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Common practices of psychological selection of aviation personnel in Europe

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Abstract

Introduction. The EAAP Working Group on Psychological Selection has issued a report on best practices in the selection of aviation personnel in 2022. All EAAP members and partners who are currently involved in selection work were invited to give their inputs via an online survey distributed in 2020. **Research question.** The purpose of this survey was to investigate the current practices in selection of aviation personnel primarily in Europe. **Method.** A total of N=83 participants responded to this survey, which equals a response rate of 16 to 20%. **Results.** The results will be presented in two ways: Firstly, it will be shown how selection procedures are organized in general with commonly used selection methods and immersive technologies also presented. Secondly, comparative frequency charts of different selection criteria will be shown for civilian pilots, military pilots, ATCOs and cabin crews. **Discussion.** The findings are discussed with reference to previous industry surveys to infer the current state of scientific rigour in aviation selection. **Conclusion.** Opportunities for growth and potential shortcomings will be discussed.

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Keywords: selection; pilots, air traffic controllers; ATCOs; cabin crew; air crew

1. Introduction

In 2019, the European Association for Aviation Psychology (EAAP) formed the Working Group on Psychological Selection. The working group decided on the creation of a report on the topic of aviation selection and

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to survey EAAP members on how they were carrying out selection of aviation personnel (Eaglestone, Damos, Hörmann, Stadler & Wium, 2022).

The main intention of the EAAP survey was to compile the current selection practices of EAAP-affiliated practitioners working for airlines, air navigation service providers (ANSP) and other aviation organisations. Questions were asked about selection methods, instruments and other procedural aspects related to selection (e.g. decision making, norms, cut-off). The survey did not ask questions on number of applicants, vacancies, selection ratio, pass/fail rates or other similar metrics as the intent was to capture how selection was carried out (in particular for different operational groups in aviation such as pilots, air traffic controllers and cabin crew) rather than organisational specifics.

Two previous studies with a comparable survey could be located in the literature, one by the International Air Transport Association (IATA) for civilian pilots and one by EUROCONTROL for ab-initio air-traffic control trainees. IATA distributed an online survey in 2009 to 327 aircraft operators from around the world. Altogether 91 questions were asked, partly about the organisational and financial aspects of their selection process. The last part of the survey focused on the structure and contents of the pilot selection methods themselves. Only 66 of the 327 addressed organizations (20.2%) completed the survey, in whole or partially. Detailed information about the contents and conditions of the selection procedure was shared by less than 10%. It was identified that most pilot selection systems lacked a conceptual basis. Especially, selection systems for experienced first officers and captains seemed to be less sophisticated, while ab-initio systems appeared more mature. Only about 42% to 50% of the selection criteria were based on scientific analyses of job requirements. Further weaknesses reported by the organisations were (a) lacking qualification requirements for the test-operators, (b) a low “degree of automation”, and (c) the time-consuming efforts involved. The strengths were seen in the high reliability and quality of the evaluation procedure. The most prevalent instruments at all levels of experience were questionnaires and semi-standardized interviews. In addition, at the ab-initio level computer-based psychometric tests of mental abilities and personality and for licensed pilots full-flight simulator checks were administered. Two-thirds of respondents preferred at least a two-step selection process. In 70% of the cases, candidates received information about the selection procedure in advance. Re-applications were possible in 60% of the organisations. Only half of the organisations involved psychologists in the selection process. Despite the limited response rate, IATA based its published guidance material and best practices manual for pilot aptitude testing on results from this survey (IATA, 2012, 2019).

Information on selection tools and methods for ab-initio trainee controller selection was gathered in 1996 by EUROCONTROL’s Selection Task Force (STF). The intention was to get an overview and detailed information on available or emerging tools and methods. A total of 63 institutions in 52 different nations were approached and 34 (53.9%) returned the information (EUROCONTROL, 1997, 2001).

A second wave of data collection was done between November 1999 and May 2000 as part of the development of the First European ATCO Selection Test package (FEAST). 51 providers received the survey in 35 nations and 44 (86.3%) returned the required information.

Notable figures from EUROCONTROL’s surveys were that at least 83% used interviews as part of their selection process, with 52% using biographical interviews, 16% using situational interviews and 32% using mixed type of interviews. The interviews could be intended to measure general motivation (88%), specific job-oriented motivation (83%), personality (75%), communication skills (71%), teamwork skills (63%), biographical elements (63%), punctuality (50%) or stress resistance (46%) (EUROCONTROL, 2001).

A slightly higher percentage stated they used ability tests in their selection. Organisations using ability tests used them to measure: multi-tasking (76%), logical reasoning (73%), memory capacity (70%), spatial orientation (70%), mental arithmetic ability (70%), verbal English ability (67%) or written English ability (53%). While the attributes assessed therein are not mentioned, 30% of organisations used some form of assessment centers in their selection (EUROCONTROL, 2000).

Re-applications were possible in 25% of cases (EUROCONTROL, 2001) and 23% of respondents said they use mostly or exclusively paper-and-pencil testing, with 33% stating that they had moved to using mostly or exclusively computer-based testing (EUROCONTROL, 2000).

As previously stated, the intent of the EAAP survey was to determine how EAAP-affiliated professionals were selecting for different aviation roles. While the answers provide a useful indicator of distribution and frequencies, where possible we have tried to compare the results from the survey with comparable data (i.e the IATA and

EUROCONTROL surveys). On that basis, the state of professional rigour in aviation selection can be inferred, developments can be estimated and current weaknesses and opportunities for advancement and growth determined.

2. Method

2.1. Procedure

In April 2020, the EAAP Working Group for Selection in Aviation distributed an online survey to all EAAP members and some EAAP partners (N = 508) to share the expertise in selection of operational staff in aviation. The survey was open for two months.

2.2. Sample

A total of N = 83 participants responded to this survey. Since several of the email addresses on the distribution list were outdated, the invitation mail was bounced back and did not reach the recipients. Therefore, an estimate of the actual response rate is approximately between 16.3% and 20%. Respondents were 45% female and 53% male with an average of 17 years' experience in selection of aviation personnel. A description of sample characteristics is shown in Table 1.

Table 1: EAAP-Survey 2020 - Sample characteristics

Characteristic	Value	Frequency
Total sample	N	100%
Gender	Female	45%
	Male	53%
	Undisclosed	3%
Geographic region	Europe	87%
	non-European	12%
Occupational background/Specialized field	Aviation Psychologist	73%
	Human Factors Specialist	14%
	ATCO	1%
	Pilot	8%
	Other	2%
Selecting primarily	Civilian fixed wing pilots	52%
	Military fixed wing pilots	13%
	Civilian helicopter pilots	5%
	Civilian ATCOs	16%
	Military ATCOs	2%
	Cabin crewmembers	6%
	Others	6%

2.3. Survey

The survey intended to capture the pre-COVID conditions with altogether 27 questions. Six questions were related to demographics and the present work environment. Twenty-one questions addressed the measured selection criteria, the used selection instruments and test technologies, the data processing and decision-making aspects. In most instances a multiple-choice answer format was chosen with the opportunity to add explanatory comments.

3. Results

In order to compare the main selection criteria for the different positions, helicopter pilots were left out because of the low number of answers. Military and civilian ATCOs were categorized into one group. This led to a comparative analysis of four groups: 43 civilian pilots, 11 military pilots, 15 ATCOs, and 5 cabin crew. The compared selection criteria were grouped into Knowledge, Skills (technical and interactive), Abilities, and Others (personality, interests, attitudes). Results are shown in Figure 1 to Figure 3 below. Because the unequal group sizes statistical significance testing was not conducted.

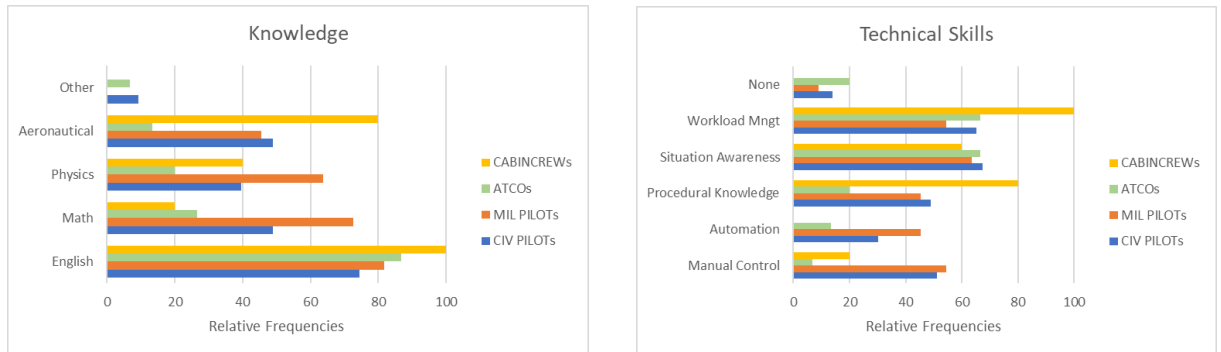


Figure 1. Relative frequencies of knowledge related selection criteria (left) and of technical skills related selection criteria (right)

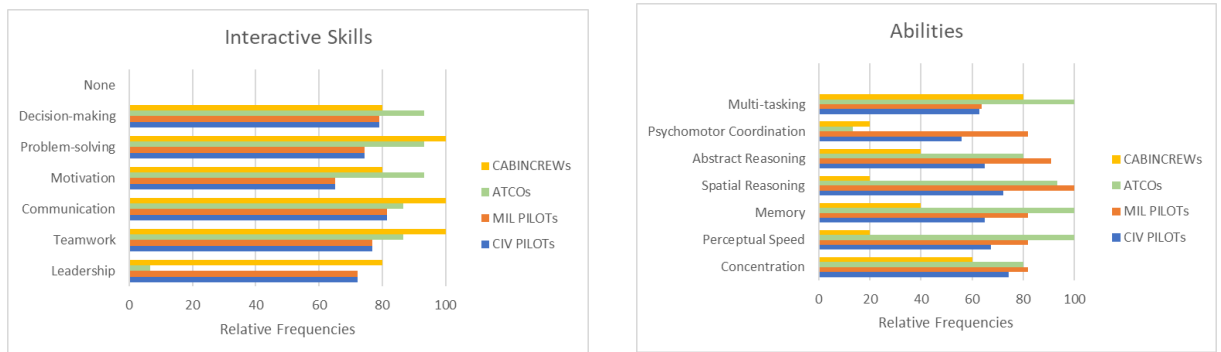


Figure 2. Relative frequencies of interactive skills related selection criteria (left) and of ability related selection criteria (right)

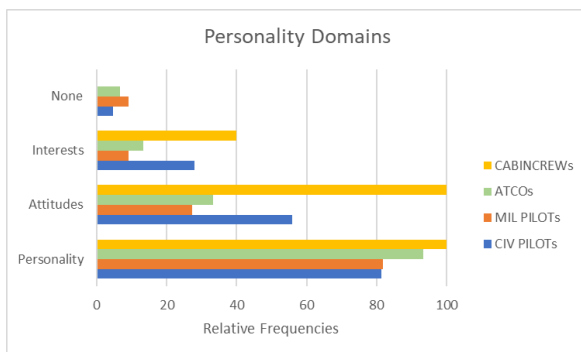


Figure 3. Relative frequencies of personality related selection criteria

According to these figures, the top-rated attributes included by over 80% of the respondents in the respective selection procedures for the different positions are as follows:

- Cabin crews: English knowledge, workload management, communication, teamwork, problem-solving, personality, attitudes.
- ATCOs: Perceptual speed, memory, spatial reasoning, multi-tasking, English knowledge, teamwork, communication, motivation, problem solving, decision making, personality.
- Military pilots: Concentration, perceptual speed, memory, spatial reasoning, abstract reasoning, psychomotor coordination, English knowledge, motivation, personality.
- Civilian pilots: Communication, personality.

Assessments of abilities, interpersonal skills, and personality appear to be more common in selection of aviation personnel compared to assessments of knowledge (except for English) or technical skills. This is probably due to the fact that especially ATCOs and military pilots are usually selected at the ab-initio level where technical skills and job-specific knowledge are not required. They are subject to the subsequent job training.

Table 2. Summary of administered selection instruments

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Psychometric tests				
Computerized ability tests	100%	67%	82%	40%
Pen and Paper ability tests	20%	33%	9%	40%
No ability tests	0%	9%	18%	40%
Computerized personality tests	87%	60%	44%	0%
Pen and Paper personality tests	27%	21%	27%	20%
No personality tests	7%	14%	18%	80%
Situational judgement test	7%	23%	10%	20%
Interpersonal exercises				
Group exercises	67%	49%	64%	100%
Role plays	33%	33%	9%	100%
Work samples and simulations				
Manual control task	7%	23%	36%	0%
Full-flight simulator	0%	21%	18%	0%
Fixed-based simulator	0%	28%	27%	0%
ATC radar simulator	27%	2%	0%	0%
ATC tower simulator	7%	2%	0%	0%
Low fidelity job sample	40%	5%	9%	0%
Interview techniques				
General interview	67%	47%	18%	80%
Psychological interview	80%	70%	82%	80%
Mental health screening	47%	37%	55%	20%

ATCOs and military pilots compared to civilian pilots and cabin crews. Interpersonal exercises are used in all groups at a percentage of 49% or higher. These instruments are especially typical for selecting cabin crews. Simulations and work samples are used in less than half of the cases.

The rate of agreement for the civilian pilots was the lowest. Only communication and personality were included in most pilot selection procedures. A reason for this disagreement is probably that our survey did not allow a clear distinction between selection systems for ab-initio and experienced pilots. If we lower the threshold from 80% to 70% agreement then the most prominent attributes were concentration, spatial reasoning, English knowledge, leadership, teamwork, communication, problem solving, decision making, and personality.

Table 2 compares the selection methods used to measure the different selection criteria for the four operational groups. The percentages of using computerized classroom tests are higher for selecting

Table 3. Use of immersive technologies for selection

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Immersive techniques applied				
Virtual reality	7%	19%	18%	0%
Augmented reality	0%	9%	9%	0%
Gamification	47%	12%	27%	20%
None	53%	53%	55%	80%
Intentions to use immersive techniques in future				
Virtual reality	20%	12%	0%	20%
Augmented reality	20%	12%	0%	20%
Gamification	13%	9%	9%	20%
None	53%	60%	82%	40%

Table 3 presents the results of immersive technologies used in selection as well as intentions to use them in future. Less than half of the respondents reported that they are using some kind of immersive techniques. Also, the intentions for their future usage are rather low ($\leq 20\%$).

Length of selection procedures: Respondents were asked how many rounds or stages were in their selection procedure. The specific number of rounds, or stages, in a selection process ranged from 1 to 10 (with an average of 3.4) with 3 rounds being the most frequent answer.

Time taken to assess a successful applicant (i.e. one who is eventually selected for the role) ranged between 2 – 48 hours (average 12.7 hours) with some difference between whether the selection was for civilian pilots (12.2), military pilots (12.3), ATCOs (15) or cabin crew (13.5)

Re-testing: 43.9% of respondents stated that they allow candidate re-testing. Of those, 19.4% allows a re-testing within 1 month, 8.3% within 4 – 6 months, and 72.2% after more than 6 months. For specific organisational groups, 53.3% answered that they allowed re-testing for ATCO candidates, 41.9% for civilian pilots, 36.4% for military pilots and 0% for cabin crew.

Validation and norms: 80.4% of respondents stated that they had conducted an in-house validation on a selection instrument or battery (93.3% for ATCOs, 67.4% for civilian pilots, 81.8% for military pilots and 40% for cabin crew).

Respondents were asked what norm group they used for assessments, both for personality and ability tests. Options provided were occupation specific in-house norms, occupation specific assessment provider or general population norms.

For personality testing, 59.8% use in-house occupation specific norms, 40.2% use assessment provider norms, 28% use general population norms. For ability testing 65.4% use in-house occupation specific norms, 40.7% use assessment provider norms, 19.8% use general population norms. A breakdown by occupational group is provided in Table 4.

Table 4. Summary of norm group use by occupational group.

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Personality tests				
In-house occupational specific	66.6%	41.8%	80%	40%
Assessment provider occupation specific	40%	44.2%	0%	0%
General population norms	40%	23.2%	20%	20%
Ability tests				
In-house occupational specific	53.3%	55.8%	70%	80%
Assessment provider occupation specific	66.6%	37.2%	10%	80%
General population norms	20%	16.3%	20%	40%

Decision making: 71.1% say they use some form of psychometric cut-off scores when using psychometric tools. 17.2% base their cut-offs on applicants' numbers and available vacancies, 45.6% base it on their own validation research and expectancy of success, 33.3% base cut-offs on score distribution and 34.5% use test provider advice for cut-off scores. Table 5 gives a summary of cut-off score use by occupational group.

Table 5: Summary of use of cut-off scores by occupational group.

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Cut-off Scores				
Based on number of applicants	6.7%	18.6%	10%	40%
Based on expectancy of success	60%	34.9%	50%	20%
Based on score distribution	26.7%	25.6%	30%	40%
Based of assessment provider advice	40%	32.6%	20%	20%

54.3% respondents state they used composite scores (i.e. an algorithm that yields a total score based on behavioural competency weights or weighted aptitude test scores as some competencies or aptitude tests are more predictive than others) for their selection. Use of composite scores by occupational group was 86.7% for ATCOs, 41.9% for civilian pilots, 50% for military pilots and 60% for cabin crew.

When it comes to the final decision, 24.1% answered that they use algorithmic data integration in their decision making (i.e. test scores and other selection data are statistically combined and integrated for a final selection decision). 75.1% state they use expert data integration (i.e. that test scores and other selection data are combined and integrated based on human judgement for a final selection decision). A breakdown by occupational group is found in Table 6.

Table 6. Integration of selection data.

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Integration of selection data				
Algorithmic data integration	20%	22.5%	33.3%	40%
Expert data integration	80%	77.5%	66.7%	60%

60.8% state that they use compensatory decision making by adding different results in an overall selection/assessment score. 39.2% state they use “hurdling” where single but critical selection/assessment results are used as “knock out” hurdles in the assessment process. Breakdown by occupational group is provided in Table 7.

Table 7. Decision making in selection.

	ATCO	Civ Pilots	Mil Pilots	Cabin Crew
Selection decision making				
Compensatory decision making	80%	72.5%	56.6%	60%
“Hurdling”	20%	27.5%	44.4%	40%

Promotions: 45.8% say they use assessments for promotion. Assessments for promotion in 33.3% of ATCO cases and 48.4% of civilian pilot cases. Assessment for promotions was not used for military pilots or cabin crew (0%).

4. Discussion

According to our findings the most relevant selection criteria in aviation across the four analysed jobs are interactive skills (an average of 78% across the different roles), cognitive abilities (73%), and personality (87%). Less frequently measured attributes are technical skills (49%) and knowledge (52%; except for English with 80%). It could be expected that the importance of technical skills and (job-related) knowledge increases if candidates already had job experience at the time of selection. In our case, especially ATCOs and military pilots are primarily selected at the ab-initio level where job-specific experience is not a requirement.

Correspondingly, the most widespread instruments are (computerized) cognitive ability tests, personality tests, and interviews. Interpersonal exercises seem to be on a rise. They had not been identified to a large extent in the IATA and EUROCONTROL surveys. Especially, the selection of cabin crews seems to be primarily based on interpersonal exercises and interviews. Also, the degree of computerization has increased. While EUROCONTROL (2000) reported only 33% usage of computerized ability testing, the figure is now 100% for ATCOs and between 67 and 82% for pilots.

The acceptance of re-applications has increased for ATCOs from 25% (EUROCONTROL, 2000) to 53% in our study. For pilots our figures are slightly lower (between 42% for civilian pilots and 36% for military pilots) than those found by IATA (60%).

A more surprising finding is the relatively rare usage for work samples and simulations. Only between 21% and 40% of the respondents reported using low fidelity job-samples or simulators as selection instruments for ATCOs and pilots. Since meta-studies have repeatedly identified these methods as showing the highest prognostic validities for job performance (Almamari & Traynor, 2019; Martinussen, Jenssen & Joner, 2000), it seems that here is some room for improvement. In this context the application of immersive selection technologies or gamification could enable further developments. At the time of the survey, only a few respondents reported intentions to make more use of such technologies in future. However, this might have been related to onset of the Covid pandemic at the time of our survey.

Indications of scientific rigour can be found in the usage of occupation specific norms (between 40% and 80% for personality and 53% to 80% for abilities) and the realisation of in-house validation studies (80%). However, in this context it should be highlighted that data integration is still based on expert judgement (60% to 80%) and less on algorithmic data integration (20% to 40%). Since meta-studies of mechanical versus clinical decision-making have repeatedly proven the superiority of the mechanical approach (e.g., Kuncel, Klieger, Connelly & Ones, 2013), further efforts to rethink the decision strategies when selecting aviation personnel could be advised.

5. Conclusion

The survey results revealed a broad range of how selection in aviation is structured and conducted. While some commonalities exist (e.g. the common usage of ability tests, interviews and personality testing), there are also stark differences between selection even within the same occupational group.

More worryingly perhaps, was the widespread use of methods not found in the research literature. This could either be methods that have never been adequately codified or described (e.g. mental health screening or psychological interviews) or methods that have not yet received systematic research supporting its use in aviation (e.g. SJT, group exercises or role-play), even though their use in other industries has been demonstrated. This could be viewed as an opportunity for practitioners in aviation selection. For example, as an economical instrument SJTs could fill the gap between general trait-based questionnaires and job specific exercises. Especially in the medical field, SJTs have proven incremental predictive validity above tests of knowledge and cognitive abilities (Webster, Patan, Crampton & Tiffin, 2020). That there are commonly used methods that have little or no published research data opens up the possibility for topical and relevant research and practitioners are urged to use the opportunity to analyze and publish their results.

Given the significant differences observed in the reported selection procedures, it will be important that EAAP speak with one voice when discussing or answering questions on aviation selection moving forward. The “Selection in Aviation: A European Association for Aviation Psychology Report” is the first step in that direction, from which quality standards and best practice recommendations can be derived (Eaglestone et al., 2022). As psychological assessment of aviation personnel recently became mandated by EASA (2019), EAAP may well become the arbiter of what counts as professional or unprofessional when it comes to aviation selection. Disagreements on technical nuances and specific issues in implementation could readily become something that the professional body of aviation psychology would be expected to weigh in on. A survey like this one is an important step to determine the level of professional rigour and where there are opportunities to grow and advance. This type of survey, done regularly, could also become a useful metric to observe how selection changes as time passes and whether quality is being maintained in the aviation system.

6. References

- AlMamari, K & Traynor, A. 2019. Multiple test batteries as predictors for pilot performance: A meta - analytic investigation. *International Journal of Selection and Assessment*. 27, 337 – 356.
- Eaglestone, J., Damos, D., Hörmann, H.-J., Stadler, K., & Wium, J. 2022. Selection in Aviation: A European Association for Aviation Psychology Report. European Association.
- EUROCONTROL 1997. Information on Available and Emerging Selection Tests and Methods for ab-initio Trainee Controllers (1st ed). Report of the European Air Traffic Control Harmonisation and Integration Programme HUM.ET.ST04.1000-REP-01. EUROCONTROL: Brussels.
- EUROCONTROL 2001. Information on Available and Emerging Selection Tests and Methods for ab initio Trainee Controllers (Revised) (2nd ed). Report of the European Air Traffic Management Programme HUM/MSP-002-GUI-01. EUROCONTROL: Brussels.
- EUROCONTROL 2000. Update of Information on Selection Tools and Methods for ab initio Trainee Controllers. Report of the European Air Traffic Management Programme HUM/MSP-002-REP-01. EUROCONTROL: Brussels.
- European Union Aviation Safety Agency 2019. Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Annex IV Commercial air transport operations [Part-CAT] of Commission Regulation (EU) 965/2012 on air operations.
- International Air Transport Association (IATA) 2019. Pilot aptitude testing - Guidance material and best practices (3rd ed). IATA: Montreal-Geneva.
- International Air Transport Association (IATA) 2012. Guidance material and best practices for pilot aptitude testing (2nd ed). IATA: Montreal-Geneva.
- Kuncel, N. R., Klieger, D. M., Connelly, B. S., & Ones, D. S. 2013. Mechanical versus clinical data combination in selection and admissions decisions: A meta-analysis. *Journal of Applied Psychology* 98.6, 1060–1072
- Martinussen, M., Jenssen, M., & Joner, A. 2000. Selection of air traffic controllers: Some preliminary findings from a meta-analysis of validation studies. 24th Conference of the European Association of Aviation Psychology, Crieff, Scotland.
- Webster, E.S., Paton, L.W., Crampton, P.E.S., & Tiffin, P.A. 2020. Situational judgement test validity for selection: A systematic review and meta-analysis. *Medical Education*, 54, 888-902.