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Perceived Belbin team roles of first year university students studying aerospace engineering: a multi-year study

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ABSTRACT

Effective teamwork is critical in engineering and engineering degree programmes are designed to encourage, develop and allow students to demonstrate this transferable skill. This is particularly true in aerospace engineering where the complexity and inherent multidisciplinary nature of both defined and open-ended projects demands a well-balanced team with diverse team role preferences. This study investigates trends in the perceived team roles of aerospace engineering students over six years (2018–2024), utilising Belbin's Team Role Self-Perception Inventory (BTRSPI). The study identifies the overall distribution of role perceptions amongst aerospace engineering students, the perceived traits of male or female participants, as well as the trends and fluctuations in role perceptions over time, with consideration given to the influence of the COVID-19 pandemic. Overall, Monitor Evaluator, Plant, and Completer Finisher roles were found to be consistently prominent, while Coordinator, Shaper, and Specialist roles were less favoured. Clear differences are identified between female and male participants, with females showing higher percentile scores in people-orientated roles and males dominating in thinking-orientated roles. Trends and shifts in perceived team roles are considered in the context of aerospace engineering students and their implications for curriculum design and team-based learning strategies in engineering education.

1. Introduction

Teamwork is a crucial element within Higher Education (HE) settings, particularly engineering disciplines, where projects often involve interdisciplinary collaboration and the integration of various technical skills. Understanding how students perceive their roles within teams can provide valuable insights for educators in designing effective curriculum and team-based learning experiences and pedagogies. In addition, demonstrable effective teamwork is one of the most in demand skills from engineering companies, although it has been observed that most

engineering graduates lack such skills (Felder 2012; Zhang et al. 2020), hence it forms a key part in the accreditation of engineering degree programmes (Engineering Council 2020).

Belbin's Team Roles framework, developed by Dr. Meredith Belbin in the 1970s, offers a well-established method for assessing individual contributions to team dynamics (Belbin 2010). Based on extensive research into team effectiveness, Belbin identified nine distinct roles that members might assume within a team, each of which can be considered as part of one of three types: thinking roles, action roles, and people roles. Details, descriptions, and potential weaknesses of the nine Belbin team roles are provided in Table 1. In addition, how these team roles potentially link to aerospace engineering careers and roles has been considered and detailed in Table 1.

Many studies within HE settings have used Belbin team roles to support student preferred and perceived team roles of a cohort and how this may fit within the curriculum and desired learning outcomes. Aranzabal, Epelde, and Artetxe (2022) investigated student performance of chemical engineering students in project-based learning, where teams are formed on the basis of Belbin team roles, demonstrated a clear improvement when compared to the method of student self-selected teams, highlighting the benefit of team role balance. Similar findings were reported by Smith, Polglase, and Parry (2012), although no improvement was found in Belbin assigned teams compared to randomly selected teams amongst dental students in work by McHarg, Kay, and Coombes (2012). Several studies have looked at how particular team roles link in with individual and group behaviours, for instance, Fekry, Dafoulas, and Ismail (2019), analysed the how team roles related to presentation behaviours, with coordinators showing less probability to lose focus. Senior software engineering student teams formed with either none, one, or multiple leaders (identified as the 'shaper' team role), was the focus of Henry and Todd Stevens (1999), examining team effectiveness. It was evident that teams with a single leader performed better than those with none or multiple leaders. Research by Pollock (2009) revealed that overall role diversity did not have a large influence on team effectiveness, but certain roles within a team could, specifically Shaper, Co-ordinator, Completer-Finisher roles. While it is generally considered that balanced teams are more effective, a direct correlation between team role diversity and effectiveness remains unclear (Batenburg, van Walbeek, and In der Maur 2013). In longer term studies, Boone et al. (2022), investigated team roles of medical students over a five-year period, with team workers revealed to be the most preferred role, highlighting the challenge of a medical educational system prioritising individual achievements.

This study uses Belbin's Team Roles Self-Perception Inventory (BTRSPI) to examine the perceived team roles of first year (UK FHEQ Level 4) aerospace engineering students at Swansea University, UK across a six year period (academic years 2018/19–2023/24). The distribution of team roles is examined across all years, as well as the trends and shifts that appear over the six year time frame, and the potential influence of the COVID-19 pandemic. In addition, female and male team role differences are studied from an overall perspective. The findings are considered for their broader implications on curriculum design and team-based learning strategies in engineering education.

Table 1. Belbin team role descriptions (Belbin 2010) and their potential link to aerospace engineering roles.

Team role	Description	Potential weaknesses	Potential alignment to aerospace engineering roles
Thinking orientated roles			
Plant (PL)	The creative innovator who generates ideas and solves difficult problems. Plants are often seen as the source of original thinking within a team	- Can lack effective communication - Could be easily distracted and ignore incidentals	Engineers working on innovative aerospace technologies such as propulsion systems, space exploration, and advanced materials, where creativity is crucial, e.g. research engineers
Monitor Evaluator (ME)	The critical thinker who analyses options and makes judgments. Monitor Evaluators are valued for their objectivity and ability to assess ideas critically	- Slow decision-making - Falls short on the ability to inspire - Could be highly critical	Roles such as flight dynamics, aerodynamics, and structural integrity due to their need for critical thinking, logical decision-making, and risk assessment
Specialist (SP)	The expert who provides deep knowledge in a specific area. Specialists are valuable for their technical expertise and focused contribution to the team's work	- Can dwell on technicalities - Tends to contribute to a narrower field	Roles that hold technical authority in particular topics, which require specific in-depth expertise, e.g. aerodynamics expert, or avionic specialist
Action orientated roles			
Implementor (IMP)	The practical executor who turns ideas into actionable plans. Implementers are known for their reliability and discipline in getting things done	- Susceptible to inflexibility - Can be slow to embrace opportunities and changes	Roles which transform theoretical designs into functional aircraft or spacecraft, adhering to strict industry standards, e.g. manufacturing engineers
Shaper (SH)	The driver who challenges the team to improve and achieve objectives. Shapers are dynamic and tend to push the team towards high performance	- Tendency to provocation - Could offend people - Can seem aggressive	Project leaders, test pilots, and lead engineers who thrive under high-pressure environments
Completer-Finisher (CF)	The perfectionist who ensures that tasks are completed to the highest standard. Completer Finishers are detail-oriented and focus on polishing the final product	- Resistant to delegate - Worries excessively - Could exaggerate with perfectionism	Roles that focus on quality assurance, safety checks, and final design validation
People orientated roles			
Co-ordinator (CO)	The organiser who clarifies goals, delegates tasks, and ensures that the team stays on track. Coordinators often act as the chairperson in team discussions	- Might over-delegate work - Can be considered manipulative	Managers, team leads, or senior engineers who coordinate teams and delegate tasks effectively
Resource Investigator (RI)	The networker who explores opportunities and brings new ideas into the team. Resource Investigators are enthusiastic and adept at finding external resources	- Over-optimistic - Loses interest quickly - Could forget to follow up	Aerospace engineers involved in business development, partnerships and collaborations
Team Worker (TW)	The team-oriented member who supports others, builds cohesion and helps to maintain team harmony. Team Workers are sensitive to interpersonal relationships and often mediate conflicts	- Avoids confrontations - Indecisive in crisis - Hesitant to make unpopular decisions	Roles that facilitate multidisciplinary cooperation ensuring cross department collaborations

2. Methodology

BTRSPI is a tool designed to help individuals identify their preferred roles within a team setting. The inventory was developed by Dr. Meredith Belbin and is widely used in both educational and professional environments to understand how people contribute to group dynamics. BTRSPI was completed by first year aerospace engineering students at Swansea University online through Belbin GETSET (Belbin Associates n.d.), within the first two months (October and November) of the academic year. Ahead of students completing BTRSPI, they are given a lecture on teamwork and leadership, that covers various models that have been proposed such as great man theory by Thomas Carlyle (Carlyle, Knapp Linson, and Gunn (1893), action-centred leadership by John Adair (Adair 1973) and small group development sequence by Tuckman (1965) and Belbin.

Table 2 provides the number of students who completed the BTRSPI within this study over six academic years. Students provided informed consent during the process, and a total of 943 students (female – 139, male – 804) participated across all years, with a minimum of 122 for each year.

BTRSPI consists of a questionnaire with eight sections where each section contains ten statements that describe different behaviours or characteristics associated with team roles. Participants are asked to allocate a total of ten points across the eight statements in each section. Points are distributed by participants according to how well each statement reflects their behaviour or contribution within a team setting. There is the possibility that participants answer according to how they wish to behave or be socially perceived (Aritzeta, Swailes, and Senior 2007), although in this study the large number of participants is deemed to mitigate against this potential skewing of the data. The allocated points are then tallied, and the Belbin algorithm then looks at a participant's response and compares to a large norm database, to reflect the participants affinity with the nine Belbin team roles, through a percentile score. Typically, BTRSPI results will highlight one primary role, a secondary role, and possibly a tertiary role for an individual representing the roles they are most likely to exhibit in a team environment, likewise, it can reveal team roles which are less favoured. Quantitatively, this comes in the form of a percentile score chart that shows 'how you see yourself', an example of which is shown in Figure 1.

To compliment these quantitative outcomes, an individualised descriptive narrative is provided to all participants that indicates perceived strengths and how to make the most of them, work styles and certain elements that may be worth considering when working in a team. These results could then be used in several ways, whether by individuals to help their support personal development, as a means of informing strategies for enhanced collaboration amongst team members, or in understanding typical team role preferences

Table 2. Number of students who completed the BTRSPI in each academic year.

| Academic year	Number of students
2018–2019	122
2019–2020	138
2020–2021	231
2021–2022	180
2022–2023	150
2023–2024	122
Total	**943**
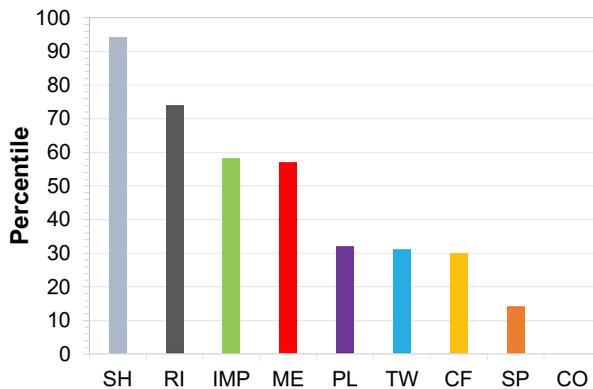
Figure 1. Example BTRSPI percentile score profile.

amongst larger groups that could help to inform potential training and interventions where appropriate. It is noteworthy that participants are also provided with the opportunity for observer assessments, which involves a shorter questionnaire that is completed by a colleague (not a family member or a friend) who has worked closely with the participant for at least three months, where a minimum of four observers are required to avoid bias. Observer assessments can provide further details, such as revealing hidden strengths of a participant or lessening the influence in potential distortions in a participant's self-perception. Nonetheless, due to the low completion rate, observer assessments have not been considered in this study.

Data analysis was carried out using Minitab (2018). All outcomes from each student BTRSPI percentile score profile (Figure 1) was considered in the data analysis as well as investigating the trends in primary team role preference. Where more than one team role received the same maximum percentile score for a student, each one was considered as a primary role, which is why the sum of primary role values exceed 100% (i.e. 102.9%). Team roles were statistically compared across the entire set of students and separately by gender (female and male; self declared by participants) and across academic years. Primary team role preferences team roles were compared separately by gender and academic year. In addition, all percentile scores outcomes across each of the team roles were compared using Spearman correlation analysis, to understand whether there was any correlation between team roles. In this case, statistical tests with a p-value lower than 0.05 were considered as statistically significant.

3. Results

The probability density distribution histograms, based on percentile score, for the nine team roles for all students are presented in Figures 2–4, with Figure 2 showing the thinking oriented roles, Figure 3 the action orientated roles and Figure 4 the people orientated roles. These distributions are then displayed as box plots in Figure 5. It is shown that across all team roles the percentile scores range between the minimum, 0 and the maximum, 100. Interestingly, although there are gaps observed, particularly in the mid-range percentile scores for each role (20 to 70),
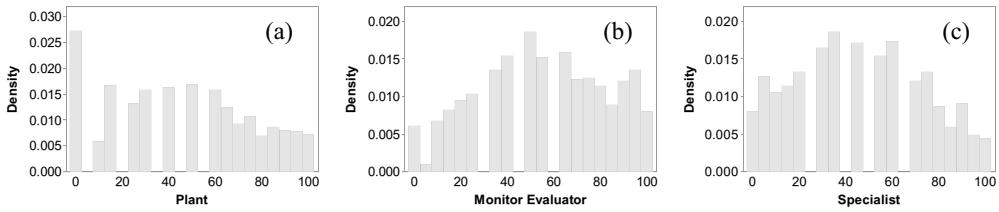
Figure 2. Belbin team role percentile probability density distribution histograms of the thinking orientated team roles. (a) Plant, (b) Monitor Evaluator, (c) Specialist for all students in the study.
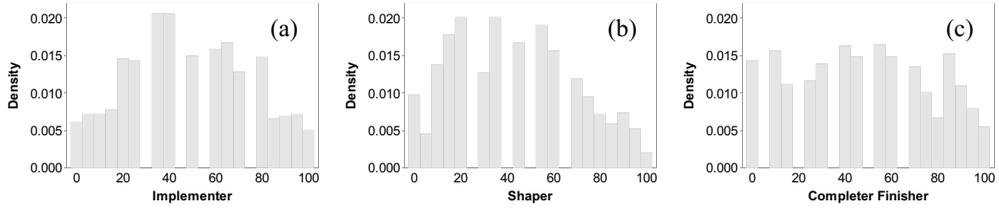
Figure 3. Belbin team role percentile probability density distribution histograms of the action orientated team roles. (a) Implementer, (b) Shaper, (c) Completer-Finisher for all students in the study.
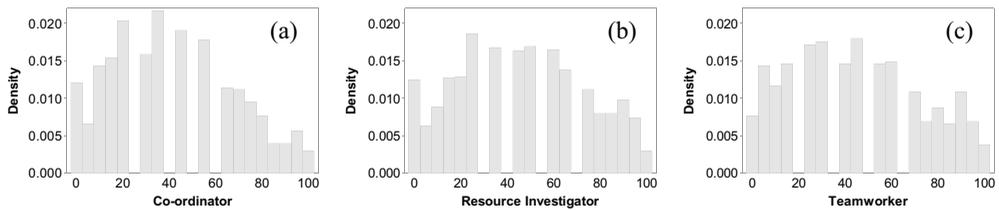
Figure 4. Belbin team role percentile probability density distribution histograms of the people orientated team roles. (a) Co-ordinator, (b) Resource Investigator, (c) Teamworker for all students in the study.

which, based on the number of participants, is considered a function of the BTRSPI questionnaire and algorithm. Overall, the individual team role histograms appear to demonstrate a relatively normal distribution, with a degree of positive or negative skew observed, which is reflected in Figure 5. Nonetheless, it is the Plant role that deviates from this description due to the significant number of zero percentile scores.

Key statistical data for each team role is provided in Table 3, specifically the mean percentile score, when considering all percentile scores, and the primary team role and zero percentile score results across all the nine team roles. Analysing the primary team role and zero percentile score roles helps to indicate where there is a particular prevalence or lack in a team role in absolute terms, that may not be otherwise identified through taking the central tendency of all percentile scores. Across the whole study, the Monitor Evaluator role was the most prominent primary team role across all students (17.0%), with the Plant role ranked second (14.7%) and Completer-Finisher third (14.0%). The least prevalent primary roles were Co-ordinator (7.0%), Shaper (9.0%) and Specialist (9.1%).
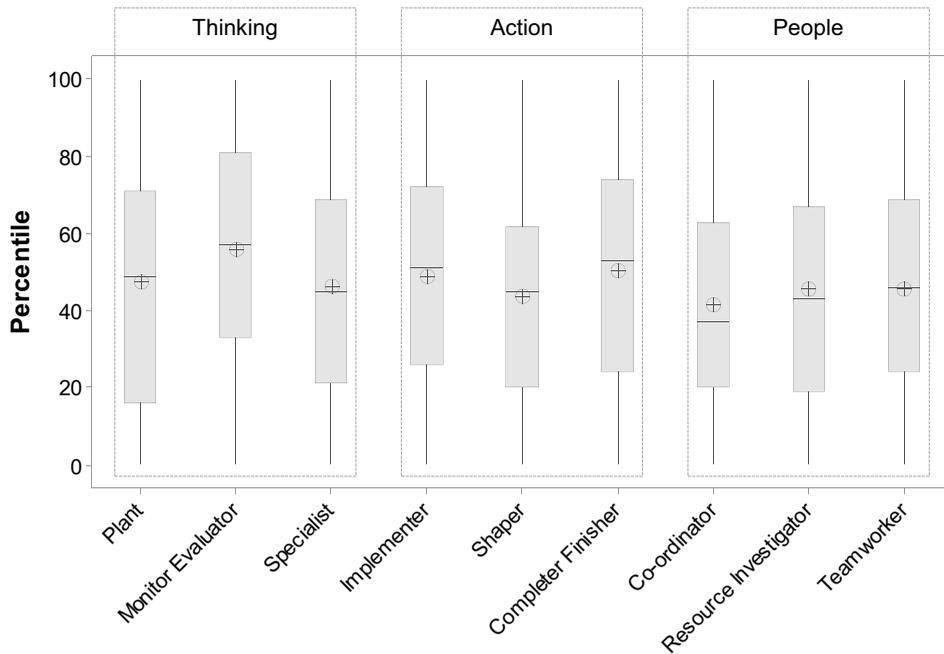
Figure 5. Box plot of Belbin team role percentile score results for all students.

Table 3. Statistical data of the nine team roles across all students.

Team Role	Mean	Primary role (N)	Primary role (%)	Zero score (N)	Zero score (%)
Plant	47.1	139	14.7	129	13.7
Monitor Evaluator	55.7	160	17.0	29	3.1
Specialist	46.0	86	9.1	38	4.0
Implementer	48.5	98	10.4	29	3.1
Shaper	43.6	85	9.0	46	4.9
Completer Finisher	50.0	132	14.0	68	7.2
Co-ordinator	41.5	66	7.0	57	6.0
Resource Investigator	45.5	106	11.2	59	6.3
Team worker	45.3	98	10.4	36	3.8
$n = 943$					

When considering zero percentile score, typically each role had a zero score from 3% to 7% of students, however, the Plant role significantly stood out from this, at 13.7%.

A Spearman correlation analysis across all percentile scores for each team role was carried out, with the results presented in Table 4. Overall, it revealed no significant correlations between team roles, with the magnitude of all r_s values < 0.400. There is evidence of negative correlations with r_s between −0.300 and −0.400, although these would be considered rather weak (Akoglu 2018). These were a negative correlation between Completer-Finisher and Resource Investigator ($r_s = -0.316$, $p < 0.001$) and between Monitor Evaluator and Resource Investigator ($r_s = -0.308$, $p < 0.001$), which means the higher a students Completer-Finisher or Monitor Evaluator team role score is, the lower their Resource Investigator score.

Table 4. Spearman correlations between team roles (above diagonal) and corresponding *p*-values (below diagonal), based on all percentile scores.

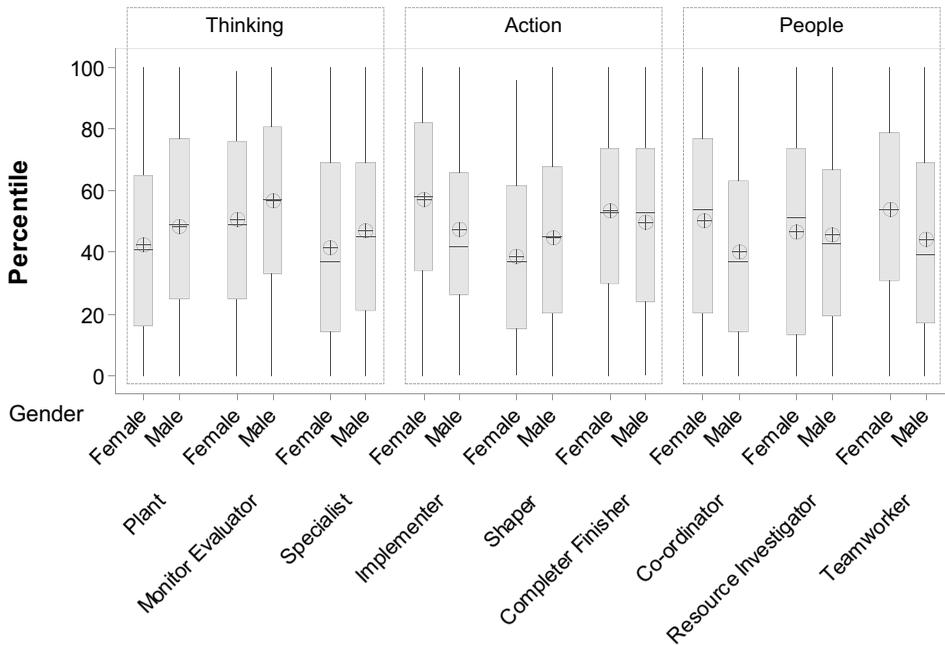|	Plant	Monitor Evaluator	Specialist	Implementer	Shaper	Completer Finisher	Co-ordinator	Resource Investigator	Team worker
Plant		−0.159	−0.021	−0.271	−0.059	−0.197	−0.142	0.148	−0.209
Monitor Evaluator	0.000**		−0.059	−0.009	−0.076	0.126	−0.147	−0.316	−0.179
Specialist	0.516	0.068		−0.191	−0.162	−0.041	−0.185	−0.084	−0.094
Implementer	0.000**	0.793	0.000**		0.077	0.129	−0.047	−0.274	−0.092
Shaper	0.070	0.019*	0.000**	0.018*		−0.032	−0.040	−0.096	−0.287
Completer-Finisher	0.000**	0.000**	0.204	0.000**	0.333		−0.172	−0.308	−0.128
Co-Ordinator	0.000**	0.000**	0.000**	0.153	0.225	0.000**		0.065	0.161
Resource Investigator	0.000**	0.000**	0.010*	0.000**	0.003*	0.000**	0.045*		0.041
Team worker	0.000**	0.000**	0.004*	0.005*	0.000**	0.000**	0.000**	0.208	

*p < 0.05.
**p < 0.001.

Figure 6. Box plot of Belbin team role percentile score results for female and male students.

Table 5. Statistical data of the nine team roles, according to female and male responses.

Team Role	Primary Team Role			
	Female (N)	Female (%)	Male (N)	Male (%)
Plant	14	10.1	125	15.5
Monitor Evaluator	17	12.2	143	17.8
Specialist	5	3.6	81	10.1
Implementer	23	16.5	75	9.3
Shaper	8	5.8	77	9.6
Completer Finisher	19	13.7	113	14.1
Co-ordinator	15	10.8	51	6.3
Resource Investigator	17	12.2	89	11.1
Team worker	25	18.0	73	9.1

$n = 139$ (Female)
$n = 804$ (Male).

A boxplot of the all percentile scores across the nine team roles, compared by gender, is shown in Figure 6, with primary team role data provided in Table 5. Clear differences are observed in this comparison, which correlates with previous studies on this topic (Anderson and Sleap 2004). Female students show a higher mean percentile score, and primary role prevalence in all people-orientated roles and male students a higher mean percentile score, and primary role prevalence across all thinking orientated roles. For people-oriented roles, the primary role for female students was shown to be 10.8%, 12.2%

Table 6. Primary role data of the nine team roles over the six academic years.

Team Role	18–19		19–20		20–21		21–22		22–23		23–24	
	N	%	N	%	N	%	N	%	N	%	N	%
Plant	15	12.3	17	12.3	39	16.9	24	13.3	23	15.3	21	17.2
Monitor Evaluator	16	13.1	16	11.6	38	16.5	37	20.6	29	19.3	24	19.7
Specialist	9	7.4	8	5.8	22	9.5	19	10.6	15	10.0	13	10.7
Implementer	13	10.7	12	8.7	21	9.1	24	13.3	14	9.3	14	11.5
Shaper	10	8.2	15	10.9	21	9.1	9	5.0	17	11.3	13	10.7
Completer Finisher	23	18.9	27	19.6	31	13.4	16	8.9	14	9.3	21	17.2
Co-ordinator	8	6.6	11	8.0	12	5.2	19	10.6	7	4.7	9	7.4
Resource Investigator	13	10.7	16	11.6	27	11.7	22	12.2	21	14.0	7	5.7
Team worker	17	13.9	19	13.8	23	10.0	17	9.4	16	10.7	6	4.9

and 18.0% for the Co-ordinator, Resource Investigator and Team worker roles, respectively, compared to 6.3%, 11.1% and 9.1% for male students. Whereas, for thinking-oriented roles, the primary role for female students was shown to be 10.1%, 12.2% and 3.6% for the Plant, Monitor Evaluator and Specialist roles, respectively, compared to 15.5%, 17.8% and 10.1% for male students. For action-orientated roles there is more balance between female and male students, with near parity for Completer-Finisher (Primary role percentage; Female – 13.7% vs. Male – 14.1%), an increase in primary role prevalence for female students for the Implementer role (Female – 16.5% vs. Male – 9.3%), and an increase in primary role prevalence for male students for the Shaper role (Female – 5.8% vs. Male – 9.6%).

A boxplot of the nine team roles, compared by academic year, is presented in Figure 7, split into three parts, with thinking-orientated roles in Figure 7(a), action-orientated roles in Figure 7(b), and people-orientated roles in Figure 7(c). Primary team role data is then provided in Table 6. While the box plots provide an overview of the data distribution for all team roles across each of the years, they are not particularly easy to interpret overall trends from, and tend to show relative consistency. Analysing the percentage difference from the averages for each team role over the years in terms of the mean, median and upper and lower quartile values shows almost all being within 10% of the average. The most significant exception to this where all statistical values deviated from the averages by greater than 10% was the Team Worker role in 2023–2024. When considering the primary role preference results for the individual years, it follows the trend from the overall results, with Monitor Evaluator, Plant and Completer-Finisher team roles most prominent and Co-ordinator, Shaper and Specialist roles less so. Nonetheless, there are a number of cases where there is significant deviation from the overall results. Examples include the large increase in Co-ordinator in 2021–2022 and a large drop in Team worker role in 2023–2024. A spider diagram in presented in Figure 8 to help visualise these changes.

In addition, it is noted that this volatility in the results appears to start from 2020–2021 onwards (i.e. following the COVID-19 pandemic). From 2018–2019 to 2019–2020, the change in primary role percentages were all less than 2%, expect Shaper, which increased 2.7% (8.2 to 10.9%). However, beyond this, shifts in excess of 5% for primary team role preferences are regularly observed for individual roles between years, with the largest changes occurring between 2022–2023 and 2023–2024, specifically for the Resource Investigator (8.3% decrease) and Completer-Finisher (7.9% increase) team roles.
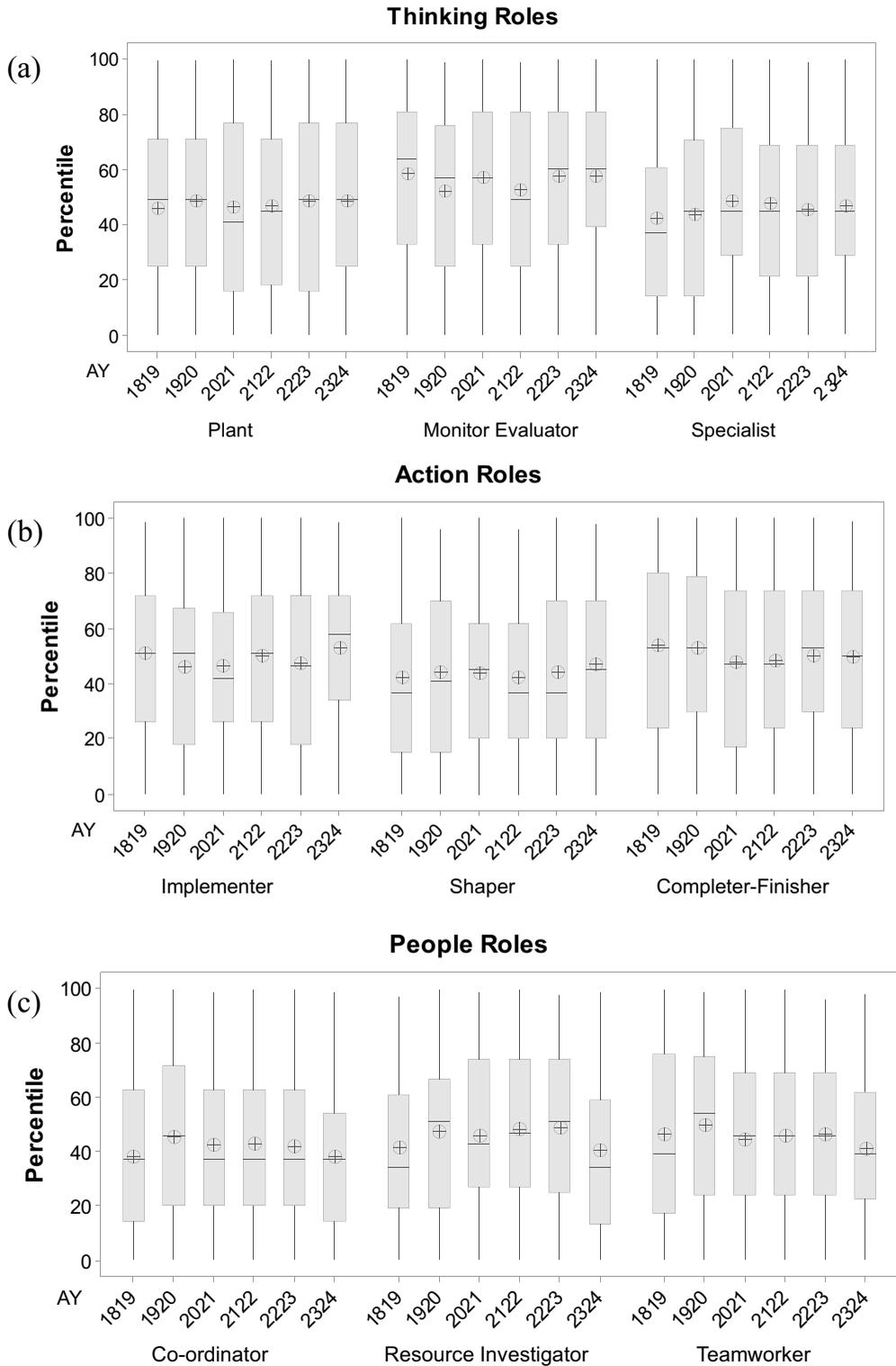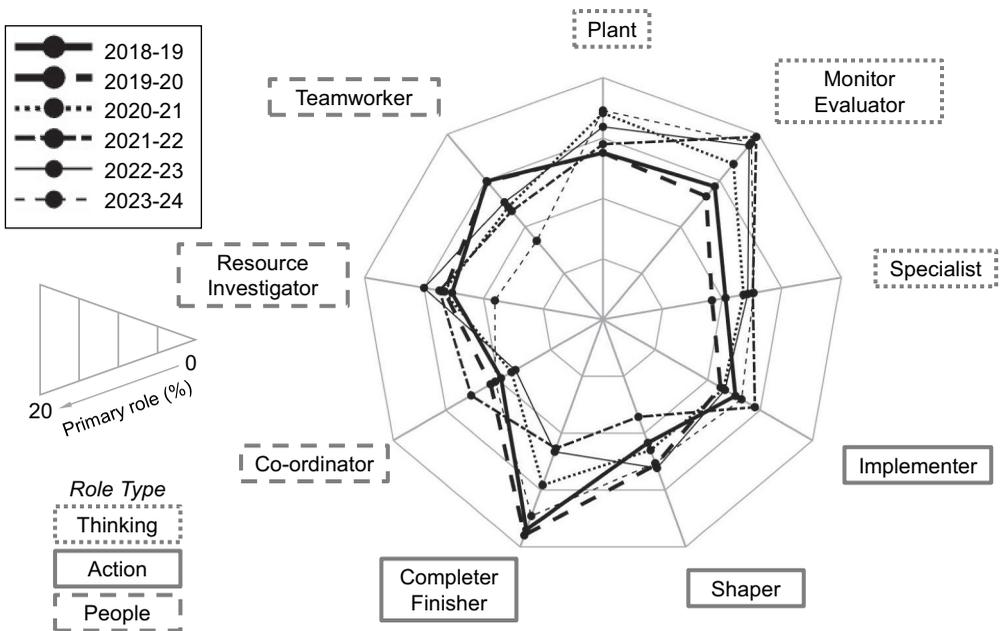
Figure 7. Box plot of Belbin team role percentile score results across six year period: (a) thinking roles, (b) action roles, (c) people roles.

Figure 8. Spider diagram of perceived Belbin primary team roles ranked over time.

4. Discussion

This study shows that Monitor Evaluator was the prominent self-perceived primary team role amongst aerospace engineering students at the University, meaning that they consider themselves to be critical thinkers in nature. This is closely followed by the Plant and Completer-Finisher teams roles, indicating creativity and detail focus. Conversely, the Co-ordinator role is identified as the least preferred primary role, indicating a potential lacking organisation and leadership qualities. Nonetheless, these findings are significantly influenced by gender, as analysis by gender shows clear differences, with females aligned to the People roles (Co-ordinator, Resource Investigator, Team worker) and males aligned to the Thinking roles (Plant, Monitor Evaluator, Specialist). This has been supported in previous studies (Anderson and Sleap 2004) and also that the percentage of females in a group appear to be highly predictive for teamwork quality and group cognitive complexity (Meslec and Lucian Curşeu 2015). Nonetheless, there are several roles that show less prominence across both females and males, specifically Shaper and Specialist, the practical implications of which will be discussed.

When analysing the trends across the six academic years, there are two team roles that appear to show a shift from the 2020–2021 onwards, which is the first set of BTRSPI results following the COVID-19 pandemic and the overall move towards online and asynchronous type learning (Agostinelli et al. 2022; Pokhrel and Chhetri 2021). Firstly, the Specialist team role, which saw an increase in primary role prominence (9.5%) in 2020–2021, up from 7.4% and 5.8% in 2018–2019 and 2019–2020, respectively. This increase is then maintained, with 10–11% of the students identifying Specialist as their primary role for the subsequent years. While the Specialist role is still somewhat low relative to other team

roles it does demonstrate a change from the 2020–2021 year, which could be attributed to the COVID-19 pandemic in that online and individual working led to tasks being assigned to individuals rather than groups as a whole (Wildman et al. 2021), thus leading to the perception of more in-depth knowledge of specific topics.

Secondly, the primary role preference of the Team Worker role was almost 14% in the two years prior to COVID-19, after which the percentage dropped to 10.0%, 9.4%, 10.7%, and 4.9% in the following years. This drop in primary role alignment to the Team Worker role through this period has been corroborated in other studies (Divle, Ertac, and Gumren 2024), which have similarly concluded that there is evidence that increasing the salience of COVID-19 leads individuals to shy away from interactive work environments and a low willingness to engage in teamwork overall. While the results presented suggest differences in self-perceived team roles throughout the years, it is important to note that studies have shown that, throughout this time frame, there has been no apparent variation in how students understand and recognise the most frequently used categories and responsibilities related to effective teamwork (Fidalgo-Blanco et al. 2023), and can identify, assign, and execute shared leadership responsibilities during the development of teamwork.

4.1. Practical implications

These findings contribute to an increased understanding of how aerospace engineering students perceive themselves in relation to their Belbin team roles and associated characteristics, and how this is related to gender and how they appear to alter over a six year period. There are several potential implications for those in engineering education, in terms of teaching and learning strategies and curriculum design. These could be strategies that help to elucidate the perceived lesser preferred team roles (Co-ordinator, Shaper, Specialist) in students or towards ensuring effective and agile teams and groups in engineering settings.

The authors consider two key teaching strategies with the aim of improving the Co-ordinator team role in engineering students, specifically rotating leadership during team-based projects and embedding reflective practices. Through systematically rotating leadership in a given project, all students have the opportunity to manage tasks, mediate any arising conflicts, and align the team towards it goal, promoting inclusive leadership practice (Oakley et al. 2004). Coupled with this, including a level of reflection, encourages students to critically evaluate their effectiveness during their leadership (Angliss 2024), improving their self-awareness and understanding in a leadership position that is aligned with the characteristics with the Co-ordinator team role.

To enhance the Shaper role among engineering students, a team role that is typically characterised by drive and challenge, the incorporation of time-bound projects that simulate real-world engineering constraints could be considered (Kolodner et al. 2003). Such projects encourage students to take the initiative, and i has been demonstrated that such environments promote assertive communication and proactive problem-solving among software engineering students (Berrezueta-Guzman et al. 2025). Furthermore, implementing peer evaluation systems that assess individual contributions to team progress and performance can reinforce accountability and enable students to refine their ability to influence group dynamics.

The Specialist team role, defined by deep technical expertise, is not as obvious in nature to try and develop amongst students since this can often come from years of experience and professional practice. Nonetheless, there are teaching strategies that could increase alignment to the role, such as those which assign technical ownership within team environments, e.g. the 'aerodynamics expert' in the case of aerospace design projects, which promotes expertise development or industrial placements which encourages a student to develop individual expertise in a specific industrial setting. The effectiveness of such approaches in computational fluid mechanics education has been demonstrated (Pinto and Zvacek 2022). The strategies outlined above could provide input to frameworks for engineering educators that may want to intentionally develop particular Belbin team roles, within their engineering curriculum. All the while considering that the overall aim is to prepare engineering students for the diverse demands of professional engineering careers where team and project work are often crucial aspects (Buch and Andersen 2015; Petre 2004).

4.2. Strengths and limitations

An important strength of this research includes the large sample size ($n = 943$), and that data was consistently collected from a large group of aerospace engineering students over a six-year period, increasing the generalisability and trustworthiness of the results. Furthermore, this research provides valuable information on aerospace engineering self-perceived Belbin team roles, which could be used to produce new research questions or form hypotheses on cause-and-effect relationship. Nevertheless, several limitations in this research are noted.

Firstly, this study had a cross-sectional design, which might be prone to cohort effects, which in this instance could include the incoming grade entry level to the aerospace engineering course, whether students have taken a foundation year the previous year, or are perhaps resitting the year. Likewise, factors including social background, age, previous experiences, etc., are included. Nonetheless, the results have remained consistent over six consecutive years, indicating limited cohort bias.

Secondly, the BTRSPI is an online questionnaire and self-rapportage is known to be prone to social desirability bias (Aritzeta, Swailes, and Senior 2007), and studies have revealed discrepancies between self-perceptions and observer ratings, indicating that individuals might not accurately assess their own team roles (Aritzeta, Senior, and Swailes 2005; Broucek and Randell 1996). While observer assessments were encouraged throughout, the low response rate means they have not been considered in this study. As such, further research is necessary to determine whether these findings can be applied and generalised to multidisciplinary engineering, specifically aerospace teams.

The authors recognise that it would be beneficial to retest students in their final year of study to explore the influence of their education experience on perceived Belbin team roles. Likewise, these results could have been combined and assimilated into the forming of more coherent, balanced project groups. This would need consideration alongside other factors, such as learning adjustments, disability and policy around relevant University regulations and accreditation. However, due to resource constraints, these were deemed beyond the scope of this work. In addition, the roles described could be considered partially outdated or incomplete with regard to advanced technologies, specifically artificial intelligence, which has been shown to have an increasing influence on team dynamics and behaviours (Georgara et al. 2025; Siemon 2022).

5. Conclusion

This multi-year study offers analysis of the perceived Belbin team roles of aerospace engineering students entering a specific UK HE institution over the academic years 2018/19–2023/24. The study reveals both patterns consistent with other, similar, studies in the literature and emerging trends which it is argued are influenced by social factors and external events including the COVID-19 pandemic. The COVID-19 pandemic, and it inevitable lean towards asynchronous, individualistic learning led to a statistically significant shift in Belbin role preferences towards roles such as Specialist. This study also revealed a significant difference in perceived team roles between females and males, with females tending towards the more people-focused roles (team working, resource investigator, co-ordinator) and males tending towards the thinking roles (plant, monitor evaluator, specialist). Understanding these trends should help educators tailor curricula and team-based learning strategies to better prepare students for the diverse demands of engineering education and engineering careers.

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