

Provide a critical reflection of your roles and responsibilities within a wider archaeological project considering the requirements for professional and ethical judgement, and your relationships with other team members and other stakeholders

Introduction

Lewis and Gospel (2011) describe technical roles as involving specialised work in which the post-holder is trained and has developed the required skills through ample practical experience. However, in reality, technicians perform a much more diverse role, especially in Higher Education institutes, and must adapt not only their approach but their overall skillset to meet contrasting demands as and when they arise (MI Talent 2022). This has certainly been my experience so far as an Assistant Technician in Durham University's Archaeology Department. Since starting the role in 2022, it has been a constant learning experience, and I have found myself engaging in numerous different aspects of archaeological research, through which I have developed a plethora of specialist and general skills. This critical reflection examines my first experience of being involved in a large-scale commercial project, considering both the positive and negative elements together with the many learning outcomes that arose from the situation. My role within this project undertaken by the Durham Archaeomaterials Research Centre (DARC Lab), compelled me to confront my approach to tasks by exploring my work ethic and response to responsibility. It also caused me to appreciate my role as a technician in a research-led university, whilst also interrogating the pressures that technicians face. Perhaps most importantly however, this project helped me understand the practicalities of research, and the need for a team to communicate effectively in order to achieve realistic, defined goals. These key impacts will be explored throughout the critical reflection of this rather complex multifaceted project, adapting Gibbs' (1988) technique of structured debriefing to structure the essay. Ultimately, this essay endeavours to critically evaluate my role and responsibilities within this specific project, whilst also reflecting on the influence it has had on my professional and ethical judgement and my role as an archaeological technician in general.

Description of Situation and Response

In late 2022, I was asked by the manager of the DARC Lab (referred to as "the academic") to cost equipment and consumables for a geoarchaeological method they agreed to undertake as part of a large incoming commercial contract. This particle size analysis (PSA) method was new to both me and the academic, and had not previously been carried out in our department's labs. As requested by the client, PSA would be used to analyse soil samples from a British site, alongside phosphate analysis and organic matter content determination

via loss on ignition (LOI). It was agreed between myself, the academic, and my line manager that I would support the necessary sample preparation where possible, due to the scale of the project. This provided a welcome opportunity to gain experience in geoarchaeology, which I was relatively new to at the time. I was excited to develop and expand my technical skillset whilst also improving my understanding of how large-scale lab-based commercial projects worked, so that I could support future projects in this lab and others. I was told my involvement would include drying and weighing samples, carrying out LOI analysis, and undertaking sample preparation for PSA; with the workload for the latter two tasks shared between myself and the academic.

With this agreed plan I felt ready and keen to begin the project, and started by creating a risk assessment for PSA (see supporting documentation) and drying the samples. However, issues soon started to arise. Departmental equipment planned to be used for PSA was found to be unsuitable and was either too expensive to replace or wasn't available. Additionally, after I finished drying the 130 samples, the academic informed me they had agreed to analyse 250 more using LOI and phosphate analysis, which also needed to be prepared. This was frustrating, and I felt quite shocked by this unexpected increase in workload, not least because myself and my line manager had made it clear in planning discussions that we needed to know exact technical support requirements, so we could ensure I had capacity to take on the project whilst still fulfilling my other duties. The most pressing issue however, was that emergency roof repairs were about to begin and the Department's extraction would be switched off, making it impossible to use the fumehood and furnace for PSA and LOI. Thankfully, we liaised with the Geography Department's technical team, and were able to use their labs and equipment, with me taking responsibility for managing lab bookings and supervising archaeological work. Whilst this felt daunting at first, Geography's technicians were incredibly helpful, kindly providing me with training and protocols for both analyses (see supporting documentation).

Once these mitigating arrangements were in place, LOI work began in May 2023 (figure 1). This took four weeks to complete with me working two or three days per week in Geography. Unfortunately, due to personal circumstances, the academic was no longer able to support sample preparation and analysis, and responsibility was instead passed entirely to me. Truthfully, I struggled with the weight of this responsibility, and feared letting the academic down. However, I tried to counteract any further issues by being as organised and efficient with my time as possible. I arranged student supervisions around times that I needed to be in the lab myself, recorded all sample weights in an excel file and applied a formula to calculate LOI (figure 2), and tracked which of the 380 samples had been analysed. In doing

this, I was able to provide the academic with the results in a timely manner, so they could be compiled into a report and sent to the client on time.

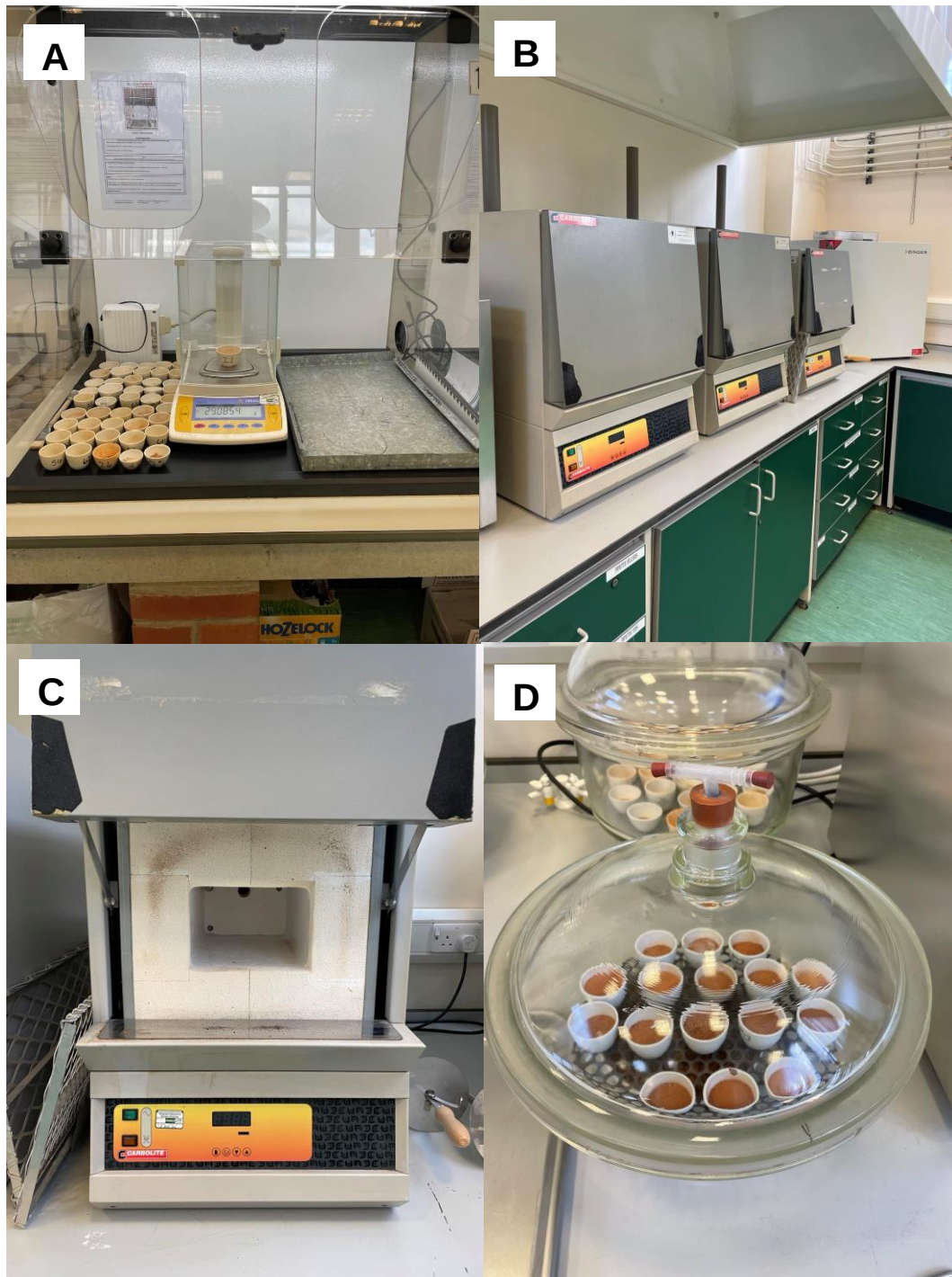


Figure 1: The LOI process involved multiple steps. 3-5mg of each sample was added to pre-weighed crucibles (A), which were then dried and reweighed before being ignited in the furnace at 550°C for four hours (B). Using two furnaces, approximately 50 samples could be processed per day (C). Once ashed, the samples were dried in the desiccators (D) and reweighed, with weights recorded and LOI (%) calculated in an excel spreadsheet (Photos taken by author 2023).

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	A	B	C	D	E	F	G	H	I	J	K
	Sample ID	Sample #	Crucible #	Crucible Weight	Sample Weight	Crucible + Sample Weight	(Furnace) Crucible + Ash Weight	Ash Weight	LOI (%)	Notes	
3	8271	1	89	18.5429	5.0825	23.6254	23.4328	4.8899	3.78947		
4	8276	2	Y1	25.1347	4.995	30.1297	30.0297	4.895	2.002		
5	8274	3	W3	15.1566	5.0042	20.1608	19.9248	4.7682	4.71604		
6	8273	4	W1	16.9641	5.0047	21.9688	21.8185	4.8544	3.00318		
7	8275	5	V5	17.5223	5.0098	22.5321	22.3734	4.8511	3.16779		
8	8277	6	67	18.7199	5.0012	23.7211	23.6122	4.8923	2.17748		
9	8278	7	55	18.4608	5.0069	23.4677	23.2624	4.8016	4.10034		
10	8279	8	29	26.7614	5.0003	31.7617	31.5931	4.8317	3.3718		
11	8280	9	37	19.433	5.0015	24.4345	24.3351	4.9021	1.9874		
12	8281	10	71	17.6448	4.995	22.6398	22.4596	4.8148	3.60761		
13	8282	11	58	18.0677	5.0126	23.0803	22.8657	4.798	4.28121		
14	8262	12	46	18.7357	5.0027	23.7384	23.5651	4.8294	3.46413		
15	8263	13	44	22.7193	5.0087	27.728	27.5582	4.8389	3.3901		
16	8264	14	13	19.1793	5.0303	24.2096	24.0295	4.8502	3.5803		
17	8268	15	V2	22.5229	5.0099	27.5328	27.3809	4.858	3.032		
18	8269	16	Y7	24.5597	5.0061	29.5658	29.3842	4.8245	3.62757		
19	8270	17	45	19.2985	5.014	24.3125	24.0695	4.771	4.84643		
20	8213	18	69	19.1912	5.0181	24.2093	23.9597	4.7685	4.97399		
21	8214	19	25	23.7845	5.0093	28.7938	28.5787	4.7942	4.29401		
22	8215	20	87	19.0774	5.0161	24.0935	23.8652	4.7878	4.55134		
23	8216	21	Y5	25.1985	5.0201	30.2186	30.0173	4.8188	4.00988		
24	8217	22	W10	14.0439	5.015	19.0589	18.9147	4.8708	2.87537		
25	8218	23	90	18.6537	5.0089	23.6626	23.4769	4.8232	3.7074		
26	8219	24	85	19.9263	5.0226	24.9489	24.7813	4.855	3.33692		
27	8220	25	59	19.2875	5.0298	24.3173	24.1617	4.8742	3.09356		
28	8221	26	56	20.1952	5.0203	25.2155	25.0188	4.8236	3.91809		
29	8222	27	62	20.0787	5.0237	25.1024	24.8616	4.7829	4.79328		
30	8223	28	60	18.343	5.0126	23.3556	23.1204	4.7774	4.69218		
31	8224	29	2	19.6729	5.017	24.6899	24.3725	4.6996	6.32649		
32	8225	30	11	19.4028	5.0257	24.4285	24.1682	4.7654	5.17938		
33	8226	31	79	19.3687	5.0131	24.3818	24.1821	4.8134	3.98356		
34	8227	32	75	19.1691	5.0182	24.1873	23.9581	4.789	4.56737		
35	8228	33	66	17.796	5.0138	22.8098	22.5248	4.7288	5.68431		
36	8229	34	36	18.8049	5.0053	23.8102	23.5467	4.7418	5.26442		
37	8232	35	41	19.3921	5.0166	24.4087	24.253	4.8609	3.1037		
38	8236	36	33	19.8716	1.0096	20.8812	20.8476	0.976	3.32805	LOW SAMPLE QUANTITY	
39	8237	37	64	19.4444	5.0185	24.4629	24.3112	4.8668	3.02282		
40	8235	38	30	21.1713	5.0072	26.1785	25.9429	4.7716	4.70522		
41	8233	39	22	17.1742	5.0247	22.1989	21.9925	4.8183	4.10771		
42	7222	40	38	19.0689	2.5036	21.5725	21.535	2.4661	1.49784	LOW SAMPLE QUANTITY	
43	8234	41	76	18.8912	5.0002	23.8914	23.68	4.7888	4.22783		
44	7206.2.3.1	42	X10	24.4136	2.4952	26.9088	26.83	2.4164	3.15806	LOW SAMPLE QUANTITY	
45	8238	43	17	19.4959	5.0306	24.5265	24.3974	4.9015	2.56629		
46	8239	44	35	19.258	5.0284	24.2864	24.1884	4.9304	1.94893		
47	7229	45	22	24.7926	2.5081	27.3007	27.1614	2.3688	5.55401	LOW SAMPLE QUANTITY	
48	8240	46	40	19.1328	5.0147	24.1475	23.9785	4.8457	3.37009		
49	8241	47	26	24.2388	5.0182	29.257	29.1435	4.9047	2.26177		
50	7206.1.2.1	48	12	21.8749	2.5011	24.376	24.3248	2.4499	2.0471	LOW SAMPLE QUANTITY	
51	8242	49	101	21.8978	5.027	26.9248	26.7115	4.8137	4.24309		
52	7194	50	171	21.1927	5.0184	26.2111	26.0087	4.816	4.03316		
53	8243	51	Y10	24.5103	5.004	29.5143	29.3548	4.8445	3.18745		
54	8244	52	48	19.6661	5.0238	24.6899	24.5124	4.8463	3.53318	Batch 2 - weighted 25/5	
55	8245	53	80	20.3558	5.0121	25.3679	25.2219	4.8661	2.91295		

Figure 2: This screenshot shows the layout of the excel spreadsheet used to compile the results of LOI analysis of 380 soil samples. The equation input within the LOI (%) column uses the protocol's formula to automatically calculate the LOI result when all weights are recorded. Samples for which a low quantity of material was available for LOI following phosphate analysis are highlighted in red to indicate potential unreliable results (spreadsheet compiled by author 2023).

I also took initiative by running a batch of PSA control samples in July to check if the sample weights were suitable. This turned out to be a crucial decision as the weights were too low to yield accurate analysis results, so I was able to amend this for all other samples. The academic had capacity to support some PSA sample preparation and analysis, and I was grateful to have help. However, as they didn't fully understand the specificities of the PSA process, the academic perhaps naively gave the client an ambitious deadline, not taking into account the length of time the laser granulometer needed to analyse each sample. This placed additional pressure on both of us and caused some conflict, as whilst I believed it was important to stick to the protocol to ensure integrity and comparability of results, the academic looked for ways to make the process more time efficient. Nevertheless, working as a team we managed to complete sample analysis (figure 3) in eight days over two weeks, and the PSA results were submitted to the client just after the deadline.

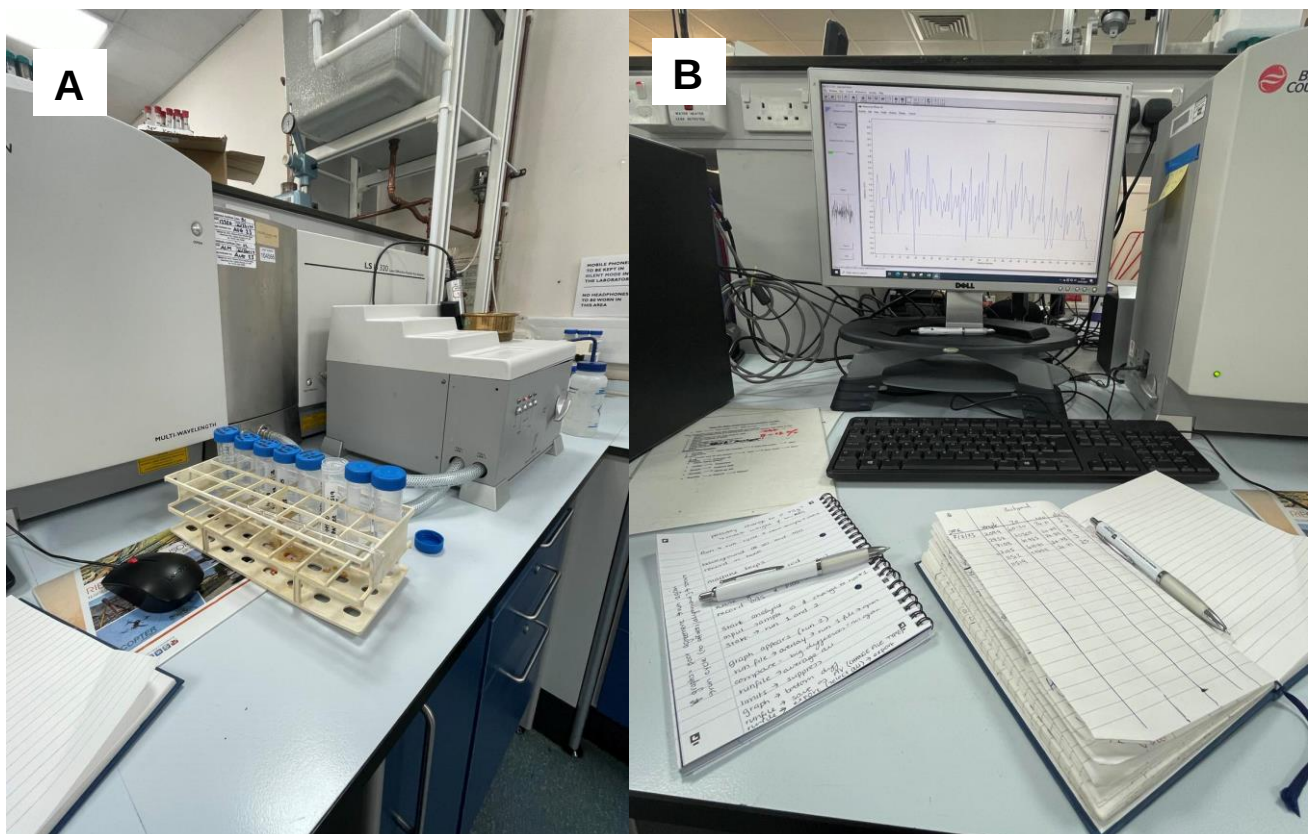


Figure 3: Following sample pre-treatment involving digestion of organic materials using Hydrogen Peroxide and deflocculation using Sodium Hexametaphosphate, the PSA samples were analysed on the Coulter laser granulometer (A). This required loading each sample into the machine, recording background measures, and analysing the graphs produced by the duplicate sample runs to ensure they matched (B). All results were then exported and sent to the academic to pass onto the client (Photos taken by author 2023).

Evaluation and Reflection

Following this at times overwhelming project, I initially felt disheartened in my ability to take responsibility in commercial projects, and began to question my capabilities in my role as a technician overall. The effort I had put into this project despite the time pressure and physical burden of continuous lab work, had not been enough to meet the deadline on time, and I felt like I had let myself, the academic, and the client down. Yet, it was not until reflecting on the situation, that I realised just how much I had achieved and learned. As a Grade 3 technician, I managed to plan, undertake, and adapt the preparation and analysis of 380 LOI samples plus another 130 for PSA largely by myself, whilst working in a new lab with new people, undertaking entirely new processes in a new field of study, and also contending with the fallout from large-scale emergency repairs in my own Department. I recognised therefore, that my stress and worries had largely come from my lack of experience in all aspects of the situation, rather than my lack of competence. This was a valuable insight to uncover, as I could relate it to my approach to work elsewhere. In situations where I believe my abilities and professional judgement are not suitable to meet perceived demands (Dietz *et al.* 2017), I now realise I have a tendency to be overly self-critical and put additional pressure on myself to do everything right so as not to be a burden or liability, which is likely linked to my perfectionistic standards (Besser *et al.* 2004; Ocampo *et al.* 2019). I can see that my lack of self-confidence and fear of not living up to perceived expectations made the situation harder for myself, as my doubtful viewpoint combined with the unprecedented circumstances impacting the project, made my responsibilities feel like a burden that I had to bear alone (Besser *et al.* 2004). Ultimately, although I managed to handle the responsibility of this project and the various unexpected circumstances accompanying it, in future I imagine I would cope much better if I sought more guidance and confided in others about my doubts and concerns.

With this observation in mind, I was also able to reflect on my time spent with Geography's technicians and the importance of understanding the practicalities behind research. Their breadth and depth of knowledge was notable, and I felt reassured in my abilities through their praise, trust, and acknowledgement that confidence comes with experience (Lewis and Gospel 2011). As with many technical teams, there was a clear prioritisation of complying with protocols and best practice to safeguard health and safety and a productive working environment (MI Talent 2023). Recognising this, I realised that perhaps my frustrations with the academic's attempt to "cut corners" and ignore aspects of the protocols, stemmed from my experience working on isotope projects, where strict protocol adherence is required to prevent sample contamination and ensure reliable data production (see for example Ambrose 1990; Beaumont *et al.* 2013). In hindsight, because I prioritised it myself, I had

assumed all protocols would be followed as part of good professional and ethical practice, especially in geoarchaeology, where discrepancies between methodologies have been proven to affect results of analyses such as LOI (Holliday *et al.* 2004; Hoogsteen *et al.* 2015). This recognition helped me appreciate how developing and utilising my own professional and ethical judgement is reliant on me having a full understanding of the work I am carrying out, especially in contexts where, as a technician, I am the person responsible for physically interacting with the samples to provide data which the academic gives theoretical and scientific context to (Lewis and Gospel 2011). In this situation I admittedly felt out of my depths initially without this background knowledge, and as a result felt anxious about making mistakes. In retrospect, I should have researched the processes more before starting, and asked the academic to show me how the data I collected would be analysed for the client in order to understand the sampling methods in context. However, I also believe that as a junior member of staff, the academic should not have placed this volume of work solely under my responsibility, as whilst I was capable, working above my current job requirements with less support and communication than promised put excess pressure on me and made me feel like my role was a resource being used to achieve results in an unrealistic timeframe (MI Talent 2022). Overall, this experience made me value the practical perspectives my role allows me to offer within projects, whilst also emphasising that clear communication within a team is imperative for technicians to effectively support researchers and understand their decisions and priorities.

Conclusion

Although this project was undoubtedly difficult at the time, taking the time to reflect on it has proven how educationally beneficial it was for me as an introduction to the often turbulent nature of large-scale commercial projects. Despite the novelty of the situation, I quickly picked up the skills required for LOI and PSA, and gained enough competence to teach others the processes, which I continue to do in my role now. Having the opportunity to network with technicians in another department also taught me that the workload and confidence issues I face in my role are not unique, and proved to me the importance of learning by doing. Even the negative experiences yielded considerable learning outcomes. In recognising my own weaknesses such as my perfectionistic tendencies and reluctance to confide in others when struggling, I now actively try to identify when these stress responses interfere with my work and regularly communicate concerns with my line manager. Furthermore, despite this being a “trial by fire” introduction to geoarchaeology, I have not let this dissuade my interest in learning new skills, and have recently agreed to take on another

geoarchaeological commercial project. Following this experience, I have worked with my line manager to introduce changes to better manage and protect my time, including having a designated day a week for work in different commercial labs. This has been incredibly useful so far, and has ensured I have a regular routine that avoids one project monopolising my time. In summary, this largely successful project taught me more about myself and my professional and ethical judgement than I expected, and I intend to consolidate these learning outcomes into my everyday practice. I now understand and value the essentiality of technicians to the generation of scientific knowledge (Iliffe 2008), and the crucial shared responsibility within project teams to uphold effective communication.

Bibliography

- Ambrose, S.H., 1990. Preparation and Characterisation of Bone and Tooth Collagen for Isotopic Analysis. *Journal of Archaeological Science*, 17(4), pp. 431-451
- Beaumont, J., Gledhill, A., Lee-Thorp, J., Montgomery, J., 2013. Childhood Diet: A Closer Examination of the Evidence from Dental Tissues Using Stable Isotope Analysis of Incremental Human Dentine. *Archaeometry*, 55(2), pp. 277-295
- Besser, A., Flett, G.L., Hewitt, P.L., 2004. Perfectionism, Cognition, and Affect in Response to Performance Failure vs. Success. *Journal of Rational-Emotive and Cognitive-Behaviour Therapy*, 22(1), pp. 297-324
- Dietz, A.S., Driskell, J.E., Sierra, M.J., Weaver, S.J., Driskell, T., Salas, E., 2017. "Teamwork Under Stress" In Salas, E., Rico, R., Passmore, J. (Eds.) *The Wiley Handbook of The Psychology of Team Working and Collaborative Processes*. Chichester: John Wiley and Sons Ltd, pp. 297-315
- Gibbs, G., 1988. Learning by Doing: A Guide to Teaching and Learning Methods. Oxford: Oxford Polytechnic Further Education Unit
- Holliday, V.T., Stein, J.K., Gartner, W.G., 2004. "Appendix 3: Variability of Soil Laboratory Procedures and Results" In Holliday, V.T. (Ed.) *Soils in Archaeological Research*. New York: Oxford University Press, pp. 363-374
- Hoogsteen, M.J.J., Lantinga, E.A., Bakker, E.J., Groot, J.C.J., Tittonell, P.A., 2015. Estimating Soil Organic Carbon Through Loss on Ignition: Effects of Ignition Conditions and Structural Water Loss. *European Journal of Soil Science*, 66(2), pp. 320-328
- Iliffe, R., 2008. Technicians. *Notes and Records of the Royal Society*, 62(1), pp. 3-16
- Lewis, P.A., Gospel, H., 2011. Technicians Under the Microscope: A Study of the Skills and Training of University Laboratory and Engineering Workshop Technicians. London: Gatsby Charitable Foundation
- MI Talent 2022. The TALENT Commission: Technical Skills, Roles and Careers in UK Higher Education and Research. Birmingham: Midlands Innovation
- MI Talent, 2023. Creating and Maintaining Safe Environments: The Role of Technicians in Health and Safety. Birmingham: Midlands Innovation
- Ocampo, A.C.G., Wang, L., Kiazad, K., Restubog, S.L.D., Ashkanasy, N.M., 2019. The Relentless Pursuit of Perfectionism: A Review of Perfectionism in the Workplace and an Agenda for Future Research. *Journal of Organisational Behaviour*, 41(2), pp. 144-168