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NOT JUST A STUDENT PROBLEM: PLAGIARISM IN AVIATION ACADEMIC RESEARCH

David Carl Ison

Abstract

Plagiarism has long been a concern for educators. However, research literature has indicated that faculty and researchers have themselves conducted plagiarism at alarming rates. Further, there appears to be a large amount of research that has been recycled through egregious self-plagiarism. As aviation research becomes increasingly important to the field of study, it is critical that such research is of high quality, legitimate, and original. This descriptive study investigated the prevalence of plagiarism in aviation research published in five prominent, peer-reviewed research journals (*Collegiate Aviation Review*, *Journal of Air Transportation*, *International Journal of Applied Aviation Studies*, *International Journal of Aviation Psychology* and *Aviation, Space, and Environmental Medicine*). From each of these journals, 30 articles ($n = 150$) were uploaded to Turnitin plagiarism detection software for analysis. The mean similarity index of the articles was found to be 16.01% ($SD = 18.12$). A Kruskal-Wallis test revealed a statistically significant difference in similarity indices across the five journals, $X^2(4, n = 150) = 9.785$, $p = .044$ with the *International Journal of Applied Aviation Studies* and the *International Journal of Aviation Psychology* having the highest levels of plagiarism. Within the 150 journal articles, 68 cases (45.3%) met the minimum level of plagiarism (similarity index > 10% as advocated in the literature). Overall, 102 (68%) articles contained instances of self-plagiarism (overlap with material written by an article author without citation). Sham-type (exact text but improperly cited) plagiarism was evident in 88 (59%) of articles and 78 (52%) contained at least one instance of verbatim-type (exact text without citation) plagiarism. Plagiarism appears to be a concern for aviation research stakeholders and it is evident that there is a need for more guidelines and oversight by journal editors and reviewers. Suggestions for future research are provided.

Plagiarism, defined by the American Psychological Association (2010) as an instance when authors "present the work of another as if it were their own work" (p. 16), has long plagued the campuses of colleges and universities. The majority of the available literature on the subject references inquiries into the prevalence of such misconduct among students (Batane, 2010; McCabe, 2009; Scanlon, 2003; Walker, 2010). Apparently, though, plagiarism is not limited to the student body. Evidence "suggest[s] that plagiarism by faculty is not a rarity, that it cross-cuts academic disciplines, and that very experienced academicians seem just as likely to engage in plagiarism as newer faculty" (Gibelman & Gelman, 2003, p. 239). Further, Gibelman and Gelman (2003) cited 19 cases over a 4 year period in which faculty

or prominent administrators at higher education institutions were found to have plagiarized material that they published. Even the most prestigious universities are not immune. In 2010, a Harvard University psychology professor faced dismissal following accusations of plagiarism (Srivasta & White, 2010).

The incidence of researcher and faculty involvement in plagiarism has been reported to be increasing in extant research (Cabral-Cardoso, 2004; Shahabuddin, 2009; Sikes, 2009). Sikes (2009) summarized this trend, explaining that:

the ubiquity of the Internet, the ever intensifying demand to publish or perish, and maybe a general shift in perceptions of what constitutes 'bad'

plagiarism and collusion which challenge traditional notions of what constitutes authorial honesty, mean the time may be ripe for a consideration by academic writers and journal editors of how they regard and deal with [plagiarism] (p. 13).

The U.S. Department of Health and Human Services Office of Research Integrity, responsible for monitoring related research, reported an increase in inquiries into research misconduct from 77 cases in 1993 to 267 in 2006 (Homer & Minifie, 2011).

Even in light of these facts, the response to plagiarism by the research and academic communities has been mostly muted. In some cases, there have even been attempts to cover up such misconduct (Cabral-Cardoso, 2004). Shahabuddin (2009) found that a majority of 81 journal editors surveyed had no formal policy to address plagiarism. Yet there have been some actions by individual fields of study to crack down on the problem. In the management information science (MIS) field, one primary industry association "decided to establish a standing committee on member misconduct" (Kock & Davison, 2003, p. 512). Funded research has come under closer inspection by sponsoring agencies, e.g. the U.S. Department of Health and Human Services has an Office of Research Integrity and the National Science Foundation, with each adopting regulations that define and govern acts of research misconduct (Gibelman & Gelman, 2003). Many medical journals, perhaps in light of the potential for erroneous research to do harm, tend to have more oversight of contraventions. For example, the biomedical field convenes a peer review conference to evaluate retracted articles. Over a 30 year period, 235 articles were retracted from medical journals, 86 (36.6%) of which were for misconduct (Homer & Minifie, 2011). Only recently has an aviation publication, the *Collegiate Aviation Review*, specifically noted plagiarism in its call for papers (Beckman, 2011).

Shahabuddin (2009) stated that if plagiarism among academics is allowed to continue "it will encourage unethical, immoral, and unprofessional conduct among academicians" (p. 356). Beyond the fact that plagiarism goes against ethical expectations within the research community, such misconduct degrades:

the entire institution of original research an institution premised on the basis of credit being due to those who deserve it through their original and creative work [... which] is likely to suffer if plagiarism occurs, as plagiarism is a form of affront to the institution and can undermine the

values that most of the institution's stakeholders hold dear (Kock & Davison, 2003, p. 512).

There is also true danger to the production of new ideas and the unearthing of relevant data: "new ideas will not be discovered and the old ideas will simply continue to be repackaged in new forms. This trend is disastrous for society and future generations" (Shahabuddin, 2009, p. 356).

Another common problem in academic publishing is self-plagiarism defined by Bretag and Carapiet as "textual re-use; multiple publication; redundant publication; dual publication; [or] duplicate publication" (as cited by Sikes 2009, p. 19). Green (2005) stated that self-plagiarism "is detrimental to scientific progress and bad for our academic community [...] whenever a self-plagiarised paper is allowed to be published, another, more deserving paper, is not" (para. 6). This type of plagiarism is apparently fairly common as Sikes (2009) presented several studies that indicate a high prevalence of self-plagiarism within academic journals. One example, a pilot study conducted by Bretag and Mahmud (2009a), found that 70% of examined articles included "'cut and paste' textual re-use" (p. 199).

Clearly plagiarism is a concern for all fields of study. Aviation, of course, is no exception. It is also evident that such misconduct is detrimental to the ethical foundations of research and restrains gains in knowledge necessary for advancement and innovation. In order to stop plagiarism among academia, future researchers must be properly guided. Academics must avoid "downplaying the importance of plagiarism [... as it sends] the wrong message to the student and the academic communities" (Cabral-Cardoso, 2004, p. 86).

Beyond the general concerns about plagiarism, aviation faces additional challenges within the general research community that necessitates extra attention to the quality and originality of the research produced in this field. This is due to the fact that aviation has been recognized as an "emerging discipline" (Johnson, Hamilton, Gibson, & Hanna, 2006, p. 83). As is common among neophyte areas of study, research produced by such fields often "faces many criticisms, including that of producing research that is largely irrelevant to industry practitioners" (Kock & Davison, 2003, p. 521). The process to gain acceptance among the research community takes commitment to the production of quality studies: "as aviation education establishes itself in academia, it must continue to advance the discipline by creating a rich depository characterized by scholarship and inquiry" (Johnson, Hamilton, Gibson, and Hanna, 2006, p. 83). In recent years there has been a rise in the pressure to research and for publication production in

aviation (Ison, 2011). Yet this growing body of research has largely been allowed to go to print without attention to the potential of author misconduct.

Considering the importance of the production of original, valuable research and the need to project an image of legitimacy and beneficence to the aviation industry as well as to the research community, it is critical that aviation research be free of delinquency, particularly plagiarism. In light of the prevalence of plagiarism in academic publishing and the increasing pressure to publish among aviation faculty, it is necessary to identify plagiarism within the body of research (Kock & Davison, 2003; Shahabuddin, 2009; Sikes, 2009). No such studies or efforts were identified in the existing literature. This study sought to identify the prevalence of plagiarism among recent, prominent, peer-reviewed aviation research publications.

Method

This descriptive study sought to quantify the prevalence of plagiarism within well recognized, peer-reviewed aviation research publications. Articles from issues of the included journals were submitted to Turnitin plagiarism detection software for analysis. The resultant output was what is referred to as a similarity index which represents the percentage of overlap that existed between the article and source material.

Participants

The selection of the journals to include in analysis was guided by Johnson, Hamilton, Gibson, and Hanna (2006) who analyzed the research merit and usefulness indices of various aviation publications. The top five peer-reviewed journals that were available in electronic format were selected for analysis (note: the *Journal of Aerospace/Aviation Education and Research* was ranked as the fourth peer-reviewed journal, but was unavailable in electronic format at the time of this study; the *Human Factors and Aerospace Safety -Journal of Human Factors* was ranked the fifth peer-reviewed journal, but was unavailable in electronic format at the time of this study). Articles were needed in electronic format to be analyzed by Turnitin plagiarism detection software. The most recent five years of journal issues that were available were mined from various library databases. The included journals were:

- *Collegiate Aviation Review (CAR)* (2006-2011)
- *Journal of Air Transportation (JAI)* (1999-2004)
- *International Journal of Applied Aviation Studies (IJAAS)* (2006-2011)
- *International Journal of Aviation Psychology (JJAP)* (2006-2011)

- *Aviation, Space, and Environmental Medicine (ASEM)* (2006-2011)

Articles were then randomly selected from these journals and issues. The data was found not conform to the assumptions required for parametric analysis (data failed both Kolmogorov-Smirnov and Levene's tests). Due to this fact, a Kruskal-Wallis test and chi-square tests were utilized as the primary methods of inquiry. An *a priori* analysis of statistical power was conducted to insure an adequate sample size. A variety of literature has claimed that there is no way to calculate power for a Kruskal-Wallis, however other literature indicated that such calculation was possible yet very complicated (Fan, Zhang, & Zhang, 2011; McDonald, 2009; Watthanacheewakul, 2011). Both Heeke (2010) and Watthanacheewakul (2011) recommended using a X^2 power analysis to estimate of the sample size required to reach the desired power level whilst using a Kruskal-Wallis test. This estimation was calculated to insure the sample size of this study met that which was required to meet a power of 0.80 and a medium effect size for both the Kruskal-Wallis and chi-square tests. An *a priori* calculation indicated that a minimum of 133 articles was required. Journal issues were split into individual articles as needed, depending upon the format available from the publisher. Thirty articles from each journal, for a total of 150 articles, were randomly selected from the aforementioned sample of journals. The additional articles above the minimum calculated in the power analysis were included to insure some security in case the effect size did not meet the expected level.

Measures

Individual articles were uploaded to the Turnitin plagiarism software server. Turnitin was utilized at the recommendation of several research articles as well as the familiarity the researcher had with the system. Martin, Rao, and Sloan (2009) stated:

the academic cheating literature has been [...] plagued by a lack of criterion variables. This study addresses these limitations by strictly defining the cheating behavior (plagiarism) and providing a strong criterion variable, Turnitin, which is not susceptible to self-report bias (p. 48).

A study of users of Turnitin found that over 90% believed the use of the software was effective at identifying plagiarism (iParadigms, 2010). Lastly, Turnitin received rated the highest score among a test of 11 plagiarism detection systems (Scaife, 2007).

Research Design

This descriptive study sought to define and analyze the prevalence of plagiarism in aviation research. Journals were divided into individual articles and were insured to conform to file types that were supported by Turnitin, e.g. PDF or Word documents. Articles were then randomly selected from the total number of downloaded documents. Articles to be included in the study were then bulk uploaded to Turnitin for enquiry. In order to insure that the software produced an accurate similarity index, quotations were eliminated from the analysis. Similarity indices presented by Turnitin had to be examined to insure that there was no erroneous overlap with other databases and uploads to the software system. For example, all *Journal of Air Transportation* articles initially had high similarity indices. This was found to be attributable to the fact that these articles were also available from a Department of Transportation website causing false plagiarism overlap percentages. Other articles had high levels of similarity due to the fact that the abstract was listed on various database websites. These types of false positive results were removed. Also, it was discovered that the format of some articles caused false positive overlap percentages with other articles uploaded for the purposes of this research. These, too, were removed. Another anomaly that was detected during the analysis was that there were overlaps detected with material produced at a date later than the publication date of the article being analyzed in this study, i.e. the article included in this study was actually plagiarized by an author of material available from other internet sources. Similarity percentages due to these instances were manually removed.

Each article was scrutinized for the presence of additional attributes of plagiarism. Overlaps with source material authored by the individual(s) listed as creators of the article, but not properly cited, were classified as "self-plagiarism" for inclusion in the descriptive portion of this study. Each article was then analyzed for the presence of plagiarism types identified by Walker (2010) described as:

Sham -citing a source for the material but presenting it as own paraphrase when it is copied verbatim.

Verbatim -copying material verbatim without citing the source (p. 45).

Articles with these types of misconduct were classified appropriately for inclusion in the analysis.

Lastly, following the initial inspection of the data, it was determined that the 1% similarity index cutoff value described by Batane (2010) was too conservative to dependably brand an article as being plagiarized (unrealistically, this study identified that 100 % of papers had plagiarized text using this benchmark). As noted by Allan et al. (2005), it is common that almost 90 % of papers would be classified as plagiarism if using the standard advocated by Batane (2010). Following an evaluation of the literature providing guidance on a sensible and valuable

similarity index reference, a compromise of 10% was adopted (Allan et al., 2005; Bretag and Mahmud 2009a; Bretag and Mahmud 2009b; Martinet al., 2011 Teesside University, 2010). Final similarity indices, grouped by the source journal, were loaded into SPSS. Descriptive and inferential analysis of the data was then conducted.

Results

Among the 150 journal articles analyzed, 68 cases (45.3%) met the literature-defined plagiarism threshold (similarity index > 10%). The mean similarity index of the articles was 16.01% (SD = 18.12). The median of all indices was 9.00% and the mode of all indices was 5.00%. A Kruskal-Wallis test revealed a statistically significant difference in similarity indices across the five journals, $X^2(4, n = 150) = 9.185, p = .044$. An evaluation of mean ranks revealed that the *JJAAS* (92.43) and the *IJAP* (84.45) had the highest levels of plagiarism which was confirmed by the fact that both of these journals had median scores ($Md = 12.0%$) higher than that of the *JAT* ($Md = 7.5%$), the *ASEM* ($Md = 7.0%$), and the *CAR* ($Md = 6.5%$). *Post hoc* Mann-Whitney *U* tests were conducted on journal pairs to identify those that had a similarity index that was statistically significantly different. Applying a Bonferroni correction, the only journal pair found to be significantly different was the *JJAAS* – *ASEM* grouping ($U = 262.00, z = -2.785, p = .005, r = .019$). Due to the low power ($1 - \beta < .05$) of the performed Mann-Whitney *U* tests, there was potential for additional significant relationships that were not detected. A breakdown of the occurrence of similarity indices in each journal is provided in figure 1.

Overall, 102 (68%) articles contained instances of self-plagiarism. The two journals with the highest incidence of self-plagiarism were the *JJAAS* (57%) and the *IJAP* (40%). There was a significant association between self-plagiarism and the publishing journal, $X^2(4, n = 150) = 15.809, p = .003$, Cramer's $V = .325$. Sham-type plagiarism was evident in 88 (59%) of articles. Again, the *JJAAS* (73%) and the *IJAP* (67%) had the highest levels of this type of plagiarism, however there was no significant association between the presence of sham and the publishing journal, $X^2(4, n = 150) = 5.663, p = .226$, Cramer's $V = .194$. Among the articles analyzed, 78 (52%) contained at least one instance of verbatim plagiarism with the *JJAAS* (67%) and the *JAT* (51%) having the most prevalence. No significant association between the presence of verbatim-type plagiarism and the publishing journal was detected $X^2(4, n = 150) = 6.063, p = .196$, Cramer's $V = .196$. A summary of plagiarism types found in each journal is shown in figure 2.

The results provided by Turnitin showed that no articles were without some level of plagiarism, though 82 (54.7%) had negligible, i.e. less than 10%, similarity indices. A summary of the distribution of similarity indices organized as advocated within the literature is shown in table 1.

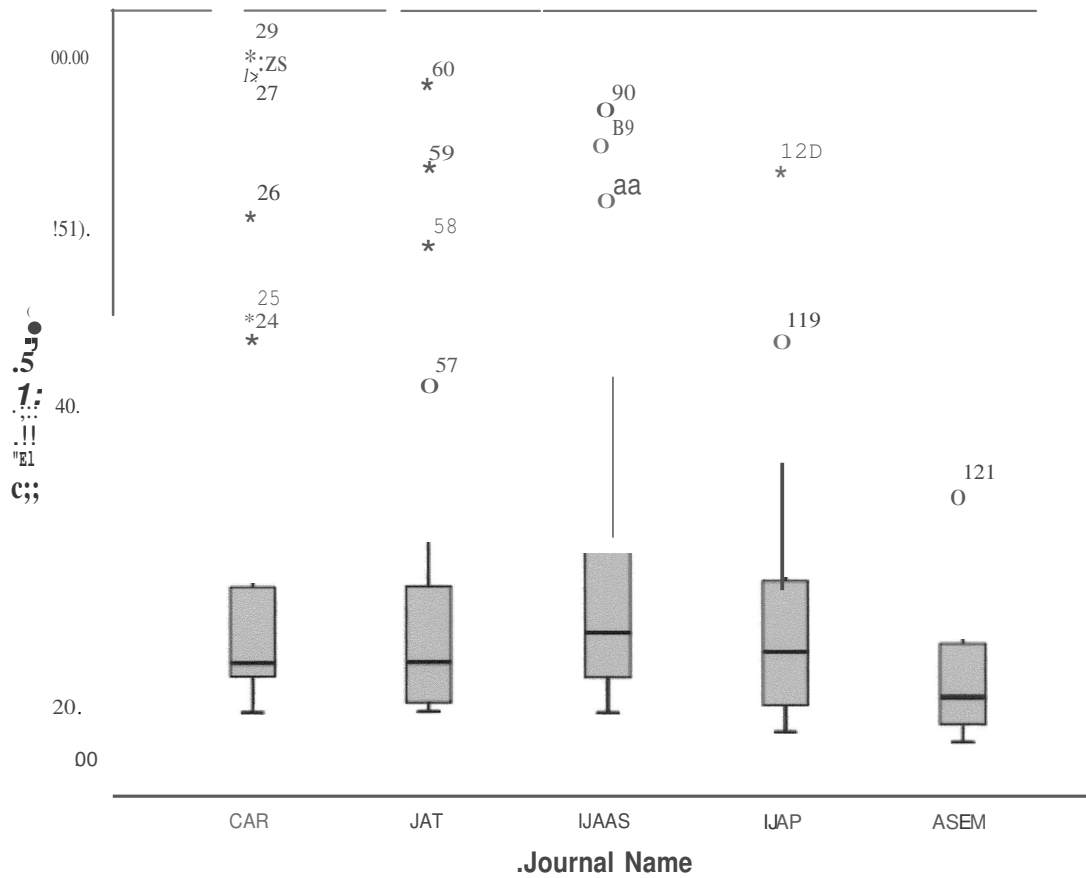


Figure 1. Similarity indices (%) in each analyzed journal (numbers represent the SPSS case code for extreme scores [o] and outliers[.]).

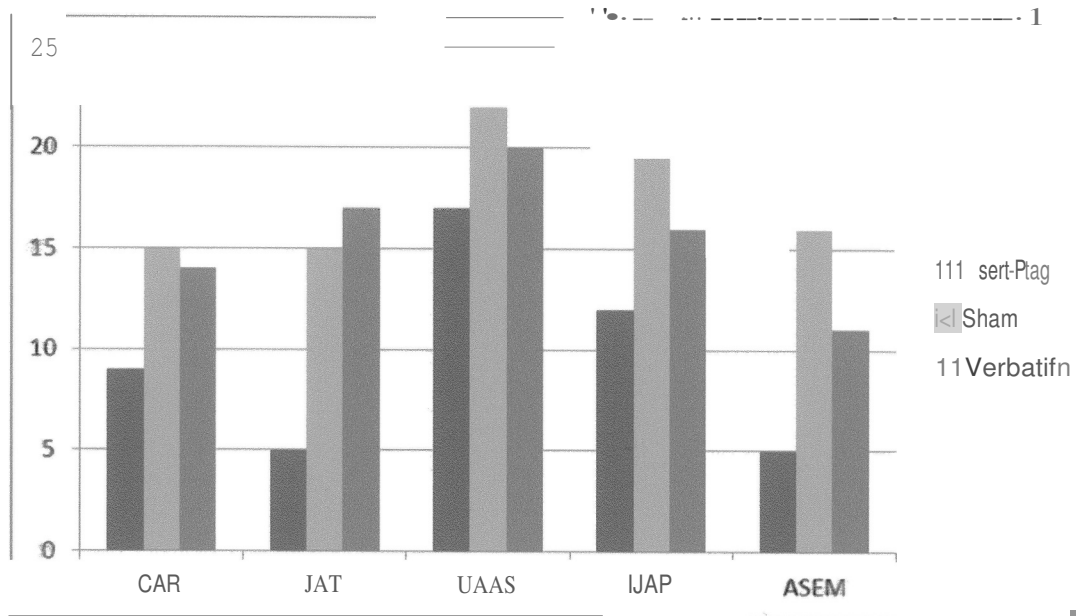


Figure 2. Number of occurrences of different types of plagiarism in each analyzed journal.

Table I

Number of articles per plagiarism level calculated by Turnitin categorized as indicated (0/0 in parentheses are similarity indices).

| Let: >itimate (< 10%) | Low Scale (11-24%) | Medium Scale (25-49%) | High Scale (> 50%) |
|---------------------------|-----------------------|--------------------------|------------------------|
| 82 (54.7%) | 40 (26.7%) | 14 (9.3%) | 14 (9.3%) |

Discussion

The results of this study should be cause for serious concern among the academic research community, especially those in the aviation field. The fact that over 45% of the articles accessed in the study contained a significant level of plagiarism must raise alarm among researchers, journal reviewers, and journal editors. This reinforces the findings of Cabral-Cardoso (2004) who indicated that academic research is "showing some signs of ethical erosion" (p. 76) and that a "nontrivial number" (p. 76) of researchers have been involved in such misconduct. All of this trumps the fact that "science largely stands on the assumption that community members behave ethically and on the trust relationship scientists build with their peers" (Cabral-Cardoso, 2004, p. 76). What does it say about aviation research and its creators when the mean similarity index was over 16% and that almost 20% of the articles analyzed in this study had medium or high levels of plagiarism? These findings also support the notions explicated by Gibelman and Gelman (2003) and Batane (2010) stating that cut-and-paste plagiarism has become all too easy with the widespread use of the internet in research. Moreover, such gives merit to the increasing drive being pushed down upon aviation faculty to "publish or perish" noted by Ison (2011).

Weighing the findings of Sikes (2009) as well as Bretag and Mahmud (2009a) with those of this study, it appears that aviation research is committing self-plagiarism at approximately the same rate as other fields of study. The fact that 68% of aviation articles included in this study having some form of self-plagiarism aligns with the 70% found by Bretag and Mahmud (2009a). While it is somewhat reassuring that aviation is fairing no worse than its peers in this category, self-plagiarism apparently is a noteworthy problem for the academic research community as a whole. The negative effects of constant recycling of research material cannot be underestimated (Bretag & Mahmud, 2009a; Green, 2005; Sikes, 2009). However, there was an association detected between the presence of self-plagiarism and the journal in which such articles were published which should signal the need for a more structured and stringent plagiarism policy to be adopted by the editors of the aberrant journals.

When comparing the findings of this study with previous research that categorized plagiarism types, the contrast is more problematic. Aviation researchers performed nearly four times the level of sham-type

plagiarism (59%) compared to that conducted by students (15%) in the study by Walker (2010). In terms of verbatim-type plagiarism, aviation research had five times the level (52%) found in the work of students (11%) (Walker, 2010). As mentioned by Cabral-Cardoso (2004), "the importance of faculty acting as role models and promoters of ethical behavior should not be underestimated. Any misconduct on the part of faculty will be interpreted as legitimizing similar behavior on students" (p. 86). Additionally, such misconduct may be viewed by graduate students and new faculty as the industry "norm" and model such behavior.

The distribution of levels of plagiarism varied from that found by Batane (2010) with 14% of the submissions being classified as "legitimate" versus 54.7% meeting the standard in the current study. Low-scale plagiarism occurred in 26.7% of cases in this study compared to 66% in Batane (2010). Although combining the more realistic "legitimate" and "low" scales of this study with the same categories in Batane (2010), the numbers were comparable with 81.4% found in the current study and 80% in Batane (2010). At the higher levels plagiarism, the resemblance of data increased. At the medium-scale, 9.3% of cases in this study fell into this range versus 10.7% in Batane (2010) while high-scale instances encompassed 9.3% of papers in this study vis-a-vis 8.8% in Batane (2010).

Some caution in the review of these results is required. Although the use of Turnitin removed much of the bias in determining the rate of plagiarism in the analyzed articles the software is not perfect. As noted previously, some false positive results were indicated and had to be removed from the analysis. It is possible that not all false positive index overlaps were removed. Also, there is some natural overlap among research articles due to the similar language used among them. For example the phrase "a statistically significant difference was detected" is commonly used in research, thus it could be presented as an overlap with source material when in fact it is a legitimate, original piece of the work. Extreme care was taken to insure that the articles were classified within the delineations noted in this study. During the analysis process it was almost always clear and obvious if an article violated the boundaries demarcated by the definitions of each type of delinquency. The finite boundaries outlined in this study should provide for ease of replication in future research. Lastly, although the findings of this study should certainly be concerning for the aviation research community, the fact that parametric analysis could not be conducted due to the

nature and distribution of the data as well as that two primary research journals could not be analyzed due to format constraints, the conclusions of this study cannot be interpreted as applicable to the entire body of aviation research without further inquiry.

Clearly, plagiarism is a concern for all education stakeholders from students to faculty to administrators. Such misconduct is unethical and undermines the utility and legitimacy of the work. Borrowed or recycled findings do little for the research community and the turning of a blind eye to such transgressions by faculty, reviewers, and editors only further enables deviant behavior. This study indicates that plagiarism is a problem in aviation research, as it is in many other fields of study. The findings of this research indicate a need for more ethical oversight of aviation research. As suggested by Batane (2010), Homer and Minifie (2011), Sikes (2009), and Shahabuddin (2009), researchers must model ethical behavior for their peers and students. Furthermore, these researchers indicated the need for ethical oversight bodies and a more aggressive and uncompromising response from editors and their reviewers. Only through these actions can improvements be made in the legitimacy and quality of research produced by a particular field -and only then will true enhancements and advancements be made possible.

Recommendations for Future Research

The findings of this study revealed several aspects

concerning plagiarism in aviation research that would benefit from future research. These include:

1. A wider study should be conducted with the hope that improved inferential statistics would be usable to improve the quality of results and its applicability to a larger body of research. If possible digitized versions of omitted journals should be included.
2. A study of faculty opinions about plagiarism and how they would define it would add to the understanding of this type of misconduct. An inquiry into how it is handled if it is detected. Also, investigation into the types of plagiarism detection software should be included.
3. This study should be repeated every several years to track trends of plagiarism in aviation research.
4. A survey of aviation journal editors should be conducted to see how they define plagiarism and how they handle it as well as inquire into how it is handled if it is detected. Also, investigation into the types of plagiarism detection software should be included. +

David Ison has been involved in the aviation industry for over 25 years during which he has flown as a flight instructor and for both regional and major airlines. He has experience in a wide variety of aircraft from general aviation types to heavy transport aircraft. While flying for a major airline, David was assigned to fly missions all over the world in a Lockheed L-1011. Most recently, he flew Boeing 737-800 aircraft throughout North and Central America. His true dream was to become an aviation educator which led him to teaching at the college level first working as an associate professor of aviation for seven years at a small college in Montana. He is currently discipline chair- aeronautics and an assistant professor of aeronautics for Embry-Riddle Aeronautical University- Worldwide. He also serves as research faculty assisting doctoral learners at Northcentral University. David has conducted extensive research concerning aviation faculty, plagiarism in dissertations, statistics in aviation research, as well as the participation of women and minorities in aviation. His previous work has been published in refereed journals and has been presented at numerous education and industry conferences. David also is regularly published in popular aviation publications such as *Plane & Pilot*, *Professional Pilot*, and *IFR Refresher*. ASA Publications just released his first book, *Oral Exam Guide: Aircraft Dispatcher*. His educational background includes a master's in aeronautical science from Embry-Riddle Aeronautical University and a Ph.D. in educational studies/higher education leadership/aviation higher education from the University of Nebraska- Lincoln.

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