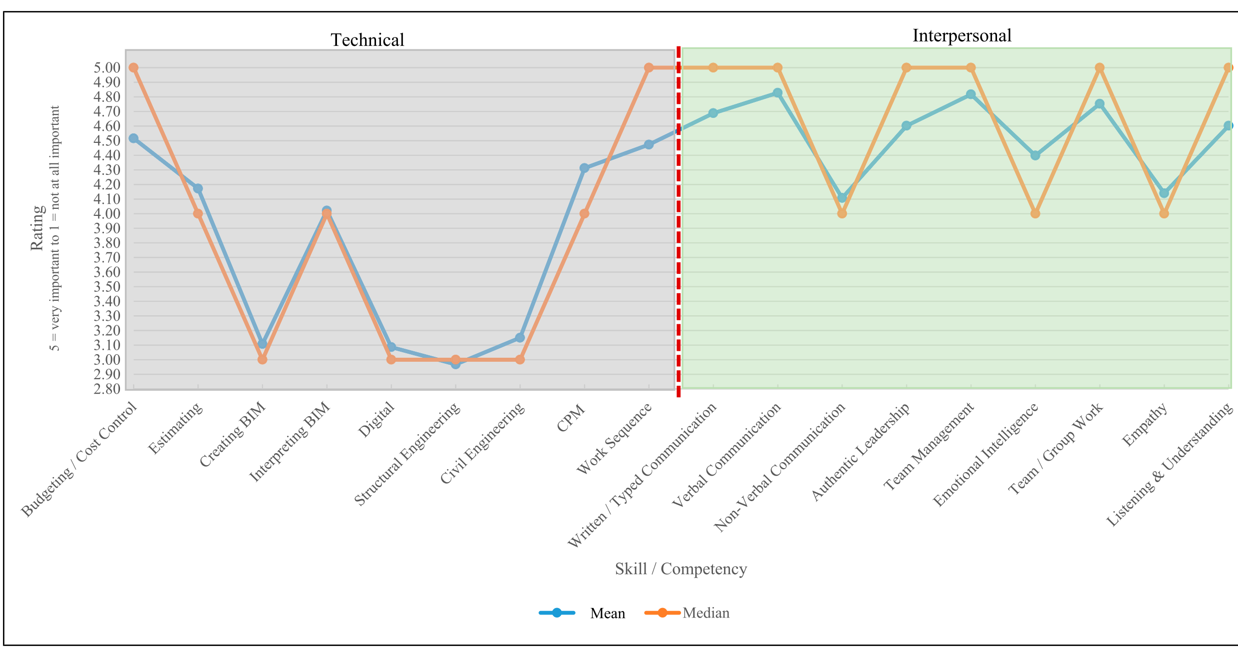


Figure 7. Mean and median values overlay for interpersonal and technical skills and competencies.

body of knowledge and defined community of practice researching in this area. Consequently, an untested conceptual model was developed from the previous literature analyses which noted the internal and external factors influencing the curriculum and its development (Posillico et al., 2022a). Metaphorically speaking, the stability and longevity of any structure is inextricably dependent upon its foundation; for a weak foundation yields a weak structure

Table 10. Weighted averages of interpersonal and technical skills and competencies.

Rank	Question	Weighted average
1	7_i – Verbal communication	449
2	10_i – Team management	448
3	12_i – Team/Group work	442
4	6_i – Written/Typed communication	436
5	9_i – Authentic leadership	428
	14_i – Listening and understanding	
7	16_t – Budgeting/Cost control	420
8	24_t – Work sequencing	416
9	11_i – Emotional intelligence	409
10	23_t – Critical path method schedule	401
11	17_t – Estimating	388
12	13_i – Empathy	385
13	8_i – Non-verbal communication	382
14	19_t – Interpreting BIM	374
15	22_t – Civil engineering	293
16	18_t – Creating BIM	289
17	20_t – Digital technologies	287
18	21_t – Structural engineering	276

$_i$ = interpersonal, $_t$ = technical.

no matter how aesthetically pleasing or well-constructed. The same is true for construction management curriculum – it needs a solid foundation. Therefore, utilising the final ranked list of the interpersonal and technical skills and competencies of construction management graduates presented in this present research study (refer to Table 11), a proof-of-concept model is presented (refer to Figure 8(a)–(b)) – such work takes the previously developed conceptual model to the next 'statistical testing' stage of both iterative and deductive development. The model is characterised as a structural foundation section detail where the four key interpersonal skills ('*communication*,' '*teamwork*,' '*leadership*' and '*listening and understanding*') represent the material components of the foundation and its mix design (e.g., aggregate, cement, water, reinforcing steel). Specifically, as the statistics in Figure 8(b) note, these four key interpersonal skills and competencies represent the top four most important skills essential to the construction manager role and thus serve as the role's nucleus. Resting upon the foundation is the entirety of the construction management curriculum, which will be delineated in future research, but broadly includes the educational mission, strategic educational plan and the matrix of course modules, all which sit in an environment inundated with external and internal factors. Whilst many structural foundations lie hidden beneath the surface with the architectural splendour of the structure standing proudly, so too does this proof-of-concept model. The core interpersonal skills and competencies that comprise the foundation are hidden from view yet provide the critical heavy lifting for the conspicuous and present curriculum.

Regards the previously identified technical skills and competencies (refer to Table 11), whilst their importance to the construction manager role is lower than most of the interpersonal skills and competencies noted (refer to Table 11), they constitute an integral supporting curriculum role. Specifically, the technical skills and competencies find their home within the matrix of course modules – explicit modules where adequate attention is given to technical skills and competencies. For example, the technical *'structural engineering'* subject matter came last across all skills and competencies, because construction managers only need an appreciation of the complex mathematics and principles involved to communicate effectively with a structural engineer who is ultimately responsible for such works. Essentially, the construction manager manages the delivery and assembly of the structured engineering works to the design created by the structural engineer. However, as the proof-of-concept model indicates, it is important to note that the appropriate educational provision for the technical skills cannot be achieved without the four inextricably linked interpersonal skills and competencies. For example, a student will be unable to grasp the holistic intricacies and concepts of construction process '*workflow and sequence*' without complete comprehension of '*communication*,' '*teamwork*,' '*leadership*' and '*listening and understanding*.'

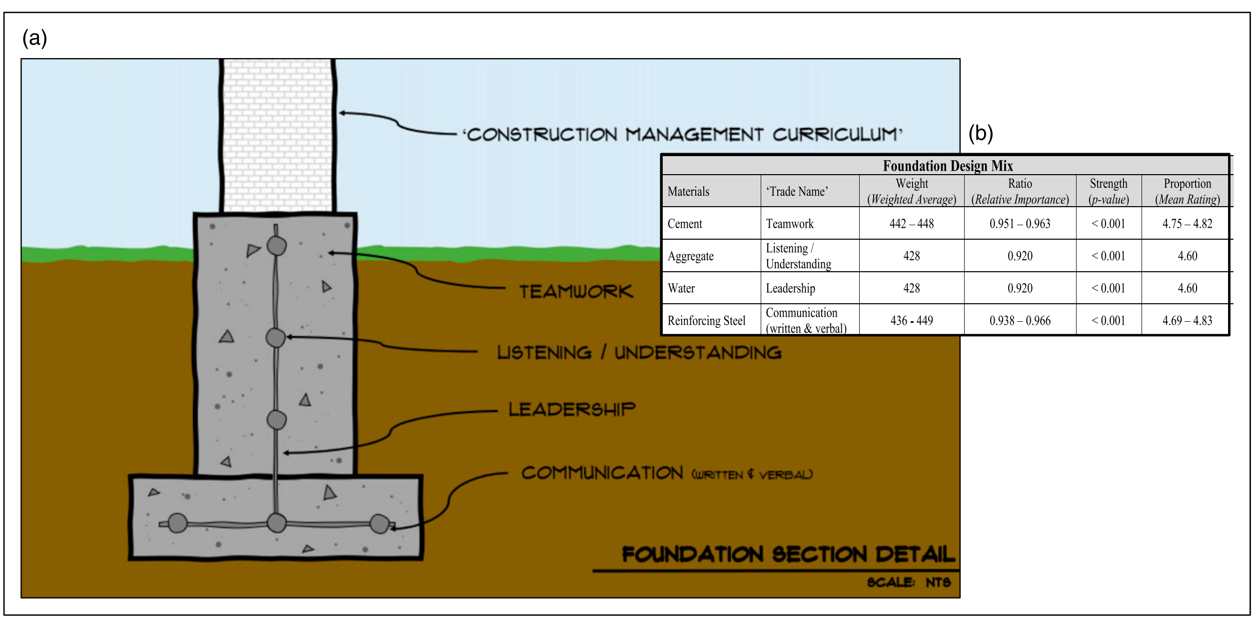
Discussion

Several practical applications of the research results are apparent for construction management education. Initially, there is an overwhelmingly strong preference from academia for interpersonal skills and competencies (i.e., '*teamwork', 'communication', 'leadership'* and '*listening/understanding')* rather than more technically focused skills and competencies. Interestingly, there was notable lack of support for the importance of digital and building information modelling (BIM) skills and competencies. At face value, this finding is perplexing given that current construction management curricula within UK HEIs, have doubled down on a digital infused curriculum development. Perhaps this momentum for '*all things digital*' is the result of a trickle-down effect from, not only the disjointed CMCD landscape, but the individualistic perceptions of senior/course leadership of what a modern curriculum 'should' be. More worrying could be the push to capitalise on a wealth of government grants and income streams that require a stronger digital presence within the HEI landscape? Anecdotal evidence suggests that this has created a situation where digital specialists are employed to teach on construction management courses but are then constrained by their limited knowledge of the practical

Table 11. Final ranked skills and competencies.

Rank	Question	Weighted average (WA)	Relative importance index (RII)
1	7_i – Verbal communication	449	0.966
2	10_i – Team management	448	0.963
3	12_i – Team/Group work	442	0.951
4	6_i – Written/Typed communication	436	0.938
5	9_i – Authentic leadership	428	0.920
6	14_i – Listening and understanding	428	0.920
7	16_t – Budgeting/Cost control	420	0.903
8	24_t – Work sequencing	416	0.895
9	11_i – Emotional intelligence	409	0.880
10	23_t – Critical path method schedule	401	0.862
11	17_t – Estimating	388	0.834
12	13_i – Empathy	385	0.828
13	8_i – Non-verbal communication	382	0.822
14	19_t – Interpreting BIM	374	0.804
15	22_t – Civil engineering	293	0.630
16	18_t – Creating BIM	289	0.622
17	20_t – Digital technologies	287	0.617
18	21_t – Structural engineering	276	0.594

$_i$ = interpersonal, $_t$ = technical.



Foundation Design Mix					
Materials	'Trade Name'	Weight (*Weighted Average*)	Ratio (*Relative Importance*)	Strength (*p-value*)	Proportion (*Mean Rating*)
Cement	Teamwork	442 – 448	0.951 – 0.963	< 0.001	4.75 – 4.82
Aggregate	Listening / Understanding	428	0.920	< 0.001	4.60
Water	Leadership	428	0.920	< 0.001	4.60
Reinforcing Steel	Communication (written & verbal)	436 - 449	0.938 – 0.966	< 0.001	4.69 – 4.83

Figure 8. (a)–(b): proof-of-concept model.

aspects of employment within the sector and cannot teach practice-based work (e.g., how to manage a project). Perhaps HEIs have gone too far in their estimation of the importance of digital in a management orientated curricular? Further work is required to explore these speculations in more detail and delineate the boundaries of digital teaching on a construction management course. Anecdotal evidence suggests that construction management students need to keep abreast of digital technologies only in order to adequately converse with colleagues (such as designers) who are more immersed in such technologies as well as read digital aids (such as plans, schedules/programmes and costings). However, some construction management professional bodies, such as the Chartered Institute of Building (CIOB) and the Royal Institution of Chartered Surveyors (RICS), have begun to offer training and development courses focusing on interpersonal skills (Chartered Institute of Building, 2023; Royal Institution of Chartered Surveyors, 2023).

Higher education institution's fascination with digital technologies within the built environment disciplines (Macchiarella and Smith, 2021) is in stark contrast to the humanistic, interpersonal skills and competencies preference noted within the research findings. With a prominent goal of student employability upon graduation (Jackson and Tomlinson, 2021), it is a concern how curricula are currently designed, implemented and promoted with little regard to not only the voice of the industry in which they are preparing students, but front-line, industry robust academics (cf. Akdur, 2022; Jacobs and Lu, 2022). With such lucrative short- and long-term employment offerings leading to an increased number of students enrolling in construction management courses (Besné et al., 2021; Khan et al., 2021), it is worrisome that the curricula currently in place are not only insufficient in the short-term but potentially fail to adequately meet the long-term character-building needs of construction management professionals (cf. Posillico et al., 2022a). The proof-of-concept model offered provides a foundational slice of an overall construction management curriculum, upon which course content is built. Validation of this model is now needed to confirm agreement of the top interpersonal skills and competencies from the primary data and how these could be better integrated in HEI practice. More importantly, future work is now required to determine how practicing academics perceive the specific interpersonal skills as the core foundational element of construction management curricula and how they integrate such within their construction management modules and courses. In addition to validation, action research within various construction management courses is required to employ the lessons learnt from this present study in practice. A longitudinal case study may provide fruitful snippets of data to determine whether the application of theory developed and now tested will augment the employability of graduates within industry.

Conclusions

Applying the analysis conducted in this paper, a proof-of-concept model for the foundation of a construction management curriculum is developed. This research revealed that global built environment academics, with substantial industry experience, generally rate interpersonal skills and competencies as more important than technical skills and competencies for the role of construction manager. In fact, common interpersonal skills ('*communication*', '*leadership*' and '*teamwork*') were ranked pointedly higher in importance than more trendy and glitzy technical skills such as augmented reality, virtual reality and BIM. Therefore, it can be implicitly noted that, from an educational perspective, interpersonal skills and competencies are an essential or core aspect of a construction management degree course. This makes intuitive sense given that the role is focused on the 'management' of other construction stakeholders involved in a complex project's development. The proof-of-concept model bridges this void by providing a robust, structurally sound foundation for which to construct a bespoke curriculum. Through the development of this model, it is hoped that a central foundation of interpersonal skills and competencies for construction management curricula can be shared, not only for the modification of current education provision, but for the benefit of future construction management students.

Interpersonal skills and competencies are essential to the construction manager's role and thus, should be at the heart of construction management curricula. However, with HEI's fascination with technical skills, mainly digitally based skills, a dichotomy in educational provision is born. Academic introspection is required to re-think the lowest common denominator of construction management curricula – placing interpersonal skills and competencies at the core of the curriculum.

Successful graduate employability is an overarching factor for technically based educational programmes; graduates must have the requisite skill sets to contribute to their respective discipline. Previous research (cf. Posillico et al., 2022a) revealed that construction management education is currently misaligned with the essential core skills required of the profession – namely management. Managers need an appreciation of advanced technologies to be able to effectively communicate with other project team stakeholders, but applications of these technologies (such as BIM) are not required nor needed within the management remit. This skewed position not only impacts students but also negatively impacts their outlook of the profession and future employability within the sector. By challenging this current status quo, this present research hopes to engender wider polemic debate and discussion within both industry and academia, whilst also create a platform for future research work in this area.

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