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The impact of the COVID-19 pandemic on current tertiary aviation education and future careers: Students’ perspective

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1. Introduction

The COVID-19 pandemic has caused significant disruption around the world, particularly within the aviation industry (ICAO, 2020). While the aviation industry has been affected by similar crises in the past, the impacts of the COVID-19 pandemic have been unprecedented in their global reach and extended recovery period. For undergraduate students currently studying for a career in the aviation industry the COVID-19 pandemic has created impediments and challenges to their training opportunities and future careers (Matthews, 2020).

The aviation industry has always been susceptible to the threat of infectious diseases and pandemics (Tay et al., 2020). In recent times the outbreaks of Severe Acute Respiratory Syndrome (SARS) in 2003, Avian influenza H5N1 in 2006, Swine influenza H1N1 in 2009 and Middle East Respiratory Syndrome (MERS) in 2013 have all caused disruptions to the aviation industry (Chung, 2015; Tisdall and Zhang, 2020). Of these pandemics SARS has had the greatest impact causing reduction in Asia/Pacific airlines annual Revenue Passenger Kilometres (RPK) by 8% with a recovery period of 8 months (ICAO, 2020). However, by March 2020 the COVID-19 pandemic had already exceeded this with the International Air Transport Association (IATA) reporting a 54.7% reduction in RPKs globally compared to 2019 figures (ICAO, 2020). Furthermore, the recovery period has been much slower in comparison (ICAO, 2020). It is clear that permanent changes to aviation industry operations have occurred (Albers and Rundshagen, 2020) and as a result we should question skills potentially needed in the future.

Unfortunately, there appears to be a dearth of research regarding how previous pandemics have affected student skill set requirements and whether universities have responded to this with changes to the course content of tertiary aviation programs. This is potentially due to the comparatively short duration and regionalised nature of these past pandemics and the rapid recovery of the aviation industry. In comparison, the COVID-19 pandemic is unprecedented in its duration, global effects and long-term recovery forecast (ICAO, 2020). In the support of positive industry outcomes, tertiary institutions have a responsibility to ensure their course offerings remain abreast of current changes within industries (Fullingim, 2018). It is essential that universities provide students with the most up to date information and equip their graduates...
with the necessary skills to embark on a career in their chosen industry. The Tertiary Education Quality and Standards Agency (TEQSA) Act 2011 supports this with a key objective being to “encourage and promote a higher education system that is appropriate to meet Australia’s social and economic needs for a highly educated and skilled population” (Tertiary Education Quality and Standards Agency, 2011, p. 4). Considering the significant impact the COVID-19 pandemic has had on the aviation industry, universities offering undergraduate aviation degrees need to play a vital role in helping graduates manage the associated career shock and adapt their programs accordingly to better prepare graduates for the significant challenges of the changing industry.

The aim of this research is to examine the skills that students in current Australian undergraduate tertiary aviation programs consider to be beneficial in meeting their skill development and future career needs as a result of the impact of COVID-19 on the aviation industry. By developing an understanding of the skills students perceive to be necessary for their careers following the COVID-19 pandemic, comparisons can be drawn with industry perspectives to determine whether these viewpoints align and, more importantly, support student’s successful development of skills as sought by the industry (Uğur and Hamit Turan, 2019). The research seeks to answer the following research questions:

RQ1. What are the perceived impediments that are likely to impact on the career development of current Australian aviation tertiary students?

RQ2. What additional skill sets do Australian aviation tertiary students perceive to be valuable for future careers in the aviation industry?

RQ3. What study and employment planning strategies are current Australian aviation tertiary students contemplating post-graduation?

RQ4. From a student perspective, how can universities prepare Australian aviation tertiary students in the knowledge, understanding and skill requirements necessary in the post-COVID-19 industry?

These sub-questions will facilitate the collection of comprehensive data to gain an in-depth understanding of how aviation students perceive their skill development needs and future career opportunities within the post-COVID-19 industry. In the interests of supporting positive industry outcomes, the questions also aim to investigate how universities can support students in developing any additional skills or exploring alternative career paths.

2. Literature review

As recently as 2019 the Aviation Industry Reference Committee (IRC) Skills Forecast (Aviation Industry Reference Committee, 2019) identified the Australian aviation industry as one of Australia’s largest and rapidly growing industries. The industry report cited shortages of skilled aviation professionals including pilots, flight instructors, and maintenance engineers paving way for new graduates to feel confident in their future career prospects. However, the COVID-19 pandemic, which saw the grounding of airlines nationally and globally as countries introduced social distancing has seen commercial UAV technologies. In addition to the rapid growth of commercial Unmanned Aerial Vehicles (UAV) over the last decade (Weissbach and Tebbe, 2016) that in higher education, a greater focus on job relevant teaching and competency requirements should be linked to both the Vocational Education and Training (VET) and Higher Education sectors to ensure that the calibre of management decision makers becomes more robust. In the post COVID-19 recovery period Birrell (2020) supports this emphasising that in higher education, a greater focus on job relevant teaching and research is needed that addresses the needs of Australian industry.

Another area for consideration with respect to expanding learning opportunities for students within an aviation degree is emerging technologies. In addition to the rapid growth of commercial Unmanned Aerial Vehicles (UAV) over the last decade (Weissbach and Tebbe, 2016) the COVID-19 pandemic has resulted in the UAV industry experiencing further unexpected development and growth (International Transport Forum OECD, 2020). The COVID-19 pandemic and requirement for social distancing has seen commercial UAV’s utilised across multiple industries to perform tasks such as the delivery of medical supplies,

2.2. Undergraduate tertiary aviation programs

Following the global economic downturn in 2012, when a lower demand for pilots resulted in high unemployment rates Yadav (2012) examined Australian tertiary aviation degree programs offering flight training. Yadav (2012) concluded that universities should provide broader subject content to facilitate non-flying aviation skills to enable greater employment opportunities for graduates. Skills and knowledge in the areas of technical engineering, operational management and customer service management may be of particular benefit as they span a diverse range of potential roles within the aviation industry (Australian Industry Standards, 2017).

Research into the impact of the COVID-19 pandemic on industry sectors that directly recruit graduates is emerging. It is the General Aviation (GA) sector and associated community that provides the first employment opportunity for the aviation graduate, providing a platform for building work experience and nurturing professional culture (Schreckengast and Drury, 2015). Tisdall and Zhang, 2020 considered the observed impacts of the COVID-19 pandemic on the GA community in Australia. The study uncovered that aviation managers in the future need a greater level of business acumen. They found that the future aviation professional (including fiscal managers and licenced personnel) will need to demonstrate business competency requirements in accordance with the Australian Qualifications Framework, suggesting that competency requirements should be linked to both the Vocational Education and Training (VET) and Higher Education sectors to ensure that the calibre of management decision makers becomes more robust. In the post COVID-19 recovery period Birrell (2020) supports this emphasising that in higher education, a greater focus on job relevant teaching and research is needed that addresses the needs of Australian industry.

For current aviation students this rapid reduction to industry workforce requirements may result in a ‘career shock’ (Akkermans et al., 2020), leaving them questioning their choice of academic study and future career path. Akkermans et al. (2018, p. 4) define a career shock as a “disruptive and extraordinary event that is, at least to some degree, caused by factors outside the focal individual’s control and that triggers a deliberate thought process concerning one’s career”. While the impact may be positive or negative, the fundamental feature of career shocks is that they cause people to reflect on their current situation and develop new plans or goals (Seibert et al., 2016). The development of career competencies has been found to be an effective method in preparing people to cope with career shocks (Akkermans et al., 2020). Career competencies, commonly referred to as ‘soft skills’ or ‘non-technical skills’ (NTS) are defined as the ‘knowledge, skills and abilities central to career development’ (Akkermans et al., 2013, p. 356). These skills go beyond those required for a specific role and are transferrable across roles and industries.

In comparison with previous generations, a majority of new university graduates will hold multiple roles within an industry, or even change industries all together, over the course of their working life (Woodside, 2018). However, the career shock caused by the COVID-19 pandemic may lead some students to re-evaluate their career plans at an earlier stage when they have not yet developed the career competencies or NTS that support these disruptions and facilitate transitions between roles. The Aviation IRC (2019) also identified the importance of NTS such as critical thinking, problem solving and digital literacy in order to develop a workforce that is prepared to adapt to future challenges such as those presently being experienced through the COVID-19 pandemic.
monitoring social distancing, disinfecting public places and providing support to isolated communities (Chamola et al., 2020). The need for additional education regarding UAV operation was also highlighted by the Aviation IRC (2019) particularly for ‘beyond visual line of sight’ operations. Given the long-term recovery predictions for the aviation industry, commercial UAV operation is expected to provide alternative employment opportunities for some aviation graduates (AUAS News, 2020).

3. Methodology

The research design of this study followed the following steps:

- Establish research objective and research questions
- Design survey questions based on literature review
- Seek ethics approval
- Data collection
- Data analysis using non-parametric tests
- Answer research questions and draw conclusions

3.1. Survey construction

This research has been undertaken through an online survey of students currently enrolled in a Bachelor of Aviation at Australian universities, with questions relating to current impacts and future considerations for university programs. The survey was developed following a review of the literature regarding future skills required in the aviation industry and current aviation data following the COVID-19 pandemic. Additionally, an airline senior management focus group contributed industry insights regarding essential skills for new graduates (R. Heaton, personal communication, December 17, 2019).

The survey is divided into five sections. The initial section ensures only respondents meeting the desired criterion (students currently studying an undergraduate aviation degree), complete the survey. The remaining four sections correspond to each of the four sub-research questions. Of these four sections, the first seeks to determine the degree to which students perceive personal and external factors, caused by the COVID-19 pandemic, are likely to create impediments to their careers in the 12 months after graduation. The second section asks respondents to consider additional skill sets that may be valuable to their future careers in the aviation industry. This section also seeks to understand whether respondents believe that the career concept of aviation professionals needs to be broadened to include additional skills and knowledge. The third section seeks to determine whether current aviation students have considered future study or employment options post-graduation. The final section poses questions to gauge students’ perspectives on how universities can assist in preparing students for the post-COVID-19 industry to ensure their graduates are provided with up-to-date industry relevant learning experience and are industry ready.

3.2. Data collection

The sample population surveyed was drawn from students currently studying an undergraduate aviation degree at universities in Australia. The survey was distributed through the various university online learning platforms. A non-random purposive sampling method was utilised to approach potential participants by contacting aviation staff at relevant universities that distributed the online survey link. The survey was made available for student completion over a two-week period in October 2020.

SPSS was used for data analysis. Given the smaller sample size and non-homogeneity of participants non-parametric tests were used when analysing the data set. One is a one-sample Wilcoxon signed rank test based on ranks, which is analogous to the one sample t-test. The location parameter is the median, not the mean. The other one is the Mann-Whitney test that can be used to compare the differences between two independent samples. This test can be regarded as a nonparametric alternative to the independent t-test. Normal distribution is not assumed for both tests.

In Australia, data collected from the Department of Education and Training between 2010 and 2013 indicates that approximately 250 students (annually) are enrolled in an aviation tertiary training program, and accessing a government FEE-Help loan to support a flight operations training qualification (Australian Industry Standards, 2017). The government supported FEE-Help loan is commonly connected to the graduate diploma of aviation; or advanced diploma in aviation. Such technical programs are designed to complement studies within a Bachelor Degree. This represents the annual population of the pilot/flight major cohort being examined. 67 participants meeting the survey criteria provided complete responses to the survey. Of the 67 complete responses, 53 participants were identified as students undertaking a pilot/flight major. This represents a useable response rate of 21.2 percent. This return rate is slightly lower than the average 33% return rate for online surveys as reported by Nulty (2008). Travel restrictions imposed due to the COVID-19 pandemic limited the ability of the researchers to utilise other distribution methods in order to recruit more participants.

4. Results and discussion

4.1. Participants

A total of 67 participants who were enrolled in an Australian undergraduate aviation program completed the online survey. The majority (n = 53) was undertaking a pilot/flight major while the remaining participants were undertaking an aviation management major. Approximately two third of the participants (n = 42) commenced their aviation program prior to 2020.

4.2. Perceived personal impediments

Considering the severe impact that COVID-19 has had on the aviation industry, six statements (Table 1), using a five-point Likert scale with 1 being strongly disagree while 5 being strongly agree were developed and administered to provide a deeper understanding on the participants’ perceived impediments to their aviation career within 12 months after graduation.

A total of 36 participants (53.7%) showed their disagreement that their inability to complete flight training was due to financial situation while a total of 40 participants (59.7%) showed their agreement that there was a need to consider an alternative career pathway while the industry recovers. A one-sample Wilcoxon signed rank test supported this interpretation as the medians of statements Q1 and Q2 are significantly different from the hypothesised median of 3 (never agree nor disagree). The value of the effect size (r = 0.26) indicates a relatively small effect size according to Cohen (1988) criteria.¹ For other personal impediment statements, the medians are not statistically significant from 3.

The Mann-Whitney test was performed to determine whether there was a statistical difference in responses between two majors (i.e., pilot and aviation management). The results in Table 2 showed that the aviation management group was significantly different from the pilot group on statements Q3 and Q6 where a greater proportion of the aviation management group showed their agreement on the statements.

During the COVID-19 pandemic in Australia there were no specific

¹ According to Cohen (1988), 0.2 is considered as a small effect size, 0.5 medium effect size and 0.8 or higher large effect size. A very low effect size (absolute value) indicates that the difference is trivial even though it is statistically significant.
restrictions placed on flight schools (Morgan, 2020), enabling flight schools to continue operations with an approved safety plan in place (CASA, 2020). Thus, scheduled flight training for trainee pilots was largely uninterrupted. The continuation of training and very focused nature of the pilot profession corresponds with their greater level of disagreement to statement Q3. Conversely, the aviation management major naturally encompasses a greater variety of training and leads to greater diversity in employment opportunities. This is reflected in the results with aviation management students showing greater levels of agreement to statement Q3.

Responses to statement Q6 indicate that aviation management students had received greater levels of advice from parents and mentors to consider alternate career options. COVID-19 has forced young people in school-to-transition points to re-think their career plans. From a theoretical point of view, individuals have an active role in the construction of career paths. Several studies have shown possible intrinsic dimensions (e.g. career adaptability, Rottinghaus et al., 2005; identity, Kunnen, 2013; and self-efficacy, Hui and Lent, 2018) and extrinsic influences (parents, Marcionetti and Rossi, 2016; teachers and educators, Cheung and Arnold, 2014) that affect the career development process of students. Consequently, parents and mentors may have expressed concern with student’s career prospects and encouraged them to consider alternative career options. In contrast, the highly structured training and career path of pilot students may prevent parents and mentors from suggesting alternative training pathways hence the lower level of agreement to statement Q6 in the pilot group cohort.

Another Mann-Whitney test was performed based on the participants’ enrolment year (i.e., 2020 [2020] and prior to 2020 [P2020]). The results in Table 2 showed that the participants in the 2020 group was significantly different from the P2020 group in responses to the statements Q2 and Q3 where a greater proportion of 2020 group showed their disagreement with the statements.

The participants in the 2020 group are likely to disagree with the need to consider alternative training or career paths as the aviation industry is predicted to recover by 2024 (IATA, 2020c). With the industry expected to recover in time for their graduation, the 2020 group may have a more optimistic view of their future careers than students who began prior to 2020. The P2020 group may have greater levels of concern for their careers as they will be graduating sooner, some this year, whilst the aviation industry is still in the midst of the recovery period.

### 4.3. Perceived external impediments

Following the perceived personal impediments, seven additional statements (Table 3), using a five-point Likert scale were developed and administered to determine the participants’ perception towards external factors that would likely create the most impediment to their career within 12 months after graduation.

With the exception of the first statement, according to the one-sample Wilcoxon signed rank test with a hypothesised median of 3 (neither agree nor disagree), the majority of participants overwhelmingly agreed with the remaining statements that external factors such as oversupply of experienced aviation professionals and reduced availability of aviation jobs over the next 2–3 years would likely create an impediment to their career in the 12 months after graduation.

The forecasted aviation industry recovery estimates align with the concern participants expressed in these responses. The aviation industry is currently experiencing an oversupply of pilots and other aviation professionals, many being furloughed or made redundant. This, combined with reduced travel demands, is expected to create significant impediments for current aviation students entering the industry. However, the widespread acceptance of severance packages and early retirements of senior aviation professionals, in addition to the pre-COVID-19 aviation industry shortages will likely assist in regenerating employment demand for new graduates (Reed, 2020).

The Mann-Whitney test was performed to determine whether there was a statistical difference in responses between two majors (i.e., pilot and aviation management). Table 4 showed that the management group was significantly different from the pilot group on statements Q11 and Q12 where a greater proportion of the management group showed their agreement with the statements. However, the 2020 group was not significantly different in their responses to the seven statements from the P2020 group.

The greater level of agreement displayed by aviation management students regarding statements Q11 and Q12 may indicate a deeper

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**Table 1**

Descriptive statistics and a one-sample Wilcoxon signed rank test for the perceived personal impediments.

| Personal impediments | Descriptive | Wilcoxon signed rank |
|----------------------|-------------|----------------------|
|                      | N       | Mean | SD     | Mdn  | z     | p     | r     |
| Q1. Inability to complete flight training due to financial situation | 67     | 2.67 | 1.16   | 2.00 | -2.17 | .03   | -.26  |
| Q2. Need to consider an alternative career path while the industry recovers | 67     | 3.54 | 1.26   | 4.00 | 3.10  | .002  | .38   |
| Q3. Need to consider alternative options for training while the industry recovers | 67     | 2.76 | 1.07   | 3.00 | -1.79 | .074  | -.22  |
| Q4. Lack of technical skills necessary to respond to future role and professional requirements | 67     | 2.94 | 1.25   | 3.00 | -.45  | .65   | -.06  |
| Q5. Lack of non-technical skills necessary to respond to future role and professional requirements | 67     | 2.76 | 1.2    | 3.00 | -1.56 | .12   | -.19  |
| Q6. Advice to consider alternative career options received from mentors/parents/advisers | 67     | 3.09 | 1.25   | 3.00 | .46   | .64   | .06   |

Note: Mdn denotes the median of the statements; z is standardised test statistics or z-score; p is significance level and r effect size.

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**Table 2**

Results of the Mann-Whitney tests for the perceived personal impediments between two majors and participants’ enrolment year.

| Personal impediments | Two majors | Enrolment year |
|----------------------|------------|----------------|
|                      | U | z | p    | r  | U | z | p    | r  |
| Q1                   | 404.0 | .53 | .56 | .07 | 518.0 | -.10 | .93 | -.01 |
| Q2                   | 460.5 | 1.43 | .15 | .02 | 357.5 | -.22 | .025 | -.27 |
| Q3                   | 522.5 | 2.43 | .015 | .30 | 346.0 | -.242 | .016 | -.30 |
| Q4                   | 477.0 | 1.68 | .09 | .21 | 486.5 | -.51 | .61 | -.06 |
| Q5                   | 478.0 | 1.7 | .09 | .21 | 470.0 | -.74 | .46 | -.09 |
| Q6                   | 504.0 | 2.13 | .033 | .26 | 450.0 | -1.01 | .31 | -.12 |

Note: U denotes the Mann-Whitney U statistics.
understanding of these topics and their impacts on the industry. These statements relate to topics more likely to be studied in greater depth within an aviation management major (Castro, 2011; Watkins et al., 2016), hence the difference in scoring when compared with the pilot group. However, overall, all participants agreed with these factors creating an impediment to their career following graduation.

### 4.4. Importance of non-technical skills (NTS)

NTS have been identified as integral for current and future aviation professionals in order for them to effectively perform tasks and to adapt to changes. For instance, the International Civil Aviation Organisation (ICAO), the International Air Transport Association (IATA) and the International Federation of Air Line Pilots’ Associations (IFALPA) have agreed on a set of eight core competencies for flight crew where six relate to NTS. Additionally, an airline senior management focus group (R. Heaton, personal communication, December 17, 2019) found that certain critical NTS were absent from current aviation undergraduates such as problem solving, critical thinking, communication, collaboration and resilience. Therefore, the participants were asked to rank 12 NTS in the order of importance. In the pilot group, the participants identified the top three NTS being ‘critical thinking/analytical’, ‘communication’ and ‘decision making’ while for the management group, the top three NTS identified were ‘critical thinking/analytical’, ‘problem-solving’ and ‘emotional intelligence’. Both groups chose ‘citizenship (local & global)’ being the least important NTS for future professionals.

The ranking of ‘critical thinking/analytical’ skills as the most important NTS by both pilot and management students is consistent with the ranking of this skill by aviation industry stakeholders (Aviation IRC, 2019). Critical thinking is also frequently identified as an essential graduate attribute by Australian universities (Oliver and Jorre de St Jorre, 2018). Already an essential skill, critical thinking will be even more sought after by employers following the COVID-19 pandemic as it is fundamental to being able to adapt and evolve workplace practices to a new normal (Oxford University Press, 2020). This alignment of skill value between students, industry and universities is positive for future graduate employability and success in the industry.

The ranking of citizenship (local and global) as the least important NTS by both groups is concerning given the increasing global nature of the aviation industry. Additionally, Australian universities have identified citizenship as being another key graduate attribute for the future (Oliver and Jorre de St Jorre, 2018). This raises the question of why students do not see citizenship as an important NTS for their future. According to the Australian Bureau of Statistics (2017), in 2016, “early half (49%) of all Australians were either born overseas or had at least one parent who was born overseas” (para. 13). Furthermore, 38% of students enrolled in a university or other tertiary program were born overseas. Given the significant percentage of people with culturally diverse heritage, it is plausible to consider that students already see themselves as global citizens rather than citizenship being a specific skill to develop. Additionally, the majority of students studying an undergraduate degree in Australia are young adults, aged between 18 and 32 years (Australian Bureau of Statistics, 2017). These students have grown up in the digital age, with global connection and access to worldwide information via the internet from a young age, further normalising interactions with global societies.

Interestingly, digital literacy also did not score highly in either student group despite this NTS being the third most desirable skill sought by industry professionals (Aviation IRC, 2019). However, a US study by Phillips et al. (2018) regarding graduate strengths and weaknesses, as observed by industry professionals, found digital literacy to be a strength of recent graduates in the workplace. Aviation managers consistently noted that new graduates were adept at learning and embracing new technologies (Phillips et al., 2018). The reason for this misalignment could be similar to the observation made previously with regards to citizenship. Current aviation students may view themselves as ‘digital citizens’, having grown up in the digital age they see technology as part of normal everyday life, not a specific skill.

### 4.5. Broadening skills and knowledge

According to Australian Industry Standards (2017), new technologies and a strong drive to improve customer services are reshaping how the aviation industry operates. Additionally, the outbreak of the COVID-19 pandemic has necessitated the need to broaden the skills and knowledge requirements in a range of areas including UAVs, engineering and management (Australian Industry Standards, 2017). Thus, the
participants were asked to indicate their level of agreement on the four skills and knowledge to gauge their perceived importance on those areas and the majority of participants overwhelmingly agreed with the need to broaden their skills and knowledge on those new and emerging areas (Table 5).

The Mann-Whitney test was also performed to determine whether there was a statistical difference in responses between two majors. The result showed that the management group was significantly different from the pilot group in responses to the statements Q14 (U = 511.5, z = 2.33, p = .020, r = 0.28) and Q16 (U = 516.0, z = 2.35, p = .019, r = 0.29) where a greater proportion of management group showed their agreement on broadening their skills and knowledge on those areas of emerging technologies and operational management of pandemics and outbreaks.

While all participants agreed that broadening their skills and knowledge would be of benefit the significant difference between the pilot and management groups on statements Q14 and Q16 may be indicative of the focused career concept aligned with being a pilot. Management students likely expect to engage in a diverse variety of roles over their careers while pilot students have a deep sense of purpose associated with their occupational identity and as such are driven by a particular career development structure (Fraher and Gabriel, 2014).

While the focused occupational identity of pilots may foster high levels of motivation to reach their career goals, at times, when the industry experiences a setback, it can create impediments preventing them from exploring alternate options (Fraher and Gabriel, 2014).

Another Mann-Whitney test was performed based on the participants’ enrolment year and the P2020 group was significantly different from the 2020 group in responses to the 4th skill statement (Q17), (U = 364, z = −2.26, p = .024, r = −0.28) that a greater proportion of the P2020 group indicated their agreement on the broadened customer service management skills and knowledge.

This difference may reflect the deeper understanding of their chosen profession after completing a year or more of their university degree and being exposed to the industry. Rather than seeing their role as removed from the public, students begin to recognise the need to look after passengers and development of customer service skills being integral to the aviation profession.

4.6. Options after graduation

According to IATA (2020b) total employment within the airline industry was estimated to decline by 35.5% in 2020 and the recovery to the pre-COVID levels is not expected in the short term. Questions were therefore posed as to whether the participants contemplated alternative career options after graduation within the aviation (ACO-A) and non-aviation (ACO-NA) industries. A question was also asked if the participants were considering additional study within the aviation (AS-A) and non-aviation (AS-NA) industries upon completion of their current study. Table 6 provides a summary of the findings. A series of Chi-square tests (e.g., ACO-A by major) suggested that there were no statistically significant associations between the variables and the groups.

Participants in the groups who considered undertaking additional study indicated the Master of Aviation program is the most preferred tertiary program and the majority considered commencing the program within six months of graduation from their current degree program.

The desire to complete further study in the form of a Master of Aviation program may be one method students are using to deal with the career shock associated with the effect of the pandemic on the aviation industry. By delaying their entry into the workforce, whilst also gaining further qualifications, graduates are increasing their employability for what may be a more competitive industry. Seibert et al. (2016) identified that undertaking further education and training is an effective behavioural strategy to increase resilience when pursuing a chosen career path.

4.7. Post-COVID-19 preparation

Table 7 highlights statements that were provided to gauge the participants’ perspective on how universities could better prepare their graduates in the knowledge, understanding and skills requirements in the post COVID-19 industry. The majority of participants overwhelmingly agreed that their current aviation programs were adequately preparing them for broader roles and the contemporary challenges in the aviation industry. Additionally, the majority of

Table 6

| Major                        | ACO-A | ACO-NA | AS-A | AS-NA |
|------------------------------|-------|--------|------|-------|
|                               | Yes   | No     | Yes  | No    |
| Pilot (n = 53)                | 25    | 28     | 31   | 22    |
| Management (n = 14)           | 9     | 5      | 8    | 6     |
| 2020 (n = 25)                 | 12    | 13     | 13   | 12    |
| Prior to 2020 (n = 42)        | 22    | 20     | 26   | 16    |

Table 7

| Additional skills and knowledge | Descriptive Wilcoxon signed rank test for the additional skills and knowledge in preparation for the post COVID-19 industry. |
|---------------------------------|------------------------------------------------------------------------------------------------------------------|
|                                | N    | Mean | SD  | Mdn | z   | p   | r   |
| Q18. Adequate preparation for other roles in aviation industry | 67   | 3.36 | 1.14 | 4.00 | 2.38 | .017 | .29 |
| Q19. Development of NTS        | 67   | 3.82 | .74  | 4.00 | 6.05 | <.001 | .74 |
| Q20. Professional development  | 67   | 4.16 | .59  | 4.00 | 7.06 | <.001 | .86 |
| Q21. Knowledge on a diverse range of disciplines | 67   | 3.94 | .89  | 4.00 | 5.87 | <.001 | .72 |
| Q22. Adequate preparation for the contemporary challenges | 67   | 3.31 | 1.12 | 4.00 | 2.18 | .029 | .27 |
participants agreed the need for further educational support and opportunities to develop skills and knowledge on NTS, professional development and a diverse range of disciplines.

The overwhelming agreement of all participants for further support in developing additional skills and knowledge highlights their desire to prepare themselves for the uncertainty of the post-COVID-19 industry. Heslin et al. (2019) observed that possessing a growth mindset and being in ‘learning mode’ assisted people who faced career challenges with developing a sustainable career. The desire for professional development opportunities demonstrates student’s awareness of the specific professional culture associated with the aviation industry and the attributes that employers seek. It is a positive finding that students recognise the need to develop these important skills and attributes during their tertiary programs in order to successfully assimilate to the industry after graduation (Helmreich, 2000; O’Brien and Bates, 2015).

The Mann-Whitney test was performed to determine whether there was a statistical difference in responses between two majors. The result showed that a greater proportion of participants in the management group agreed with the need for further educational support and opportunities in the development of NTS for their future career (U = 500, z = 2.28 p < 0.023, r = 0.28).

The greater proportion of management students wanting further support in developing NTS may again be indicative of management students acknowledging the diverse paths their chosen major may lead. As NTS are transferable across roles and disciplines the development of these skills will support students in all aspects of their future careers. Pilot students are continually exposed to NTS training through their flight training programs and participation in mentoring programs (Bates and O’Brien, 2013). As they are already receiving this training, the desire for additional NTS training is less than for management students where NTS may not be so deeply embedded in the course program.

The significant difference in responses between P2020 and 2020 groups characterises the maturation process that occurs as students’ progress through their tertiary education (Kassam, 2010; Klafter, 2020). Upon beginning their degree students may possess a pre-conceived ideology of the aviation industry. As they delve into the course program the enormity of the industry becomes apparent, prompting a realisation of the limits to their current knowledge. This process results in an intellectual maturation where students become more receptive to different ideas and viewpoints (Kassam, 2010; Klafter, 2020) and facilitates the development of resilience and adaptability; necessary skills to succeed in their future careers (Seibert et al., 2016).

5. Conclusion

The COVID-19 pandemic has adversely affected the aviation industry, creating impediments for students currently studying a Bachelor of Aviation and potentially altering their future career paths. This paper has examined university students’ perceptions of the effects of the COVID-19 pandemic on their future careers and the skill sets they will require to succeed in the aviation industry following graduation. The findings from this research have implications for both undergraduate aviation students and universities offering an undergraduate aviation program.

Students are concerned with the oversupply of aviation professionals in the industry as a result of the COVID-19 pandemic. While the industry recovery forecasts align with this concern (IATA, 2020c), the widespread acceptance of service packages and early retirements of senior aviation professionals, in addition to the pre-COVID-19 aviation industry shortages will assist in regenerating employment demand for new graduates (Reed, 2020). To further alleviate this concern and support students to be successful in their careers universities need to consider the skills students will require to be competitive in the post-COVID-19 aviation industry.

Critical thinking/analytical skills were found to be the most important NTS by all survey participants. This aligns with desired attributes sought by industry professionals and essential graduate attributes highlighted by universities (Aviation IRC, 2019; Oliver & Jorj de St Joree, 2018). Of interesting note however, was the lower level of importance students placed on the NTS of digital literacy and citizenship. Comparatively, these NTS are ranked highly by aviation industry stakeholders (Aviation IRC, 2019) and also feature as key graduate attributes listed by universities. It is essential to understand why students do not value these NTS considering their importance to the industry. If it is due to generational opportunities, where students are accustomed to being exposed to digital processes and multicultural experiences then this may not be a cause for concern. However, universities need to ensure students understand the significance and breadth of these skills for successful participation in the global aviation industry.

It is promising that students recognise the need for ongoing professional development to hone the professional skills sought by the industry. The aviation industry possesses a strong professional culture with its own norms and values (Helmreich, 2000). Being exposed to this professional culture enables students to develop their own professional identity and transition into the industry (O’Brien and Bates, 2015).

This research has identified areas of concern for students and highlighted skills and opportunities they believe to be beneficial in preparing them for their future careers in the post-COVID-19 aviation industry. Universities need to consider these findings, in addition to current aviation industry requirements to determine if program changes are required in order to ensure graduates have the necessary skills to be competitive in the post-COVID-19 aviation industry. As such, when the industry recovers and the need for skilled aviation professionals returns, graduates will be adequately prepared.

Anecdotal evidence suggests applications for Australian undergraduate tertiary aviation programs for 2021 have significantly decreased in comparison to previous years due to the unprecedented downturn in the aviation industry. It is unsurprising, given the widely publicised uncertainty of the aviation industry, that future students may show reservation in joining an industry in a recessive state (Bryan, 2020). The current study was exploratory in nature given the recency of the pandemic. As the pandemic continues and the aviation industry adapts and begins its recovery the skills future aviation professionals will require needs more detailed analysis. A future study should utilise interviews to further explore how students perceive the industry has changed, what skills they believe to be essential and how universities can support them to establish a successful career in the aviation industry. Ideally the future study can use a larger sample including students from different countries, which would provide greater insight into the issues addressed in this paper.

Author statement

Peter Miani: Methodology, Investigation, Formal analysis, Writing - original draft, Taryn Kille: Supervision, Conceptualisation, Writing - review & editing, Seung-Yong Lee: Supervision, Methodology, Writing - review & editing, Paul Raymond Bates: Supervision, Conceptualisation, Writing - review & editing. Yahua Zhang: Supervision, Conceptualisation, Writing - review & editing.

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