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COLLEGIATE AVIATION REVIEW

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Cover Image: The cover depicts the new 336 foot high Memphis International Airport control tower, eclipsing the old control tower to its right. The photo was located on airliners.net and is reprinted by permission of the photographer, John E. Jauchler.

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No juried publication can excel, unless experts in the field serve as anonymous reviewers. Indeed, the ultimate guarantors of quality and appropriateness of scholarly materials for a professional journal are the knowledge, integrity, and thoroughness of those who serve in this capacity. The thoughtful, careful, and timely work of the Editorial Board and each of the following professionals added substantively to the quality of the journal, and made the editor's task much easier. Thanks are extended to each reviewer for performing this critically important work. In addition to the members of the Editorial Board, the reviewers for this issue include:

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STATEMENT OF OBJECTIVES

The *Collegiate Aviation Review* is published semi-annually by the University Aviation Association. Papers published in this volume were selected from submissions that were subjected to a blind peer review process, for presentation at the 2010 Fall Education Conference of the Association.

The University Aviation Association is the only professional organization representing all levels of the non-engineering/technology element in collegiate aviation education. Working through its officers, trustees, committees and professional staff, the University Aviation Association plays a vital role in collegiate aviation and in the aviation industry.

The University Aviation Association accomplishes its goals through a number of objectives:

> To encourage and promote the attainment of the highest standards in aviation education at the college level.
>
> To provide a means of developing a cadre of aviation experts who make themselves available for such activities as consultation, aviation program evaluation, speaking assignments, and other professional contributions that stimulate and develop aviation education.
>
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The *Collegiate Aviation Review (CAR)* is the refereed journal of the University Aviation Association (UAA). Both qualitative and quantitative research manuscripts relevant to collegiate aviation are acceptable. The *CAR* review process incorporates editorial recommendations from a panel of blind peer reviewers active in the focus area of each manuscript. A list of all reviewers is published in each edition of the *CAR*, or is available from the *CAR* editor.

Authors should e-mail their manuscript, in Microsoft Word format, to the editor at CARjournal@uaa.aero no later than December 1 (Spring 2011 issue) or June 1 (Fall 2011 issue). Manuscripts must conform to the guidelines contained in the *Publication Manual of the American Psychological Association, 6th ed*. Previous editions of the CAR should also be consulted for formatting guidance. All submissions must be accompanied by a statement that the manuscript has not been previously published and is not under consideration for publication elsewhere.

If the manuscript is accepted for publication, the author(s) will be required to submit a final version of the manuscript via e-mail, in "camera-ready" Microsoft Word format, by the prescribed deadline.

All authors will be required to sign a "Transfer of Copyright and Agreement to Present" statement in which (1) the copyright to any submitted paper which is subsequently published in the *CAR* will be assigned to the UAA and in which (2) the authors agree to present any accepted paper at a UAA conference to be selected by the UAA, if requested. Students are encouraged to submit manuscripts to the *CAR*. A travel stipend for conference attendance up to $500 may be available for successful student submissions. Please contact the editor or UAA for additional information.

Questions regarding the submission or publication process may be directed to the editor at (615) 494-8755, or may be sent by email to: CARjournal@uaa.aero.

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The Effect of Energy Drink Consumption on Collegiate Flight Students' Pilot Skills in a Simulated Flight Environment

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ABSTRACT

Over the last decade, energy drinks have become ubiquitous on college campuses. The global market for these drinks exceeds billions of dollars a year and new 'energy' products are progressively marketed and introduced annually. Outside of college student populations, the effects of energy drinks have been examined extensively. However, among college students, limited energy drink research has been conducted, and this study was the first to examine the effects of energy drinks among collegiate flight students. The purpose of this study was to determine the effects of energy drink consumption on collegiate flight students' pilot skills in simulated flight. Thirty collegiate flight students participated in two distinct simulated flight sessions after consuming a 16-ounce energy drink and a 16-ounce placebo. After students consumed each drink, the researchers evaluated pilot skills in three distinct areas; straight and level flight, complex turns, and in-flight emergencies. Even though statistical analysis on some of the flight session data failed to disprove the null hypothesis (H_0): *The consumption of energy drinks has no significant effect on collegiate flight students' pilot skills*, the results of this investigative study raise new questions and concerns regarding collegiate student pilots and provide a springboard for future research projects.

INTRODUCTION

Since the introduction of Red Bull in the United States in 1997, the energy drink market has grown exponentially. Red Bull sales alone increased from nearly 1 billion cans in 2000, to over 3 billion in 2006 (Red Bull GmbH, 2008). Between 2002 to 2006, the energy drink market increased at an average growth rate of 55% per year with over 500 new brands of energy drinks being released worldwide in 2006 (Reissig, Strain, & Griffiths, 2009). During this time frame, energy drink sales increased from just over \$1.0 billion dollars to estimates of \$3.5 and \$4.7 billion in 2006 and 2007 (Cohen, 2008; Reissig et al., 2009). According to a 2010 Ademodhi article, the 5-Hour energy drink, launched in the United States in 2004, has now topped Red Bull to become the most popular energy drink among college students. The popularity of this two ounce shot makes sense because it is incredibly easy to conceal and consume discreetly.

A large part of these increases are due to the addictive properties of energy drinks and aggressive advertising campaigns directed towards college students (Buchanan, 2010; Malinauskas, Aeby, Overton, Carpenter-Aeby & Barber-Heidal, 2007; & Pohler, 2010). One example, often seen on college campuses and at athletic events, is energy drink companies giving out free samples of their products. The objective of this strategy is simple; give young people, who have been identified as having a harder time resisting immediate rewards in the face of long term consequences, free samples to get them using a product. Then, once they are hooked, charge high prices and take full advantage of the stimulating, euphoric, and addictive properties of these drinks.

Research indicates that adolescents and young adults (those under age 25) are more vulnerable to substance use, due to incomplete development of the memory, stress, and pleasure reward centers of the brain (Lubman, Yücel & Hall, 2007; Miller & Carroll, 2006). This is an important consideration for college students because the earlier they start using energy drinks, the greater their chances of suffering from developmental brain changes that increase the likelihood of future psychological problems including addiction, depression, and anxiety.

Energy Drink Use among College Students

Energy drink use has become widespread among college students and evidence suggests that usage rates could be even higher among special student populations such as medical students and athletes who are under increased cognitive and performance demands (Oteri, Salvo, Caputi & Calapai, 2007; Woolsey, 2007). However, to date, only a handful of studies have been conducted to determine energy drink usage rates among college students and most of these studies have also been concerned with the combined-use of alcohol and energy drinks. Malinauskas et al. (2007) surveyed 496 US college students and found that 51% reported drinking at least one energy drink each month in the past semester. The top reasons cited for using energy drinks were: insufficient sleep, low energy levels, studying, driving for an extended period of time, and to mix with alcohol or to treat a hangover. Weekly jolt and crash episodes were experienced by 29% of users, with 22% reporting headaches and 19% reporting heart palpitations from consuming energy drinks.

In a July 2008 study, Miller examined the relationships between energy drink consumption and risk-taking in 795 undergraduate students. Frequent energy drink consumers (six or more days a month), according to the study's findings, were approximately three times as likely than less-frequent energy drink consumers or non-consumers to have smoked cigarettes, abused prescription drugs, or been in a serious physical fight in the year prior to the survey. In the Miller study, energy drink users reported drinking more alcohol, having more alcohol-related problems, and using marijuana about twice as often as non-consumers. Energy drink users were also more likely to engage in other forms of risk-taking, including unsafe sex, not using a seatbelt, participating in an extreme sport, or doing something dangerous on a dare.

Energy Drink Performance Enhancement Studies

Research studies have been conducted on the main ingredients found in energy drinks and these studies support energy drink manufacturers claims of increased performance, endurance, concentration, reaction time, and enhanced mood (Seidl, Peyrl, Nicham & Hauser, 2000; Warburton, Bersellini & Sweeney, 2001; Scholey & Kennedy, 2004a; 2004b; Deixelberger-Fritz). Studies that examined the traditional ingredients in energy drinks have found sustained attention and reaction time (Deixelberger-Fritz et al., 2003; Alford, Cox & Wescott, 2001; Warburton et al., 2001), improved mood and mental performance (Smit & Rogers, 2002; Deixelberger-Fritz et al., 2003), and improved driving performance and alertness (Alford et al., 2001; Warburton et al., 2001; Reyner & Horne, 2001; 2002). Researchers note a synergistic affect when the individual ingredients within energy drinks are mixed together and improvements beyond what caffeine alone will provide (Deixelberger-Fritz et al., 2003; Scholey & Kennedy, 2004a, 2004b).

Ingredients in Energy Drinks

In the basic energy drink, the stimulant and euphoric effects are felt from the main ingredients of caffeine, glucuronolactone (i.e., glucose), taurine, B-complex vitamins, inositol, panthenol, and niacin (Oteri et al., 2007). What college students may be unaware of is that newer brands of energy drinks such as Spike and Redline, contain up to 4 times the amount of caffeine per ounce, and also contain powerful herbal compounds such as yohimbine hydrochloride (HCL) and evodamine which are far more dangerous stimulants than caffeine (Energyfiend.com, 2010). Because of previous serious health complications experienced by users, these drinks now contain warning labels recommending not consuming more than 4 ounces of these 8 ounce drinks at one time. However, these are still sold commonly at convenience stores.

Energy Drink and Pilot Studies

At the time of this study, only one additional study (Deixelberger-Fritz et al., 2003) researched the effects of energy drinks on pilots. The Deixelberger-Fritz et al. study concluded that energy drink participants experienced an improvement or increase in decision time and performance increments. While this study evaluated licensed pilot participants using cognitive performance tests and psycho-physiological state tests, it did not evaluate participants in realistic flight scenarios that would examine pilot skill. Furthermore, the study consisted of twenty-four commercial and military pilots with age ranges from 23-40 years of age; not collegiate flight students.

RESEARCH METHODOLOGY

Today millions of people, including college students, are turning to energy drinks to help them get through the day and to improve alertness. As witnessed by widespread use and positive testimonials, energy drinks appear to be perceived as safe and a socially acceptable way to increase energy and enhance performance.

The main question is: do energy drinks really enhance performance on the execution of complex skills? Additionally, what happens when an individual is put under a naturally stressful situation? Does energy drink consumption actually have a positive effect on collegiate flight students' skill set (i.e., increasing their abilities to accurately conduct instructed flight procedures; responding to flight instructions and procedures; and completing instructed flight procedures in a prescribed amount of time)? The purpose of this research study was to answer these questions. The following hypothesis was established for this research study:

H_0: The consumption of energy drinks has no significant effect on collegiate flight students' pilot skills.

H_1: The consumption of energy drinks has a significant effect on collegiate flight students' pilot skills.

To measure any possible effects from energy drink consumption on student pilot skill, this study used a two-group (Group A and B) reverse treatment pretest-posttest design. Thirty collegiate student pilots participated in two distinct flight sessions in a Fidelity Flight Simulation MOTUS 622i, which can be configured for multiple aircraft types and training scenarios. Each student pilot participated in two flight sessions, completed on separate days to eliminate any potential residual effects from the energy drink on each participant. All sixty flight sessions were completed within a two week timeframe in March and April of 2010. Participants conducted each flight session after consuming either a 16-ounce energy drink or a comparable tasting 16-ounce placebo without caffeine. All participants were randomly assigned to both Group A or Group B. Group A participants received the energy drink for flight session one and the placebo for flight session two. Group B participants received the reverse; placebo for flight session one and the energy drink for flight session two.

Both flight sessions created by the researchers contained segments of straight and level flight, complex turns, and an in-flight emergency. Each student began their simulated flight with a straight and level attitude, and they were then verbally instructed by the simulator technician to complete the tasks of the flight scenario. Weather conditions for each flight session consisted of daytime VFR conditions, calm winds, clear skies, and unlimited visibility. Each flight session was identical in complexion and duration, with the exception of the in-flight emergencies. In each session, straight and level flight was measured for the same number of segments and duration, and complex turns contained the same combinations of change in altitude, heading, and airspeed. Each flight session was different in the order of instructed tasks and each session began at a different heading and altitude. These changes in each flight session limited each participant's ability to improve their performance due to experience in the flight simulator, while enabling researchers the ability to directly compare results of both flight sessions. The two in-flight emergencies, an engine failure and an engine fire, required the flight students to review and act based on a checklist placed in the simulator before the start of their flight session. The student had to locate the proper in-flight emergency checklist and follow the required five steps of the checklist.

For each flight session, the flight student consumed a16-ounce energy drink or placebo in a non-identifying white cup with a lid and a straw. This prevented the participant from identifying the color of the drink and potentially recognizing the drink's brand. The student was given five minutes to consume their 16-ounce drink; and after consuming the drink, the student waited an additional thirty minutes before beginning their flight scenario in order for the energy drink to be absorbed in the participant's body.

There were three popular energy drink brands used in this study: Monster, Rockstar, and NOS. In 2008, these drink brands represented three of the six most popular energy drinks in the United States. As a group, Monster, Rockstar, and NOS represented approximately 40% of 2008 US sales (The Top 15 Energy Drink Brands, 2008). Each of the three energy drinks used in this study were randomly assigned to each participant, with an even distribution of each product administered ten times. The researchers developed a placebo similar in taste to the energy drinks used in this study; however, only ingredients that did not contain caffeine or other stimulants were used to create the placebo.

Each participant's two flight sessions were recorded using video and audio recording devices. A video recorder was used to record progression of time and cockpit flight instrumentation for the duration of each flight session. Additionally, a microphone was attached to the participant's headset to record audio communication between the participant and simulator technician. For each flight scenario, the video recorder was fixated on a computer monitor that projected the flight instruments of the flight simulator. Additionally, a timer with measurements to a tenth of a second was placed next to the computer monitor with the flight instruments. Both the monitor and timer were included in each video recording. The microphone was connected from the participant's headset to the video recorder. This recorded all audio communication, real time, from the participant onto the video recording. Before each flight session was started, the simulator technician would initiate the microphone, video recorder, and timer allowing the researchers to evaluate the flight session for accuracy through video, audio, and time.

To test statistical significance of the means from the data collected from the flight sessions, a dependent paired sample *t* test was conducted at the .05 significance level (confidence interval of 95%). A confidence interval of 95% means that in case of rejecting the H_0, the researchers are 95% or more certain they did the right thing. For statistical analysis, data was entered into Statistical Package for the Social Sciences (SPSS) software. The calculations from SPSS included Mean, N = sample size, SD = standard deviation, *t* = t statistic, DF = degrees of freedom, and Sig. = significance level.

Selection of the Research Population

The participating collegiate flight students were undergraduate aviation students majoring in Professional Pilot at Oklahoma State University. In order to meet the requirements for this study, each flight student had to be currently enrolled in a flight course for academic credit, had logged a minimum of 25 total flight hours, and be at least 18 years of age. A total of 41 flight students volunteered to participate in this study; however, only 30 students actually completed the required two flight sessions. Permission to perform this research study involving OSU flight students was approved by the Institutional Review Board at Oklahoma State University, Stillwater, Oklahoma, on March 2, 2010 (IRB application number: ED1017).

A brief demographic survey was administered to each participant before they began their first flight session. One of the questions asked the participating flight student to identify their academic classification. Table 1 indicates that of the 30 participants; 7% were freshman, 20% were sophomores, 40% were juniors, and 33% of participants were seniors.

Table 1: *Academic Classification of Participants*

Academic Classification	Number of Participants	Percentage of Participants
Freshman	2	7%
Sophomore	6	20%
Junior	12	40%
Senior	10	33%

The total number of logged flight hours was also solicited from the participating flight students. As shown in Table 2, 53% of participants had 149 or fewer logged flight hours; whereas, 47% of participants had 150 or more logged flight hours.

Table 2: *Logged Flight Hours of Participants*

Number of Logged Flight Hours	Number of Participants	Percentage of Participants
25 – 49	2	7%
50 – 99	7	23%
100 – 149	7	23%
150 – 199	5	17%
200 – 249	1	3%
250 & Over	8	27%

RESULTS

This study evaluated the pilot skill of collegiate flight students in three distinct areas; straight and level flight, complex turns, and in-flight emergencies. After the thirty participants completed both of their simulated flight sessions, the researchers were able to statistically compare each participant's flight results after consuming the energy drink and the placebo.

Straight and Level Flight

Each simulated flight session consisted of four different segments of straight and level flight. Each of these segments lasted thirty seconds. Each participating flight student began their flight session in a straight and level attitude and was verbally instructed by the simulator technician to proceed with their flight holding a specific altitude, heading, and airspeed. Measurements were recorded by the researchers to evaluate the student's ability to hold this straight and level flight in three specific parameters; altitude, heading, and airspeed. To measure each participant's flight results, researchers viewed the video recording of the participant's flight instruments. The video was paused every three seconds to allow the researcher to accurately record the current position of flight instruments indicating altitude, heading, and airspeed. Each of the three parameters was recorded in specific increments; altitude was recorded in increments of 100 feet, airspeed was recorded in increments of five knots, and heading was recorded in increments of five degrees.

Regarding each segment of straight and level flight, the participant was verbally instructed by the simulator technician in each of the three parameters. For example;

- *Proceed straight and level at 180°, 95 Knots, and 2,500 feet.*

Overall accuracy of each straight and level segment completed by the participant was measured by assigning a point system based on his/her ability to hold the instructed parameters of straight and level flight. For each increment of inaccuracy, the participant was assigned one point. All points were then calculated and recorded. Table 3 represents a nine-second example of a participant's straight and level flight segment. Zero (0) seconds represent the starting point of each straight and level segment: 1600 feet, 95 knots, and 150 degrees heading. The shaded boxes indicate the participant's instruments at that particular time (0, 3, 6, or 9 seconds) in the straight and level segment. For example, at the six second interval, the participant was flying at 1,700 feet instead of the required 1,600 feet and 90 knots instead of the required 95 knots; resulting in a two-point penalty.

Table 3: *Measuring Straight and Level Flight Accuracy*

Altitude – 0 Seconds						
1300	1400	1500	**1600**	1700	1800	1900
Heading – 0 Seconds						
135	140	145	**150**	155	160	165
Airspeed – 0 Seconds						
80	85	90	**95**	100	105	110

Altitude – 3 Seconds						
1300	1400	1500	**1600**	1700	1800	1900
Heading – 3 Seconds						
135	140	145	**150**	155	160	165
Airspeed – 3 Seconds						
80	85	90	**95**	100	105	110

*Zero point deduction, all pre-set parameters met.

Altitude – 6 Seconds						
1300	1400	1500	**1600**	1700	1800	1900
Heading – 6 Seconds						
135	140	145	**150**	155	160	165
Airspeed – 6 Seconds						
80	85	90	**95**	100	105	110

*Two point deduction (1 point for 100 ft increase in altitude and 1 point for 5 knots decrease in airspeed).

Altitude – 9 Seconds						
1300	1400	1500	**1600**	1700	1800	1900
Heading – 9 Seconds						
135	140	145	**150**	155	160	165
Airspeed – 9 Seconds						
80	85	90	**95**	100	105	110

*Four point deduction (1 point for 100 ft increase in altitude, 1 point for 5 degrees off in heading, and 2 points for 10 knots decrease in airspeed).

When comparing participants' straight and level segments after consuming both energy drink and placebo, the majority of participants completed their straight and level segment more accurately after consuming the placebo. As shown in Table 4, 87% of participants had a larger number of point deductions after consuming the energy drink.

Table 4: *Participants Receiving Deductions - Straight and Level Flight Session*

	Total Participants	Percentage
Number of Participants Receiving Deductions - Energy Drink	26	87%
Number of Participants Receiving Deductions - Placebo	4	13%

Furthermore, after comparing the total number of points for all thirty participants, the energy drink sessions had more total point deductions than the placebo sessions. Table 5 indicates the energy drink sessions had a total of 1600 point deductions; whereas, the placebo sessions only had a total of 947 point deductions.

Table 5: *Participant's Total Point Deduction - Straight and Level Flight Session*

	Total Points	Percentage	N	M	SD	*t*	DF	Sig.
Total Point Deductions after Energy Drink Consumption	1600	63%	30	53.33	27.42	-5.721	29	0.00
Total Point Deductions after Placebo Consumption	947	37%	30	31.57	22.59			

Complex Turns

Each flight session also consisted of three complex turns including a change in altitude, heading, and airspeed. For each complex turn, participants were instructed to simultaneously change their altitude and heading while holding a required airspeed instructed by the technician. The measurement of each complex turn consisted of timing the participants from beginning to completion of the instructed complex turn. Each complex turn in each flight session was different in the amount of change in altitude, heading, and airspeed. For example, the participant was verbally instructed by the simulator technician to change altitude, heading, and airspeed:

- *Decrease and hold airspeed to 70 knots, climb to 2,800 feet, and change course to 240°.*

Since both flight sessions were started at different headings and altitudes, the complex turns were not the same to the participant; however, the complex turns were identical from a measurement standpoint for the researchers. As shown in Table 6, when measuring the total amount of time to complete the complex turns, 16 of the 30 participants (53%) completed the maneuver in less time after consuming the energy drink. In comparison, 14 of the students (47%) completed the maneuver in less time after consuming the placebo.

Table 6. *Participant's Time to Complete Complex Turn*

	Participants	Total Seconds	Average Time per Participant	SD	*t*	DF	Sig.
Quicker Completion – Energy Drink	16	1272	79.5 Sec.	6.15	7.33	14	0.00
Quicker Completion - Placebo	14	1390	99.2 Sec.	9.08			

But as a follow-up, after each complex turn the participants were instructed to complete a straight and level flight segment. The instructed ending point of the complex turn was the same altitude, heading, and airspeed parameters as the upcoming straight and level flight segment. The measurement of the straight and level flight segments after each complex turn did not begin until participants were able to achieve altitude, heading, and airspeed simultaneously for one second. Participants were measured to see how long it would take them to level out and begin their straight and level flight segment.

In Table 7, all 30 participants are compared to their response times to begin the straight and level flight segments after completing their complex turns in both flight sessions (energy drink and placebo).

Table 7. *Participant Response Time to Achieve Straight and Level Flight*

	N	Average Seconds	SD	*t*	DF	Sig.
Participants Consuming Energy Drink	30	88.73	42.43	-.834	29	.411
Participants Consuming Placebo	30	79.96	43.85			

As shown in Table 7, the energy drink participants, on average, took approximately 10 additional seconds to achieve straight and level flight than the placebo participants. So even though the participant may have completed the complex turn quicker after consuming the energy drink, it took that participant longer to get the aircraft in the proper attitude to begin the straight and level flight segment.

In-Flight Emergencies

Each flight session consisted of an in-flight emergency that required participants to identify the proper checklist and react based on the instructions of the proper checklist. Since each emergency was different, researchers compared the in-flight emergency within each flight session separately.

Upon being verbally informed of an in-flight emergency by the simulator technician, the participant was expected to review and follow a five-step checklist that was placed in the flight simulator before the beginning of the flight session. Depending on the flight session, each participant experienced an engine failure or engine fire. The checklist required participants to act as follows:

Engine Failure

- Airspeed – 60 KIAS
- Mixture – Idle Cut Off
- Ignition Switch – Off
- Wing Flaps – 30° Required
- Master Switch – Off

Engine Fire

- Mixture – Idle Cut Off
- Fuel Selector Valve – Off
- Master Switch – Off
- Alternate Air – Off
- Airspeed – 100 KIAS

When measuring the ability of participants to accurately follow the five-step checklist in order, participants were less accurate after consuming the energy drink than after consuming the placebo. Table 8 illustrates the number of accurate and complete steps accomplished by participants after consuming the energy drink and the placebo.

Table 8: *Participant's In-Flight Emergency Checklist Accuracy*

Energy Drink

Steps Complete	Participants	Percentage
Zero	1	3%
One	0	0%
Two	2	7%
Three	0	0%
Four	3	10%
Five	24	80%

Placebo

Steps Complete	Participants	Percentage
Zero	0	0%
One	0	0%
Two	1	3%
Three	0	0%
Four	4	14%
Five	25	83%

Table 9 compares the total number of accurate and completed in-flight emergency checklist steps completed by participants after consuming the energy drink and the placebo.

Table 9: *Participant's Number of Accurate Completed Checklist Steps*

	N	Total Accurate Steps	Average Steps	SD	*t*	DF	Sig.
Energy Drink	30	136	4.53	1.16	.909	29	.371
Placebo	30	143	4.76	.626			

Table 10. *Participant's Time to Complete In-Flight Emergency Checklist*

	N	Total Seconds	Average Seconds	SD	*t*	DF	Sig.
Energy Drink	30	1565	52.16	23.73	-1.16	29	.253
Placebo	30	1397	46.56	15.86			

In Table 10, the total amount of time to complete the in-flight emergency checklist is compared between participants after consuming the placebo and energy drinks.

CONCLUSIONS

Several studies have reported performance enhancing effects of energy drinks, which contributed to their increased usage for performance situations (Ballard, Wellborn-Kim & Clauson, 2010; Smit, H. J., Cotton, J. R., Hughes, S. C. & Rogers, P. J., 2004; and Smit & Rogers, 2002). The 5-Hour energy drink television commercials with father and son NASCAR drivers Rusty and Steve Wallace are an example of this performance enhancement marketing strategy (5-Hour Energy, 2010). Maintaining this focus on performance-based considerations, the researchers studied the overall effects of energy drink consumption on pilot skills in collegiate flight students in three distinct areas; straight and level flight, complex turns, and in-flight emergencies.

Straight and Level Flight Discussion

When comparing the participating student pilots' straight and level flight segments, 87% of the pilots had a larger number of point deductions after consuming the energy drink. Moreover, after comparing the total number of points for all 30 pilots, the energy drink sessions had a total of 1,600 point deductions; whereas, the placebo sessions only had a total of 947 point deductions. After analyzing total point deductions, a paired sample *t* test (t(30) = -5.721, Sig. = 0.00) resulted in statistical significance probability that the relationship between the two variables exists and is not due to chance. Therefore, the null hypothesis, H_0: *The consumption of energy drinks has no significant effect on collegiate flight students' pilot skills*, is rejected at the .05 significance level.

Complex Turns Discussion

When measuring the total amount of time to complete the complex turns, 53% of the student pilots completed the maneuver quicker after consuming the energy drink. While some may view this as a performance-based improvement, it actually took the energy drink participants approximately 10 additional seconds to recover from the complex turn and achieve straight and level flight when compared to the placebo participants. For statistical analysis, a paired sample t test was performed on complex turn completion and the response time to achieve straight and level flight. Results of the t test (t(30) = 7.338, Sig. = 0.00) indicated statistical significance for time to complete complex turns; however recover time to achieve straight and level flight after completing the complex turn was not statistically significant (t(30) = -.834, Sig. = .411) at the .05 significance level. Even though it took the energy drink participants longer to recover from the complex turn, the analyzed results of recovery time to achieve straight and level flight after completing the complex turn was not statistically significant and the null hypothesis, H_0: *The consumption of energy drinks has no significant effect on collegiate flight students' pilot skills*, was not rejected for this segment of the flight session.

In-flight Emergency Checklist Discussion

When measuring the ability of the student pilots to accurately follow (in order) the five-step in-flight emergency checklist, participants were less accurate after consuming the energy drink compared to the placebo. On average, the energy drink pilots accurately completed 4.5 steps of the five-step checklist; whereas, the placebo pilots accurately completed 4.8 steps. Furthermore, it took the energy drink participants an average of 52 seconds to complete the in-flight emergency checklist; whereas the placebo participants were able to complete the checklist in lesser time, an average of 47 seconds.

While the descriptive data recorded during the in-flight emergency flight sessions indicated an overall improvement in flight performance for the student pilots after consuming the placebo drink; surprisingly, the completion of emergency steps and the total time to complete the steps were not statistically significant. Results of t tests performed on number of accurate emergency steps completed ($t(30) = .909$, Sig. = .371) and total time to complete emergency steps ($t(30) = -1.167$, Sig. = .253) were not statistically significant at the .05 significance level; therefore; the null hypothesis, H_0: *The consumption of energy drinks has no significant effect on collegiate flight students' pilot skills*, was not rejected for the in-flight emergency segment of the flight session.

FINAL REMARKS

Perhaps gulping down an energy drink is perceived by some as a quick way to gain extra energy to get through the day, compensate for perceived nutritional deficiencies in herbs, vitamins and minerals to boost endurance, or improve brain function. However, as demonstrated by this study, college flight students became less able to perform routine flight maneuvers or apply what they have learned to unpredicted flight situations; providing an argument that the ingredients of energy drinks reduce performance decrements due to reduced alertness and concentration.

Even though there were limitations to this study: (1) the number of eligible participants during the data collection phase of this project was relatively small; therefore, the generalization of findings may be somewhat limited, (2) this study was conducted in Oklahoma and to students at one university, and (3) homogeneity, all participants were flight students whom followed the same "pilot training" curriculum - the results provide important and novel information regarding the effects of energy drink consumption on pilot skills of collegiate flight students. Most important is the finding that the energy drink pilots made more performance errors when compared to the placebo pilots in all three distinct areas of the simulated flight session: straight and level flight, complex turns, and in-flight emergencies; even though no statistical evidence from three of the flight session investigations was found to support this research finding.

Regardless of the lack of statistical significance of the research data, this type of investigation should continue. Further research should be conducted to identify if collegiate flight students recognize the amounts of caffeine and other active ingredients that are present in the wide variety of energy drinks they consume, and the physical side effects associated with energy drink consumption. Furthermore, additional simulated flight studies should be performed to determine effects that energy drink consumption may have on collegiate flight students' performance on skill sets in the cockpit.

REFERENCES

5-Hour Energy. (2010). Retrieved May 21, 2010 from http://www.5hourenergy.com/racing/default.asp

Ademodhi, A. (2010). Students weigh cost and benefits of energy drinks during finals. *The Transcript*. Retrieved May 26, 2010 from http://media.www.owutranscript.com/media/storage/paper1413/news/2010/04/29/News/Students.Weigh.Cost.And.Benefits.Of.Energy.Drinks.During.Finals-3917175.shtml

Alford, C., Cox, H., & Wescott, R. (2001). The effects of red bull energy drink on human performance and mood. *Amino Acids*, 21, 139-150.

Ballard, S. L., Wellborn-Kim, J. J., & Clauson K. A. (2010, April). Effects of commercial energy drink consumption on athletic performance and body composition. *The Physician and Sportsmedicine*, 38(1),107-17.

Buchanan, M. (2010). Addiction to energy drinks. Retrieved August 16, 2010 from http://www.helium.com/items/845026-addiction-to-energy-drinks

Cohen, H. (2008, April 2). Kids + energy drinks = dangerous mix. *The Miami Herald*. Retrieved December 8, 2009, from http://seattletimes.nwsource.com/html/health/2004322357_zhea02energy.htm

Deixelberger-Fritz, D., Tischler, M.A., & Wolfgang K. K. (2003). Changes in performance, mood state and workload due to energy drinks in pilots. *International Journal of Applied Aviation Studies*, 3(2), 195-205.

Energyfiend.com (2010). Caffeine content of drinks. Retrieved August 16, 2010 from http://www.energyfiend.com/the-caffeine-database/

Kapner, D. A. (2004). *Ephedra and energy drinks on college campuses*. The Higher Education Center for Alcohol and Other Drug Abuse and Violence Prevention. Retrieved December 8, 2009, from http://www.higheredcenter.org/files/product/energy-drinks.pdf.

Lubman, D. I., Yücel, M. & Hall, W. D. (2007) Substances and the adolescent brain: A toxic combination? *Journal of Psychopharmacology, 21*, 792-794.

Malinauskas, B. M., Aeby, V. G., Overton, R. F., Carpenter-Aeby, T., & Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students. *Nutrition Journal*, 6, 35. doi:10.1186/1475-2891-6-35

Miller, K. E. (2008, July 25). Energy drinks linked to risk-taking behaviors among college students. *Science Daily*. Retrieved May 27, 2010, from http://www.sciencedaily.com-/releases/2008/07/080724150438.htm

Miller, W. R., & Carroll, K. M. (2006). *Rethinking substance abuse: What the science shows, and what we should do about it*. New York: Guilford Press.

Oteri, A., Salvo, F., Caputi, A., & Calapai, G. (2007). Intake of energy drinks in association with alcoholic beverages in a cohort of students of the school of medicine of the University of Messina. *Alcoholism: Clinical and Experimental Research*, 31(10), 1677-1681.

Pohler, H. (2010, January). Caffeine intoxication and addiction. *The Journal for Nurse Practitioners*, 6 (1), 49-52.

Red Bull GmbH – Company History. (2008). Retrieved on November 15, 2008, from http://www.fundinguniverse.com/company-histories/Red-Bull-GmbH-Company-History.html.

Reissig, C.J., Strain, E.C., & Griffiths, R.R. (2009). Caffeinated energy drinks: A growing problem. *Drug and Alcohol Dependence*, 99, 1-10. doi:10.1016/j.drugalcdep.2008.08.001

Reyner, L. A., & Horne, J. A. (2001). Beneficial effects of an "energy drink" given to sleepy drivers. *Amino Acids*, 20, 83-89.

Reyner, L. A., & Horne, J. A. (2002). Efficacy of a functional energy drink in counteracting driver sleepiness. *Physiology and Behavior*, 75, 331-335.

Scholey, A. B., & Kennedy, D. O. (2004a). Cognitive and physiological effects of an "energy drink": An evaluation of the whole energy drink and of glucose, caffeine and herbal flavoring fractions. *Psychopharmacology*, 176, 320-330.

Scholey, A. B., & Kennedy, D. O. (2004b). A glucose-caffeine 'energy drink' ameliorates subjective and performance deficits during prolonged cognitive demand. *Appetite*, 42, 331-333.

Seidl, R., Peyrl, A., Nicham, R., & Hauser, E. (2000). A taurine and caffeine-containing drink stimulates cognitive performance and well-being. *Amino Acids*, 19, 635-642.

Smit, H. J., Cotton, J. R., Hughes, S. C. & Rogers, P. J. (2004). Mood and cognitive performance effects of "energy" drink constituents: caffeine, glucose and carbonation. *Nutritional Neuroscience*, 7. Retreived August 16, 2010 from http://www.biomedsearch.com/nih/Mood-cognitive-performance-effects-energy/15526987.html

Smit, H. J., & Rogers, P. J. (2002). Effects of 'energy' drinks on mood and mental performance: Critical methodology. *Food Quality and Preference*, 13, 317-326.

The Top 15 Energy Drink Brands. (2008, April). Retrieved May 21, 2010, from http://www.energyfiend.com/2007/04/the-15-top-energy-drink-brands

Warburton, D. M., Bersellini, E., Sweeney, E. (2001). An evaluation of a caffeinated taurine drink on mood, memory and information processing in healthy volunteers without caffeine abstinence. *Psychopharmacology*, 158, 322-328.

Woolsey, C. (2007). A study of NCAA division I athletes on the use and effects of combining alcohol & energy drinks. Doctoral dissertation, University of Missouri, Columbia. Retrieved December 10, 2009, from http://edt.missouri.edu/Summer2007/Dissertation/WoolseyC-071207-D7933/research.pdf

Instrument Pilot Course Syllabi: A Content Analysis

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ABSTRACT

The purpose of this research was to examine syllabi collected from four-year, University Aviation Association (UAA) member schools that offer Title 14 of the CFR Part 141 approved instrument pilot instruction through content analysis. These documents were examined for elements deemed essential by the research literature. This investigation sought to identify the inclusion of course descriptions, learning objectives, the coverage of topics required by regulation, the textbooks and other materials used, course assignments, evaluative tools (e.g. tests, quizzes, papers), instructional methods utilized, statements concerning class policies, and statements of academic integrity. Also, this study sought to determine if instrument pilot courses included contemporary issues, namely global position system navigation, and how this subject is conveyed to students. Instrument pilot course syllabi were found to vary widely on the inclusion of critical elements. Only 28.1% incorporated all of the recommended items. Few (15.6%) syllabi complied with Part 141 regulatory requirements for subject/objective coverage. The majority of syllabi (71.9%) included GPS instruction however the coverage of the material was very limited.

INTRODUCTION

The importance of syllabi in higher education courses is often overlooked. Syllabi set the tone for the course over the entire semester. These documents convey the expectations of the instructor and the required efforts of students in order to succeed in completing the course (Imasuen, 1999). Syllabi define how an instructor will teach a course, how to contact the instructor, and what types of materials are necessary to study the applicable material. Syllabi delineate the learning outcomes for students and provide a framework of how the semester will progress in terms of assignments, examinations, and other projects (Habanek, 2006). Students prefer to receive this clear guidance, which aids them towards completing the requisite coursework. Yet the motivation behind good syllabus design goes beyond the classroom as these documents often serve as a means of communicating outcomes and assessment for institutional self-study and accreditation (Bers, Davis, & Taylor, 2000).

Certain minimum standards for the content provided by syllabi are well known in the literature, with a large number of syllabi templates that are available to faculty (Bers, Davis, & Taylor, 2000). Numerous studies have been conducted in order to identify the most efficacious syllabi in terms of construction and content in general and for specific subject areas (Bers, Davis, & Taylor, 2000; Bers, Davis, & Taylor, 1996; Slattery & Carlson, 2005; Habanek, 2006; Johnson & Ferguson, 1998; Imasuen, 1999; Wasley, 2008). Within aviation coursework that is governed by Title 14 of the Code of Federal Regulations (CFR) Part 141, there is a need to meld campus and/or department syllabi requirements with those of federal regulations. Therefore, aviation syllabi not only must fulfill the typical communication needs to inform students of what is expected of them, but must include the content areas spelled out in the appropriate appendix of Part 141 (Federal Aviation Administration [FAA], 2009). Also, in today's rapidly changing aviation environment it is necessary for courses to cover advancing technologies so that as students are transformed into the pilots of tomorrow, they are equipped to understand and command the improvements. A prominent example of this is the need of instrument pilots to be able to learn, understand, and operate global positioning system (GPS) avionics, including the Wide Area Augmentation System (WAAS), as well as Area Navigation (RNAV) concepts including RNAV GPS approaches and Required Navigation Performance (RNP) (Peterson, 2008).

Thus it is of significant interest how well current syllabi convey the obligatory information to students including general course standards, Part 141 requirements, as well the inclusion of recent advances in content. Of particular interest are the syllabi for instrument pilot ground courses, as instrument flying is the backbone of a significant portion of commercial flight operations to which many collegiate aviation students aspire to take part, and it is also one of the most exposed to the rapidly changing technological landscape (FAA, 2008). Unfortunately, no current research exists on instrument pilot course syllabi.

The Importance of Syllabi

Syllabi are an integral part of learning. They provide a roadmap to an individual course, guiding students to their destination of course completion. The critical importance of syllabi has been identified in several research studies. Bers, Davis, & Taylor (1996) stated that syllabi "are the most complete description of classes that are made available publicly" (p. 2). Also, these guiding works provide "detail about specific class assignments, tests, classroom practices, grading standards, treatment of absences and tardiness, and course objectives that the instructor aims to achieve" (Bers, Davis, & Taylor, 1996, p. 2).

Imasuen (1999) stated that "course syllabi and the impact they have in the classroom can provide indicators of what students are expected to do in class....They are the most detailed descriptions of courses offered and they help to ensure that instructors cover required course content" (p. 8). Imasuen (1999) also noted that syllabi provide vital data necessary to determine if coursework at other institutions fulfill the requirements necessary to allow for the transfer or substitution of credit. Habanek (2006) expounded about the importance of syllabi noting that they allow "faculty members [to] define learning outcomes for students and the methods by which those outcomes will be realized" (p. 62). The syllabus also serves as an agreement or contract of how the course is to be conducted and what responsibilities and obligations will be demanded of students. Syllabi also serve as "a permanent record of curriculum and [are] sometimes considered to have official meaning" (Habanek, 2006, p. 62). Davidson and Ambrose (1994) noted that "students learn more effectively when they understand the faculty members' intentions and expectations about a course" (p. 31). Thus syllabi are not simply tossed aside by students upon receipt – students do in fact desire clear instructions and expectations for courses they take.

Evidence also exists that indicates that aviation programs benefit from well constructed syllabi. Johnson and Ferguson (1998) stated that "well-developed performance learning objectives provide the underlying foundation for effective learning" (p. 1). So not only is mention of these objectives within a syllabus necessary, they must be clear and comprehensive to provide the needed guidance to students, faculty, and assessors (Bers, Davis, & Taylor, 2000; Imasuen, 1999). "Developing clear learning objectives has many advantages for students...the student gains a better understanding of the instructor's expectations and the instructor can actually see the subject matter that has to be taught" (Johnson & Ferguson, 1998, p. 2). With a well-designed syllabus "student confusion and frustration can be limited or eliminated altogether, making the learning experience an enjoyable process" (Johnson & Ferguson, 1998, p. 2). In summary, Johnson and Ferguson (1998) noted that "clear learning objectives provide the instructor with a precise roadmap necessary for the instructional process to progress steadily and with coherence throughout the duration of the course" (p. 2).

Slattery and Carlson (2005) stated that "syllabi can be useful in engaging students and creating an effective classroom atmosphere" (p. 159). Detailing the crucial nature of syllabi, Slattery and Carlson (2005) noted that:

> A strong syllabus facilitates teaching and learning. It communicates the overall pattern of the course so a course does not feel like disjointed assignments and activities, but instead an organized and meaningful journey.... Syllabi are a ubiquitous part of the teaching process... a syllabus serves seven purposes. It sets the tone for the course, motivates students to set lofty but achievable

> goals, serves as a planning tool for faculty, structures students' work over the course of the semester, help faculty plan and meet course goals in a timely manner, serves as a contract between faculty and students about what students can expect from faculty and vice versa, and is a portfolio artifact for tenure, promotion, or job applications (p. 159).

It is evident that existing research supports the assumption that syllabi are an essential, functional, and supportive component of the classroom learning process. It is no surprise, then, that the literature has also investigated what is necessary to include within this all-important document.

What Makes a Syllabus a Good Syllabus?

Johnson and Ferguson (1998) explained that it is necessary to have objectives that are specific versus vague. For example words like know, appreciate, and understand should be avoided and instead be replaced with words such as identify, analyze, and implement, respectively. Slattery and Carlson (2005) discovered that syllabi were either written in a "warm and friendly, formal, condescending, or confrontational" (p. 159) manner. Wasley (2008) noted that research indicates that students are sensitive to the feel or mood of the syllabus. Students reported that "they would be significantly less comfortable approaching the author of [a] 'punishing' syllabus" (Wasley, 2008, A11). Habanek (2006) stated that the syllabus:

> should clearly model the accountability agreement between professor and a student by the information it provides. The syllabus should explain how the course has been designed by the professor to facilitate learning and what the professor will do to help all students achieve course goals (p. 62).

It is apparent that clear, concise rules, objectives, and guidance should be built into the syllabus to ensure that it will be successful in augmenting student awareness of course and instructor expectations.

Bers, Davis, and Taylor (1996) provided much more detail concerning what should be included in a syllabus. These authors described the need for a generic school or department-wide syllabus which "provides the basic framework for all sections of that course, is used for articulation and official reports, is relatively general in nature, and helps ensure that all instructors cover required content" (p. 2). Each individual instructor then takes this generic syllabus and molds it to develop a document unique for the individual section. This is where students will find tailored information such as assignments, textbooks, tests, due dates, and policies.

More specifically, Bers, Davis, and Taylor (1996) mentioned eleven essential components to include in syllabi:

> (1) course prefix, number, name, and credit for lecture or laboratory hours;
> (2) prerequisites;
> (3) course description from the catalogue;
> (4) learning objectives, or what knowledge and skills the student is expected to acquire in the course;
> (5) academic integrity statement...;
> (6) outline of topics to be covered in the course;
> (7) methods of instruction;
> (8) required course practices such as reading, writing in-class or out-of-class assignments, oral presentations, computer use, labs, and fieldwork or clinical assignments;
> (9) instructional materials such as textbooks and other reading assignments;

(10) methods of evaluating student progress, such as tests, assignments, class participation, and other ingredients that could in a student's grades;
(11) other course information about expectations about attendance, class policy on make-up examinations, incomplete assignments, tardiness, and references to support services such as tutoring and important college dates (p. 14).

In a later study, Bers, Davis, and Taylor (2000) expand upon what to include in syllabi: "Well-done syllabi identify learning objectives or expected learning outcomes, enumerate topics or learning activities to be covered, and describe the learning activities in which students will engage. Logical syllabi link these so that they are mutually supportive" (p. 4). Slattery and Carlson (2005) described the "parts of an effective syllabus, which include...identifying information, course description, course goals, ways to meet course goals, grades, schedule, rationale, motivational messages, and university support services" (pp. 160-162).

Even in light of the guidelines described in the literature, studies have indicated that a large number of syllabi do not meet these minimum requirements. A great deal of variability in syllabi content was noted by White (2004) while Okumus and Wong (2007) found that the "contents of [strategic management syllabi] do not really reflect recent and advanced developments in the generic strategy field" (p. 77). Davidson, Garton, and Joyce (2003) noted that only a few of the 25 collected syllabi included crucial items such as the type of instructional method that was to be utilized. Drisko (2008) found that very few of the 48 syllabi collected addressed the necessary course content. Cashwell and Young (2004) discovered that 29% of the syllabi collected had omitted course objectives. Incomplete, inconsistent, or confusing syllabi can be problematic for students. Yet, as these studies all mentioned, little research exists concerning syllabi for courses in individual areas of study (Cashwell & Young, 2004; Drisko, 2008; Okumus & Wong, 2007; White, 2004).

Syllabus Content Specific to Title 14 of the CFR Part 141 Aviation Courses

Although it is apparent that syllabi play a decisive role in communicating with students and supporting their learning, no studies have been completed on instrument pilot course syllabi. Moreover, no research has occurred to investigate if schools providing ground training under Title 14 of the CFR Part 141 are including the necessary material and objectives within such course syllabi. This is problematic considering that a large number of collegiate aviation programs offer instruction under this part of the regulations (University Aviation Association [UAA], 2008). Appendix C to Part 141 describes, in detail, the required content for any instrument pilot course. This ground training must include:

(1) Applicable Federal Aviation Regulations for IFR flight operations
(2) Appropriate information in the "Aeronautical Information Manual"
(3) Air traffic control system and procedures for instrument flight operations
(4) IFR navigation and approaches by use of navigation systems
(5) Use of IFR en route and instrument approach procedure charts
(6) Procurement and use of aviation weather reports and forecasts, and the elements of forecasting trends on the basis of that information and personal observation of weather conditions
(7) Safe and efficient operations of aircraft under instrument flight rules and conditions
(8) Recognition of critical weather situations and windshear avoidance
(9) Aeronautical decision making and judgment; and
(10) Crew resource management, to include crew communication and coordination (FAA, 2009, p. 452).

It is certainly logical if not necessary to analyze instrument pilot course syllabi to investigate if they are covering the required material.

Contemporary Aviation Content Issues

In addition to Part 141 requirements, instructors may want to include a variety of other subject areas within an instrument pilot course. In particular, especially because of its use within instrument flight, the coverage of contemporary issues such as the Global Positioning System (GPS), Wide Area Augmentation System (WAAS), Area Navigation (RNAV), RNAV GPS approaches, and Required Navigation Performance (RNP) concepts are necessary to develop pilots that are best equipped for the real world. An example of why this burden falls upon instrument pilot course faculty is that "the FAA presently has just a few basic GPS questions in each of their Private, Commercial, Instrument, and Airline Transport pilot written exam data banks" (Quinnette, 2002, p. 2). Although students will likely be exposed to the use of GPS in flight training, it is possible that the lessons provided by instrument pilot course faculty may be the only formal classroom based instruction students receive: "current flight training programs do not adequately incorporate the training of GPS navigation procedures in either their ground or flight training programs" (Quinnette, 2002, p. 5).

Further evidence of the cursory instruction on GPS that does occur is that "of the students receiving GPS training only 6% are receiving more than 2 hours of GPS specific training in the classroom with more than 50% receiving less than 1 hour of training" (Quinnette, 2002, p. 58). This is particularly troubling considering that "for IFR, it's never a good idea to use a GPS receiver for primary navigation without being thoroughly familiar with it....The best way to gain familiarity and proficiency is to take a purposeful, systematic approach to learning about the system" (Peterson, 2008, p. 2). Steuemagle (n.d.) stated that "a substantial commitment to study and practice is required before a pilot can fly IFR GPS in safety and confidence" (para. 1). In a study of the necessary amount of instruction to safely and effectively operate GPS on IFR flights by Casner (2004), the author found that "the results strongly suggest that IFR GPS is not a 'walk-up-and-use' system for pilots at any experience level. Considerable learning and practice are required to achieve proficiency with flying IFR with GPS" (p. 10). All of this is worrisome considering the push for the FAA to move towards GPS based Area Navigation (RNAV) (Bertorelli, 2004).

METHOD

Purpose

In light of the importance of syllabi to the conduct of courses and to student learning, in addition to the lack of research that has been conducted on this subject area, this study sought to analyze instrument pilot course syllabi through content analysis. The purpose of this study was to examine syllabi collected from four-year, University Aviation Association (UAA) member schools that offer Title 14 of the CFR Part 141 approved instrument pilot instruction in order to determine how or if these documents communicate course descriptions, learning objectives, the coverage of topics required by regulation, the textbooks and other materials used, course assignments, evaluative tools (e.g. tests, quizzes, papers), instructional methods utilized, statements concerning class policies, and statements of academic integrity. Also, this study sought to determine if instrument pilot courses included contemporary issues and changes, namely instruction on GPS, WAAS, RNAV, RNAV GPS approach procedures, and RNP as well as how this subject matter is conveyed to students.

Research Questions

The following research questions guided this study:

1. Do instrument pilot course syllabi include items described as essential within the research literature? Specifically, do they include course descriptions, learning objectives, topics covered,

the textbooks and other materials used, course assignments, evaluative tools (e.g. tests, quizzes, papers), instructional methods utilized, statements concerning class policies, and statements of academic integrity?

1. a. What were the listed topics covered, textbooks and other materials used, course assignments, evaluative tools, and instructional methods utilized?

2. Do instrument pilot course syllabi include the course objectives/topics required by Title 14 of the CFR Part 141?

3. Do instrument pilot course syllabi include training on GPS, WAAS, RNAV, RNAV GPS approaches and RNP?

3. a. How much training is provided on GPS and related concepts?

Participants

Purposive sampling was utilized in an attempt to ensure homogeneity among syllabi. For this study, only schools that were four-year, UAA member institutions offering Title 14 of the CFR Part 141 approved ground instruction were included. The rationale for this selection was that these types of institutions share similar goals and industry participation. Also, four-year institutions are clearly more similar to one another in comparison to weighing a two-year institution versus a four-year counterpart. In addition, the guidelines of Title 14 of the CFR Part 141 create level ground for coursework, as this regulation standardizes the material that must be covered within the course. Instrument pilot course syllabi were utilized as this type of flying is pivotal in almost all pilot careers and instrument flight is conducted across the spectrum of flying careers and components of the aviation industry (FAA, 2009; 2008).

The most recent *Collegiate Aviation Guide* (5^{th} edition) was utilized to identify schools that were four-year, UAA member institutions offering Part 141 instruction (UAA, 2008). This search yielded 50 institutions.

Procedure

Content analysis was employed to examine the collected syllabi. According to Holsti (as cited by Berg, 2007) content analysis is “any technique for making inferences by systematically and objectively identifying special characteristics of messages” (p. 306). Okumus and Wong (2007) stated that content analysis “can provide rich and in-depth accounts on a wide range of topics. It establishes categories and then counts the number of related words, sentences and issues under each category” (p. 81). The appropriateness of content analysis in the study of course syllabi was reinforced by the use of this method in a variety of literature concerning these documents (Bers, Davis, & Taylor, 2000; Bers, Davis, & Taylor, 1996; Cashwell & Young, 2004; Habanek, 2006; Imasuen, 1999; Johnson & Ferguson, 1998; Okumus & Wong, 2007; Riffe, Lacy, & Fico, 2005; Slattery & Carlson, 2005; Wasley, 2008).

The steps in measurement of data presented by Riffe, Lacy, and Fico (2005) were utilized in the development of the research design for this study. The five steps described by these authors were “develop research hypotheses or questions...examine the existing literature...use good previous measures...create coding instructions, and...create coding sheets for recording data” (Riffe, Lacy, & Fico, 2005 pp. 91-92).

Following the procedural outline utilized by Okunus and Wong (2007) this study was organized to follow the five different stages: “(1) development of research aims and the research framework, (2) finding and selecting appropriate cases, (3) analyzing documents by following the research framework,

(4) cross-checking and refining the findings and (5) summarizing and finalizing the findings" (p. 82). As recommended by Creswell (2008), the analysis of data stage began by reading through one example syllabus to get a general idea of "what is this about?" (p. 192). Also, as Berg (2007) suggested, the process of open coding was followed during the initial analysis. Open coding is described as "an unrestricted coding of the data. With open coding, you carefully and minutely read the document line by line and word by word to determine the concepts and categories that fit the data" (Berg, 2007, p. 321). From this initial reading, the construct and organization of course descriptions, learning objectives, the coverage of topics, the textbooks and other materials used, course assignments, evaluative tools (e.g. tests, quizzes, papers), instructional methods utilized, statements concerning class policies, statements of academic integrity, and whether or not GPS instruction was mentioned in the syllabus emerged.

A coding scheme was designed to further analyze the syllabi in a more systematic manner. The method of creating and testing a coding scheme described by Weber (1990) was used as a guide in this process. The first step was to "define the recording units" (Weber, 1990, p. 21) which would, in this case, identify what Berg (2007) stated as the "manifest content (those elements that are physically present and countable)" (p. 308). Both words and themes were utilized as the units of analysis. Berg (2007) stated that "the word is the smallest element or unit used in content analysis. Its use generally results in a frequency distribution of specified words or terms" (p. 312). Words such as "lecture" and "discussion" were used to identify the prevalence of these types of instruction methods. More complex content, such as course objectives, were analyzed thematically as Berg (2007) noted "the theme is a more useful unit to count. In its simplest form, a theme is a simple sentence, a string of words with a subject and a predicate" (p. 312).

The next step described by Weber (1990) was to "define the categories. In creating definitions, investigators must make two basic decisions....The first is whether categories are to be mutually exclusive....The second choice concerns how narrow or broad the categories are to be" (p. 23). Guidance for the development of initial categories was drawn from the essential components of syllabi as described by Bers, Davis, and Taylor (1996). Procedures used by Rendina-Gobioff et al. (2003) were adopted to create more detailed categories. This required the development of a coding checklist:

> During the initial stages of the review process, the checklist was revised and refined to meet the needs and goals of the assessment. Wording was clarified where necessary and indicators were added, combined, or deleted as it became more apparent the appropriateness of individual indicators with respect to the language. The final checklist included... categories....Within each of the...categories..., individual indicators were created to represent the various aspects of the domain (p. 5).

This content was then placed in an all-encompassing codebook the purpose of which was to provide explicit instructions to insure standardization in the research process. This codebook was created with guidance from Neuendorf (2001); Riffe, Lacy, and Fico (2005); and Krippendorff (2004) which called for a comprehensive set of instructions that define all variables in the study, give detailed, specific procedures to follow, and assure standardization among coders involved in the study. The actual structure of the codebook was adopted from MacQueen, McLellan, Kay, and Milstein (2008) which divided the document into "six basic components: the code, a brief definition, a full definition, guidelines for when to use the code, guidelines for when not to use the code, and examples" (p. 32). Further, examples of coding instructions by Drisko (2008), Riffe, Lacy, and Fico (2005), Rendina-Gobioff, et al (2003), and Weston, Gandell, J. Beauchamp, McAlpine, Wiesman, and C. Beauchamp (2001) were used to assist in organizing and writing a thorough set of procedures.

Upon completion of this initial coding scheme, it was used to "test coding on a sample of text" (Weber, 1990, p. 23). Next, the initial reliability of the scheme was evaluated. As Lombard, Snyder-Duch, and Bracken (2004) suggested, this took place informally during coder training and formally in this initial coding of a sample of text. Following the completion of these testing procedures, coding rules were revised as necessary.

In addition to the researcher, a coding team of two research assistants was utilized. Each coder was given a copy of the codebook that outlined the specific process with which each was expected to comply. Within the codebook was the aforementioned coding checklist. The researcher then confirmed that each coder understood what was expected of them and thoroughly explained the instructions and checklist. Any confusion or questions were resolved prior to the final steps of the data analysis. The last two steps described by Weber (1990), coding the entire sample and assessing overall reliability, were then completed. Following the guidance of Weber (1990), the entire sample of syllabi was analyzed by the researcher. To calculate intercoder reliability, a random sample of four syllabi (which is slightly above the minimum for reliability testing of ten percent recommended by Lombard, Snyder-Duch, and Bracken, [2004]) was distributed to each of the coding team members for analysis.

RESULTS

Response Rate

Emails were sent to the program directors or chairs of each of the 50 programs to request instrument pilot ground course syllabi. Forty of the requests were forwarded to the individual instructor by the program director or chair. The remaining ten requests were responded to directly by the director or chair. From the 50 requests that were sent, 37 syllabi were received resulting in a response rate of 74%. However, five institutions provided instrument instruction over two semesters; therefore such syllabi were combined into single units for the purposes of determining response rate. Thus the actual number of useful responses was 32 syllabi (64.0%). According to Okumus and Wong (2007), "15 cases can be sufficient for explanatory studies using content analysis" (p. 83), thus the number of responses was deemed to be adequate for the purpose of this study.

Essential Syllabus Items

Syllabi were analyzed for their inclusion of items considered to be essential by the literature. Specifically, syllabi were examined to identify if they included course descriptions, learning objectives, topics covered, the textbooks and other materials used, course assignments, evaluative tools (e.g. tests, quizzes, papers), instructional methods utilized, statements concerning class policies, and statements of academic integrity. Only nine (28.1%) syllabi contained all of the recommended elements.

Within the syllabi available for study, 20 (62.5%) provided a course description. Twenty-eight (87.5%) of syllabi outlined learning objectives however, among these, three (9.4%) syllabi solely focused on the objective of passing the FAA Instrument Pilot Knowledge Test. The syllabi focused on a variety of topics. A breakdown of the inclusion rates of topics can be found in Figure 1. The most prevalent of topics reported were instrument navigation (90.6%), enroute operations (90.6%), approach procedures (84.4%), holding (84.4%), departures (84.4%), and basic attitude instrument flying (84.4%). The topics that were included least were crew resource management (31.3%), FAA written test preparation (21.8%), the AIM (15.6%), safe and efficient operation of aircraft (12.5%), and aerodynamics (9.4%). Six (18.8%) syllabi reported one or more topics that were not specifically addressed in the coding scheme. These extra topics were aircraft performance (12.5%), accidents (6.3%), maintenance documentation and regulations (6.3%), technically advanced aircraft (3.1%), and situational awareness (3.1%).

Twenty-nine (90.6%) of syllabi identified what materials would be required for use in the conduct of the class. The most common material identified were texts (87.5%). The overwhelming majority of syllabi (84.3%) noted the *Jeppesen Instrument Commercial Manual* as the required text. For a complete breakdown of required texts, see Figure 2. Other items identified were maps/charts (34.3%), videos

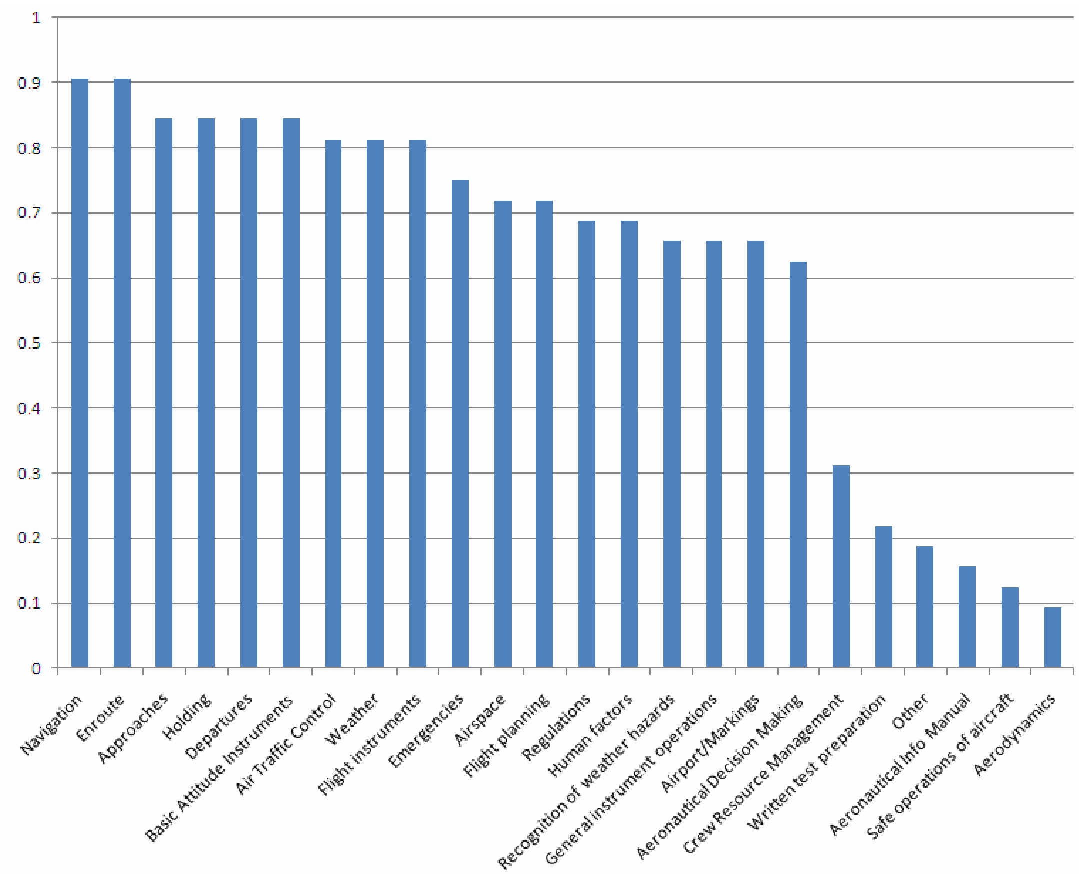

Figure 1. Inclusion rates of instrument pilot course topics.

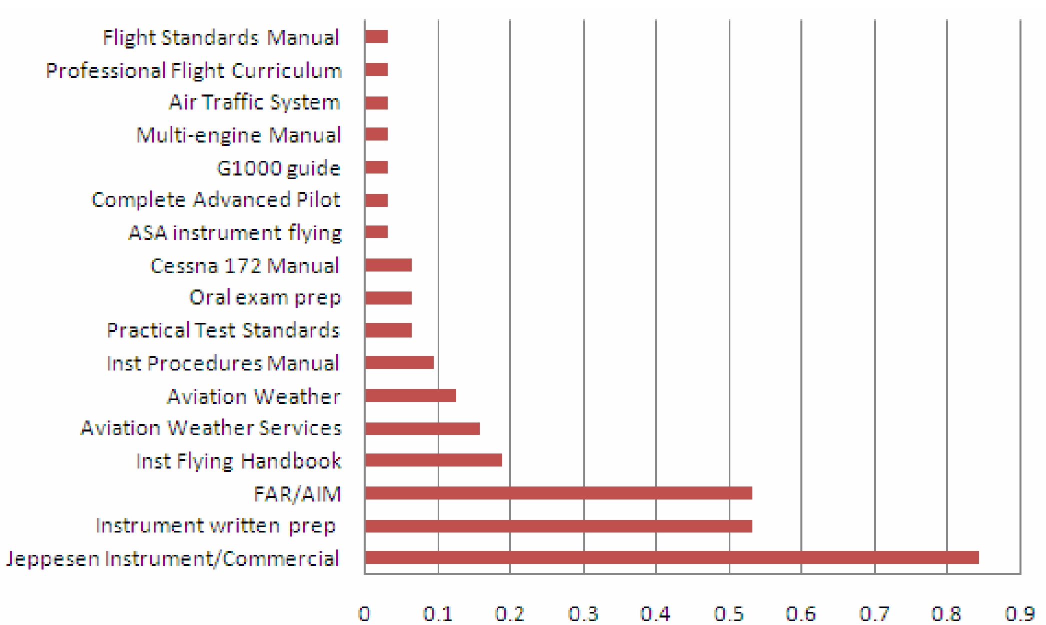

Figure 2. Required texts.

(9.4%), computer/simulation (3.1%) and websites (3.1%). Seven (21.8%) of syllabi listed materials that were not specifically addressed on the coding checklist. All of these additional responses indicated the requirement for using flight planning materials (plotters, flight computers, and flight plan forms).

Course assignment types were identified. For the purposes of this study, a course assignment was a task that was dispensed but was not directly measured for inclusion in calculation of the final grade. For example, reading assignments may be required, but are not directly graded and therefore would be included in this category. Items that are assigned but receive a grade were included in the category of evaluative tool. Almost all syllabi (96.9%) identified reading tasks as course assignments. Writing/article/paper assignments were required in five (15.6%) syllabi. Computer based exercises/simulation and projects/presentations were each required in three (9.4%) of syllabi. Two (6.3%) syllabi identified the FAA written exam as an ungraded assignment. An additional two (6.3%) syllabi indicated "other" assignments.

Evaluative tools, those items on which students were graded, were noted in all but one (3.1%) syllabus. The most ubiquitous (29 syllabi or 90.6%) tool was the exam/test that was administered during the conduct of the semester/quarter. Quizzes and final exams were each noted as evaluative tools in twenty (62.5%) syllabi while attendance was graded in ten (31.3%) syllabi. See Figure 3 for a thorough reflection of the evaluative tools identified within the syllabi.

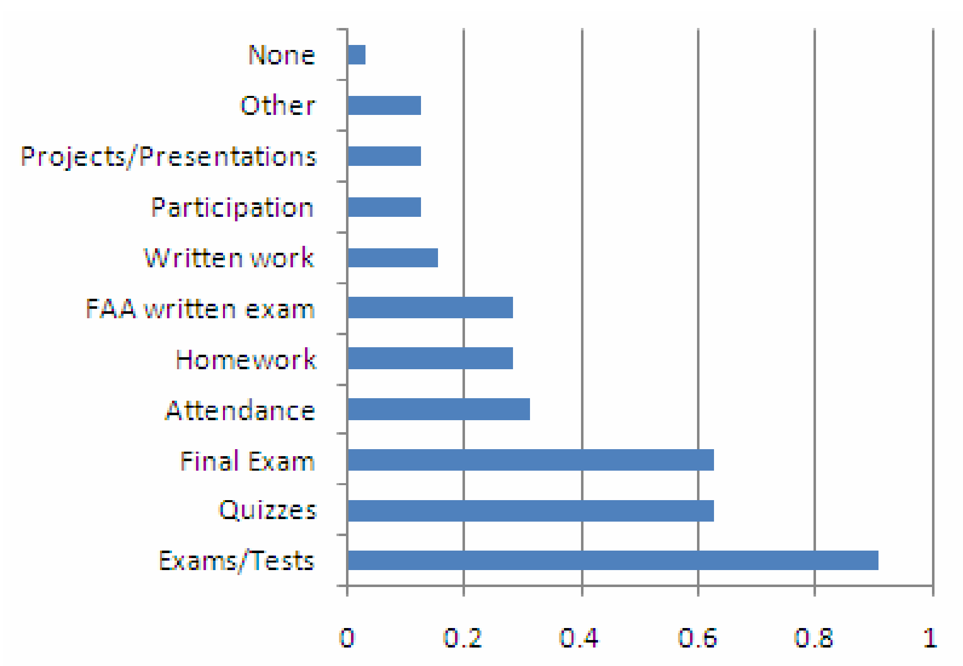

Figure 3. Evaluative tool usage.

Instructional methods were found to be absent from fifteen (46.9%) of syllabi. The method used most often was lecture (16 syllabi or 50%). Video was utilized in nine (28.1%) syllabi and discussion was identified in eight (25%) cases. The remaining types of instructional methods were online (12.5%), computer/simulation (9.4%), and laboratory (6.3%).

Statements of class policies were indicated in all but one (3.1%) syllabus. The policy on attendance/absences was noted in 28 (87.5%) of syllabi. Grading policies and/or grading scales were shown on 25 (78.1%) syllabi. Guidance for students on the course make-up policy was recognized in 21 (65.6%) cases. Figure 4 shows all occurrences of class policy statements. Slightly more than half of all syllabi (18 or 56.3%) had any kind of statement on academic integrity, e.g. the establishment of policy on or definition of cheating, plagiarism, or honor code.

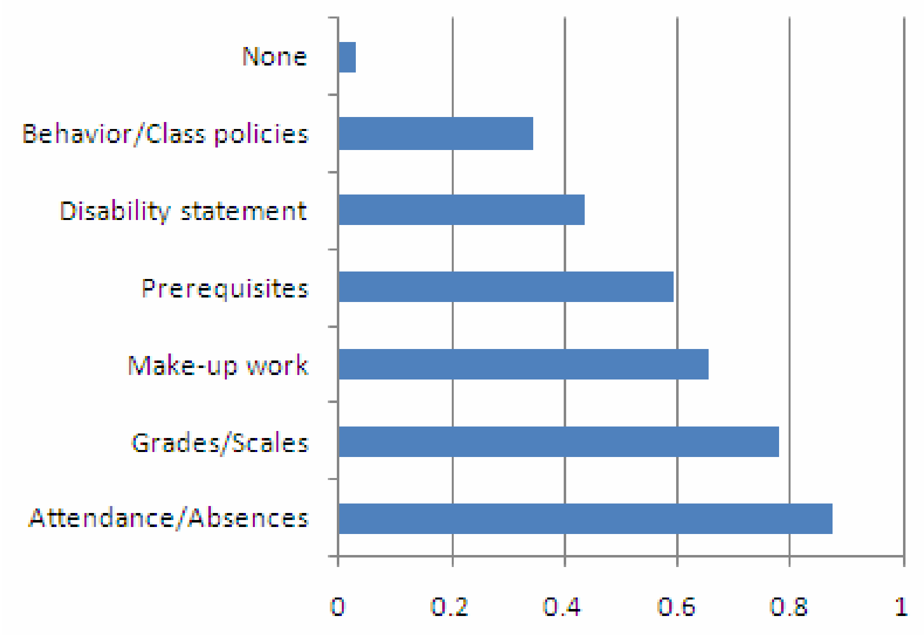

Figure 4. Incidence of class policy statements.

Title 14 of the CFR Part 141 Required Course Objectives/Topics

Among the 32 syllabi that were analyzed, only five (15.6%) complied with either the objective and/or content requirements of Title 14 of the CFR Part 141. While many syllabi listed numerous objectives/topics that are required by regulation, there were three commonly omitted subject areas. The most frequently absent was coverage of the Aeronautical Information Manual (AIM) followed by Crew Resource Management (CRM) and "safe and efficient operations of aircraft" (FAA, 2009, p. 452). A comprehensive listing of the percent coverage of subjects required by Title 14 of the CFR Part 141 is shown in Figure 5.

Coverage of GPS Concepts

Twenty-three (71.9%) of syllabi reported that GPS would be covered in some form during the course. The mean number of sessions in which GPS was indicated to be covered was 1.30 (SD = 0.703). Syllabi that indicated that GPS instruction would be included were then analyzed for the type of information that would be conveyed in the lesson(s). Six (18.8%) syllabi showed that GPS would only be discussed in general terms, such as basic information on how the system works, and applicable regulations. Fourteen (43.8%) syllabi stated that such instruction would be limited to the general use of GPS for instrument approaches. Only four (12.5%) covered both general GPS topics and GPS use in approaches. Sixteen (50.0%) syllabi included RNAV in general and twelve (37.5%) addressed specific RNAV GPS approaches and procedures. Only two (6.3%) mentioned WAAS and zero syllabi included RNP.

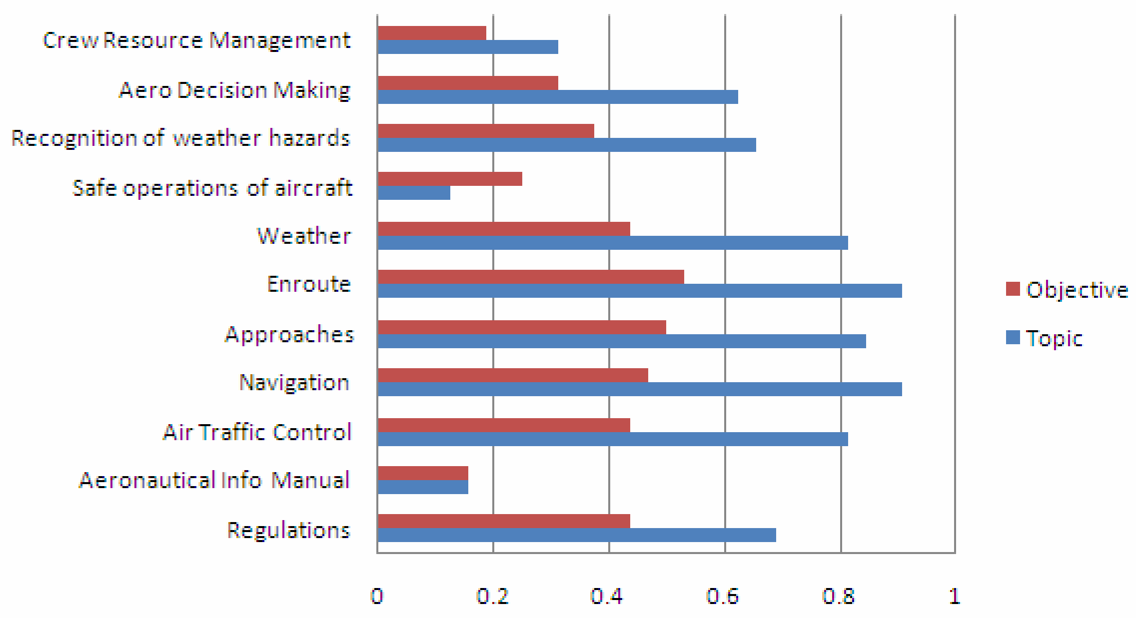

Figure 5. Incidence of objective and content requirements of Title 14 of the CFR Part 141.

Validity and Reliability of Results

According to Neuendorf (2002), a content analysis study should be valid both internally and externally. Internal validity is "the match-up of a conceptual definition and an operational definition" (Neuendorf, 2002, p. 115) which can be exemplified by a sound measurement scheme. This study utilized an exhaustive coding scheme created with the guidance of a variety of research literature. Further, detailed instructions were made available to coders. "To assess external validity, we may consider the representativeness of the sample...as well as whether the content analysis measurement is true to life" (Neuendorf, 2002, p. 115) which can be proven by a sample that closely matches the population and the replicability of the study. This study utilized purposive sampling, so the attributes of the sample should be very closely related to those of the target population. Also, the detailed coding scheme and instructions should provide a thorough guide for replication of the current study. Further evidence of validity of this study can be found in the "evidence that justifies the treatment of the text" (Krippendorff, 2004, p. 318). In this case, the justification on how to treat the data discovered from this study was established from the research literature.

Neuendorf (2002) noted that reliability, measured among coders, is necessary to be calculated for this type of study because "it must be established that more than one individual can use the coding scheme as a measurement tool, with similar results" (p. 142.) A variety of studies reported acceptable levels of intercoder reliability. Specifically, a Cohen's *kappa* of greater than .75 was considered reliable (Banjeree, Capozzoli, McSweeney, & Sinha, 1999; Ellis, 1994; Riffe, Lacy, & Fico, 2005). The Cohen's *kappa* calculated for this study was .877 (Olmos, 2007).

DISCUSSION

The purpose of this study was to examine instrument pilot course syllabi for the inclusion of items deemed essential in the research literature. Also, this study sought to evaluate these syllabi for their inclusion of requisite Title 14 of the CFR Part 141 objectives/topics and their coverage of GPS. Syllabi were analyzed for this aforementioned data through the use of content analysis. This study was successful in the collection and analysis of the data necessary to achieve the purpose of this research.

Similarly to other research in the area of the content of syllabi, a large number of instrument pilot course syllabi did not include items that were considered to be essential. While a majority of instrument pilot course syllabi did provide a wide range of objectives and topics that were advertised to be covered throughout the class, it was surprising that subjects that could be considered critical to an instrument pilot, such as the coverage of regulations, basic attitude instrument flying, and the Aeronautical Information Manual, were not omnipresent. However, it would be naïve to believe that simply because a topic is not mentioned in a syllabus it is not covered at any point in the class. Yet the omission of specific subjects does point to a deficiency in the communication between professor and student. It would certainly be understandable how such exclusions could confuse or frustrate a student. Further, as students plan ahead for the semester, they would not be able to foresee the coverage of unmentioned subjects and may believe that such subjects are not important or may not be covered in evaluative tools.

Instrument pilot course syllabi consistently identified the materials that were required for the class. An overwhelming majority utilized texts with the most commonly cited being the *Jeppesen Instrument Commercial Manual.* Again it was surprising that certain texts, in particular the Federal Aviation Regulations and the Aeronautical Information Manual, were utilized so infrequently. Considering that all but two syllabi specifically required reading assignments, the exclusion of fundamental texts is somewhat troubling. While electronic forms of these important documents are now available from the FAA at no cost, or perhaps students are assumed to already own the material, texts in which reading assignments or expectations exist should still be included on the syllabus.

As might be expected in college courses, exams and quizzes were widely used to determine the grades in instrument pilot courses. Only half of courses identified the instructional method to be used. This is unfortunate as students will not truly know what to expect throughout the academic calendar. Of the syllabi that mentioned instructional methods, most indicated that lecture would be used. The dominance of lecture is unfortunate as this method has often been cited as one that is disliked by students and that it can be marginally effectual if used as the sole means of presentation (DiCarlo, 2009; Tang & Austin, 2009).

Because students look to the syllabus as their "rule book" for a course, it was encouraging to see that all but one instrument pilot course syllabi included statements on class policies. It was surprising to see that four syllabi omitted an attendance policy although the omission of certain academic rules and standards may be explainable by the inclusion of this information in formal university/college documents or policies. Yet, considering that Title 14 of the CFR Part 141 courses have mandatory attendance, some discussion of this additional obligation should have been mentioned. Also, students that miss Part 141 classes are required to make up such work, yet only slightly more than half of syllabi indicated any kind of makeup policy.

Complete coverage of all Part 141 requirements was limited to five syllabi. Again, it is unlikely that all of these courses actually exclude the coverage of required material however, the omission is problematic for two reasons. First, it could be construed that such courses are, in fact, not fulfilling the requirements under Tile 14 of the CFR Part 141. Second, students are not being given a realistic view of what they are expected learn within the course.

Considering the rapid adaptation of GPS navigation and its increasingly widespread use, it was disquieting that only 71.9% of syllabi included instruction on this subject. Even more remarkable was the low inclusion rates of RNAV (50.0%), the general GPS use for approaches (43.8%), specific RNAV GPS approaches and procedures (37.5%), WAAS (6.3%), and RNP (0.0%). In general, the coverage was somewhat cursory with GPS being incorporated in, on average, slightly more than one class period. No syllabi conveyed a comprehensive explanation of GPS. Yet, in all fairness, GPS could be covered more thoroughly in other courses, in aircraft and/or simulators, or simply in the instrument pilot course even though it was not specifically outlined in the syllabus.

CONCLUSION

Course syllabi serve as a “road map” to students while they progress through a class. These documents also serve as an agreement between the instructor and the student, they are permanent records of course content, and are essential to proving compliance with accrediting agencies. Even in light of the seemingly critical nature of these documents, there is a wide variety of content and quality among them. The fact that few syllabi contain the basic necessary items to properly convey what is to occur in the classroom should serve as a wake-up call to faculty, administration, accreditors, and the FAA. Incomplete syllabi potentially cause irritation, uncertainty, and disorder among students. Furthermore, such deficiencies may continue to passed on as different faculty teach a course unless systematic analysis and change occur to the syllabi.

In sum, aviation faculty must make a greater effort to communicate with their students through syllabi. Faculty should review the literature on syllabi construction, the requirements of Title 14 of the CFR Part 141, and the expectations of the accrediting body responsible for their institution in order to best design their course documents. By filling the gaps in current syllabi, faculty can strengthen their courses and improve student understanding of expectations. Through this enhancement of information, students should have the tools they need to best excel in the class.

REFERENCES

Banjeree, M., Capozzoli, M., McSweeney, L., & Sinha, D. (1999). Beyond kappa: A review of interrater agreement measures. *Canadian Journal of Statistics, 27*(1), 3-23.

Berg, B. L. (2007). *Qualitative research methods for the social sciences* (6th ed.). Boston: Allyn and Bacon.

Bers, T., Davis, B., & Taylor, B. (2000). The use of syllabi in assessments: Unobtrusive indicators and tools for faculty development. *Assessment Update*, *12*(3), 4-7.

Bers, T. H., Davis, B. D., & Taylor, W. (1996). Syllabus analysis: What are we teaching and telling our students? *Assessment Update, 8*(6), 1–2, 14–15.

Bertorelli, P. (2004). *GPS technology*. Frederick, MD: AOPA Air Safety Foundation.

Cashwell, C. S., & Young, J. S. (2004, January). Spirituality in counselor training: A content analysis of syllabi from introductory spirituality courses. *Counseling and Values, 48*, 96-102.

Casner, S. M. (2004). *Flying IFR with GPS: How much practice is needed?* (Report No. 2004 212821). Moffett Field, CA: National Aeronautics and Space Administration.

Creswell, J. W. (2008). *Research design: Quantitative, qualitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Davidson, G., Garton, A., & Joyce, M. (2003). Survey of ethics education in Australian university schools and departments of psychology. *Australian Psychologist*, 38(3), 216-222.

DiCarlo, S. (2009). Too much content, not enough thinking, and too little fun. *Advances in Physiology Education*, *33*257-264. doi:10.152/advan.00075.2009.

Drisko, J. W. (2008). How is qualitative research taught at the master's level? *Journal of Social Work Education, 44*(1). 85-101.

Ellis, L. (1994). *Research methods in the social sciences*. Madison, WI: WCB Brown & Benchmark.

Federal Aviation Administration. (2009). *FAR/AIM 2010*. Newcastle, WA: ASA.

Federal Aviation Administration. (2008). *Instrument flying handbook*. New York: Skyhorse Publishing.

Habanek, D. (2005). An examination of the integrity of the syllabus. *College Teaching*, *53*(2), 62-64.

Johnson, J. A., & Ferguson, M. D. (1998). Setting the foundation for effective learning: Utilizing cognitive, affective, and psychomotor domains to establish rigorous performance learning objectives in postsecondary aviation education programs. *Collegiate Aviation Review, 16*(1), 1-10.

Imasuen, E. (1999). Campus strategies. *Assessment Update*, *11*(3), 8-9.

Krippendorff, K. (2004). *Content analysis: An introduction to its methodology* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Lombard, M., Snyder-Duch, J., & Bracken, C. (2004). A call for standardization in content analysis reliability. *Human Communication Research*, *30*(3), 433-437.

MacQueen, K., McLellan, E., Kay, K., & Milstein, B. (2008). Codebook development for team based qualitative analysis. *Cultural Anthropology Methods, 10*(2), 31-36.

Neuendorf, K. A. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage Publications.

Olmos, A. (2007). *Cohen's kappa calculator*. Retrieved from http://www.olmosantonio.com/Kappa%20calculator/calculadorakappa.html

Okumus, F., & Wong, K. (2007). A content analysis of strategic management syllabi in tourism and hospitality schools. *Journal of Teaching in Travel & Tourism, 7*(1), 77-97.

Peterson, B. D. (2008). *GPS from the ground up*. Frederick, MD: AOPA Air Safety Foundation.

Quinnette, R. J. (2002). Training of general aviation pilots on the Global Positioning System. Ed.D. dissertation, Oklahoma State University, United States -- Oklahoma. Retrieved from Dissertations & Theses: Full Text. (Publication No. AAT 3057301).

Redina-Gobioff, G., Ducher, J., Hess, M., Hogarty, K., Smith, G., Kromrey, J., Lang, T., & Helmick, I. (2003, November). A content analysis of the common core syllabi. Paper presented at the meeting of the Florida Educational Research Association, Orlando, FL.

Riffe, D., Lacy, S., & Fico, F. (2005). *Analyzing media messages using qualitative content analysis in research* (2nd ed.). New York: Taylor and Francis Group.

Slattery, J., & Carlson, J. (2005). Preparing an effective syllabus. *College Teaching*, *53*(4), 159-164.

Steuemagle, J. (n.d.). *GPS for IFR*. Retrieved from http://www.aopa.org/asf/publications/inst_reports2.cfm?article=4143

Tang, T., & Austin, M. (2009). Students' perceptions of teaching technologies, application of technologies, and academic performance. *Computers & Education*, *53*(4), 1241-1255. doi:10.1016/j.compedu.2009.06.007.

University Aviation Association. (2008). *Collegiate aviation guide* (5th ed.). Auburn, AL: Author.

Wasley, P. (2008). Syllabus. *Chronicle of Higher Education*, *54*(28), A9

Weber, R. P. (1990). *Basic content analysis* (2nd ed.). Newbury Park, CA: Sage Publications.

Weston, C., Gandell, T., Beauchamp, J., McAlpine, L., Wiseman, C., & Beauchamp, C. (2001). Analyzing interview data: The development and evolution of a coding system. *Qualitative Sociology, 24*(3), 381-400.

White, G. W. (2004). Business information courses in LIS programs: A content analysis. *Journal of Business & Finance Librarianship, 20*(2), 3-15.

The Detection and Minimization of Cheating During Concurrent Online Assessments Using Statistical Methods

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ABSTRACT

As distance learning programs in aviation continue to evolve, a natural step in the progression is the fully online assessment of distance students. In some cases, those assessments must occur in synchronous delivery systems, where distance students view lectures and/or take online examinations concurrently. Among the questions that arise in the mind of the aviation educator in such cases are those of how to determine the magnitude of academic dishonesty occurring during concurrent assessments and how to minimize the opportunities of students being assessed to participate in such dishonesty. The author has developed a statistical algorithm to allow the use of common software to detect instances where students pass answers between themselves through various means in order to improve their assessment scores. A study conducted over a period of two semesters during the 2009 – 2010 academic year in two of the author's distance learning classes indicates the validity of both the algorithm and the methods used to minimize the occurrences of dishonesty.

INTRODUCTION

Many collegiate aviation programs have in recent years added distance education delivery methods; at some such institutions, entire degrees may be earned by distance learners. Distance learning course management systems (CMS) such as Blackboard / WebCT typically include an assessment component that allows the assessment of students entirely online. Benefits of online assessment include increased grading accuracy, reduced grading time, and provision of students with immediate feedback (Eplion & Keefe, 2005). As Eplion and Keefe (2005) suggest, these benefits are also present if online assessment is used with traditional delivery methods, with the additional benefit that such assessment can make available additional class time for other learning activities.

An issue that arises with regard to the use of distance learning CMS is that of the minimization of cheating by students during the process of online assessment. Dick et al. (2003) suggest that managing the issue of cheating consists of three steps: preempting it, detecting it, and responding to it. The research described herein was targeted primarily at the first two of these steps; namely, detection and minimization.

There is no question that cheating on online assessments should be a concern for distance educators. Rogers (2006) conducted a survey of distance learning faculty who regularly use a CMS at a regional university in the southeastern United States. The survey indicated that 33 of 54 respondents also use the assessment feature of the CMS, and that 17 (or 52%) of these had experienced or suspected some form of academic dishonesty during an online exam. A comprehensive literature review by Dick et al. (2003) indicates that additional studies conducted on the frequency of cheating over a period of 37 years from 1964 to 2001 have determined a range of students found to be cheating from as low as 40 percent to as high as 96 percent. Those studies were not specifically focused on distance education, however. Mason and Woight (1998) suggest that online course offerings are typically taken by the "best" students, or those having the highest grade point averages, and that this causes the frequency of cheating on online assessments to be less than that found with traditional assessments, and, indeed, as Crown and Spiller (1998) confirm, a negative correlation exists between grade point average and cheating frequency. Other characteristics correlated with cheating include age, extracurricular involvement, and major field of study (Burlak, Hernández, Ochoa, & Muñoz, 2006). Rowe (2004), however, suggests that as distance learning becomes more popular (or perhaps a requirement in some programs), distance educators will see an increasingly broader spectrum of students. It is clear, therefore, that preparation for dealing with the academic dishonesty issue needs to occur sooner, rather than later.

With advances in computer and communications technology, there are many innovative methods that may be employed by students who wish to cheat on online assessments. Olt (2002) and Rowe (2004) describe the use of forbidden sources of information during online testing. Such sources during unproctored assessments might range from textbooks and class notes to proxy test takers, who may be easily utilized if some form of identity verification is not employed. It is clear that an instructor is unable to control a student's use of unauthorized sources of information during an assessment where a proctor is not present. Some authors (Abbott, Siskovic, Nogues, & Williams, 2000; Dirks, 1998; Kaczmarczyk, 2001; Kim, Smith, & Maeng, 2008) suggest the use of proctored testing at a predetermined location, but this approach introduces difficulties to the assessment process. The first of these is the problem of testing a large class of distance students in a facility that may not be able to accommodate the entire class (Pain & Le Heron, 2003), and the second is requiring students to travel what may be a substantial distance to reach the testing facility (Cooper, 2000).

Two other means of cheating on distance assessments, and two that are perhaps especially applicable to assessments that are delivered to students concurrently, is that of the passing of e-mail, text messages, or cellphone calls between students taking the exam (Olt, 2002), and the use of spyware placed on other students' machines to allow the cheater to see those students' answers. The research presented in this paper is particularly relevant to combating these two modes of academic dishonesty.

There are a number of authors who suggest best practices for reducing the frequency of cheating on online assessments. Dick et al. (2003) warns educators to recognize that cheating is probably occurring in their classes. Several studies (McMurtry, 2001; Olt, 2002; Rowe, 2004) propose that cheating be clearly defined by the instructor and that an academic dishonesty policy be provided to and discussed with students (and perhaps returned to the instructor with the students' signatures). Dirks (1998), however, found that only 15% of academic syllabi collected during a study actually contained such policies.

According to Olt (2002), distance education assessments should be "oriented toward higher ordered thinking skills, requiring application, evaluation and synthesis rather than mere factual recall." Meyen, Aust, Bui, & Isaacson (2002) suggest the use of collaborative projects, case studies, discussion boards, and peer evaluation in the online environment to promote such skills. However, a study conducted by Kim, Smith, & Maeng (2008) of three different distance education programs at a large university in the Midwest found that a majority of online assessments continue to rely on the same types of assessments found in traditional course delivery methods. The Rogers (2006) survey indicated that 91% of the respondents using the WebCT assessment feature in their distance courses employed a multiple-choice format. This type of question is typically easiest to set up in the CMS and easiest to grade automatically.

Best practices that are specifically applicable to online assessments conducted using a CMS and consisting of multiple-choice questions include randomizing questions selected from a larger pool, limiting the time allowed to take the assessment, and disallowing submission of answers after the time limit has expired (Illinois Online Network, N.D.; California State University, Sacramento, N.D.). Eplion and Keefe (2005) suggest that, in cases where answer patterns appear similar between exams, IP addresses be compared to determine the physical proximity of the machines from which the assessments in question were submitted. While address proximity may be an indicator that unauthorized collaboration has occurred, lack of address proximity does not prove that it has not occurred through electronic means.

Given the fact that we as distance educators do not always follow recommended practices and continue to use the multiple-choice format, it is important that we possess the tools for detecting academic dishonesty on online assessments and the knowledge of the parameters that may be varied within the typical CMS to effectively minimize such dishonesty.

DEVELOPMENT

When comparing two sets of answers to multiple-choice questions in an online assessment in order to determine whether unauthorized collaboration between the students occurred, it is essential to consider the underlying statistics. According to Rowe (2004), because of the fact that little of the test-taker may be observed online, "statistical methods are often the only hope to detect problems. To detect cheating, therefore, we shall consider the commonality of incorrect question responses between the datasets. Rowe (2004) states that the distribution of the number of answers in common between noncheating pairs of students should usually be close to Gaussian, but this observation is incorrect for several reasons; first, because the Gaussian or normal distribution is a continuous probability distribution and the case under consideration is discrete; second, because the Gaussian distribution is real-valued, whereas the number of responses in common between two assessments must clearly belong to the set of nonnegative integers; and third, because a Gaussian distribution implies a large population, which, in most cases, will not be available. The statistic in which we are interested is that of the identical *incorrect* responses between student pairs. The distribution of this random variable should, in fact, possess a Poisson probability mass function,

$$\Pr(X = k) = \frac{e^{-\lambda}\lambda^{k}}{k!}, \tag{1}$$

where *k* is a non-negative integer, in cases where no academic dishonesty has occurred.

A type of discrete probability distribution known as the negative binomial distribution occurs often in nature and is used by meteorologists to model contagious events, or processes where each event with a favorable result increases the probability of succeeding favorable events. Natural events such as tornado outbreaks are accurately modeled with this sort of distribution. The probability mass function of the negative binomial distribution has the form

$$\Pr(X = k) = \binom{k + r - 1}{r - 1}(1 - p)^{r} p^{k}, \tag{2}$$

where *r* and *p* are real-valued and *k* is a non-negative integer.

Because of the fact that we will allow the parameter *r* to be real-valued, this is more properly known as a Pólya distribution. The rationale for using a Pólya distribution to represent the number of pairwise incorrect identical responses between dishonest students concurrently taking an online assessment is twofold. First, it makes some sense, in that it is easy to see that cheating on an assessment can be considered contagious according to the definition above. Second, it is relatively straightforward to show by using the parameterization

$$p = \frac{\lambda}{r + \lambda}, \tag{3}$$

that the Pólya probability mass function converges to the Poisson probability mass function as the parameter r approaches infinity; hence, an increase in r implies a decrease in cheating on the assessment.

The process, then, of detection of cheating on concurrent online assessments becomes one of calculating pairwise vectors of identical, incorrect answers between all students taking an exam concurrently, ascertaining the number of identical, incorrect responses per pair, and then fitting the aggregate data to a Pólya distribution. A test for goodness of fit will then allow the researcher to determine how close the actual distribution comes to the ideal case, and this closeness presents a picture of the validity of the model. The degree of actual cheating for each assessment will logically follow the skewness, or third central moment, of the distribution. This is easy to see since skewness represents the "tilt" or tail-heaviness of the distribution, and it is straightforward to understand that Pólya distributions that are positively tail-heavy, or that exhibit positive skewness, imply that a handful or more students have a great many incorrect answers in common between them.

The Blackboard CMS has the ability to export results files in Microsoft Excel format for all students participating in an assessment. Assuming that multiple-choice questions are used, the worksheet can then be translated easily into a numerical format suitable for import to a matrix analysis package such as MATLAB, used for the research described herein.

The MATLAB algorithm for calculating the skewness of the observed distributions first allows the input of an n x q matrix of student answers, where n is the number of submitted assessments and q is the number of multiple-choice questions. From this, a three-dimensional matrix is computed where the third element corresponds to the answer selection. For most multiple-choice responses it is simplest just to allow the position of a "one" to designate the alphabetic response selected by the student, and to fill the remainder of the dimension with "zeroes." Similarly, a 1 x q matrix of correct answers is entered, and this is converted to a three-dimensional matrix to represent the proper alphabetic response. An "incorrect answer matrix" can then be constructed from the two three-dimensional matrices described above. This resultant is also three-dimensional. The final product, $\mathbf{X}$, a vector of $\binom{n}{2}$ elements, is calculated by making pairwise comparisons of the columns of the incorrect answer matrix. One may then calculate requisite statistics from $\mathbf{X}$, including those of the most interest to us, the mean and skewness.

Once statistics for the observed distribution have been calculated, it remains to fit the data to a Polya distribution and use a chi-square test to determine goodness of fit. The value of the parameter chi-square provides a good indication of how well the data fits the ideal Pólya distribution; the better the fit, the more cheating has occurred. The actual determination of the parameters p and r is somewhat difficult, in that it requires the solution of a logarithmic equation, but generally an iterative method can be used, in which an initial value of one parameter is provided, the value of the other is calculated, and these starting values used in a nonlinear programming exercise that, one hopes, converges to the proper solution. In practice, convergence was obtained in all cases in which the Pólya distribution was appropriate; those cases in which the iteration did not converge were, in fact, found to exhibit little cheating and could be fitted to Poisson distributions with ease.

After the distribution has been fitted, it is straightforward to calculate the ideal skewness of the model and compare this with the skewness of the data. The difference in these parameters, along with chi-square, allows the educator to quantify the degree of cheating on the online assessment in question.

RESEARCH METHODOLOGY

Purpose of the Study

The purpose of this study was to determine from a relatively small set of testing parameters common to typical distance learning course management systems those parameters producing the more significant impact relative to the minimization of cheating on concurrently administered online assessments. The study was conducted in two aviation courses taught at the Indianapolis Campus of Purdue University over a two-semester period during the 2009-2010 academic year. Both of the courses used a hybrid delivery method; that is, traditional class lectures integrated with online homework and assessments. It was originally planned to extend the study to a third, purely-asynchronous online course, but the enrollment figures in that course were too low (N = 5) to allow any sort of meaningful analysis.

Study Population

Fifty-three unique students who enrolled in the two aviation technology courses over the two-semester period were targeted as the sample population for this study. Forty-nine of those students were enrolled in only one of the courses; four students were enrolled in both.

Methodology

Online assessments administered to all members of the population consisted of two section examinations and one final examination, comprising a total of six exams for the two courses. All of the assessments were of the multiple-choice type, with section exams consisting of 50 questions and final exams consisting of 100 questions. While it was possible to select the questions randomly from a pool, the pool sizes were no larger than the number of questions on the assessments.

Three parameters were varied among the assessments in order to investigate the effects of the changes on the degree of cheating detected. The three parameters, all easily controllable in Blackboard / WebCT, were

1. Time allowed for submission,
2. Order in which the questions were presented, and
3. Whether students were allowed to revisit questions once they had been answered.

Other parameters available for variation in the CMS include the choice of when to present assessment results to students (immediately, or after all assessments have been completed), whether to disallow answer submission after time for the assessment has expired, and the point at which the assessment is available for starting by the student. These additional parameters were all fixed for this study; assessment results were released to the student immediately after completion, and answer submission was disallowed after the submission time had expired. The assessments were made available only during a one-hour window; students were required to begin the assessment at some point during the specified hour. The availability window does not affect the time available for completion of the assessment. Assessments were not accessible at any point outside of the available window.

RESULTS OF THE STUDY

The first section assessment was taken by 34 students (n = 34) and consisted of 50 multiple-choice questions (q = 50). From combinatorial analysis, we have that the total number of unique pairwise comparisons to be made is $\binom{n}{2}$, or 561. Figure 1 gives the calculated frequency distribution.

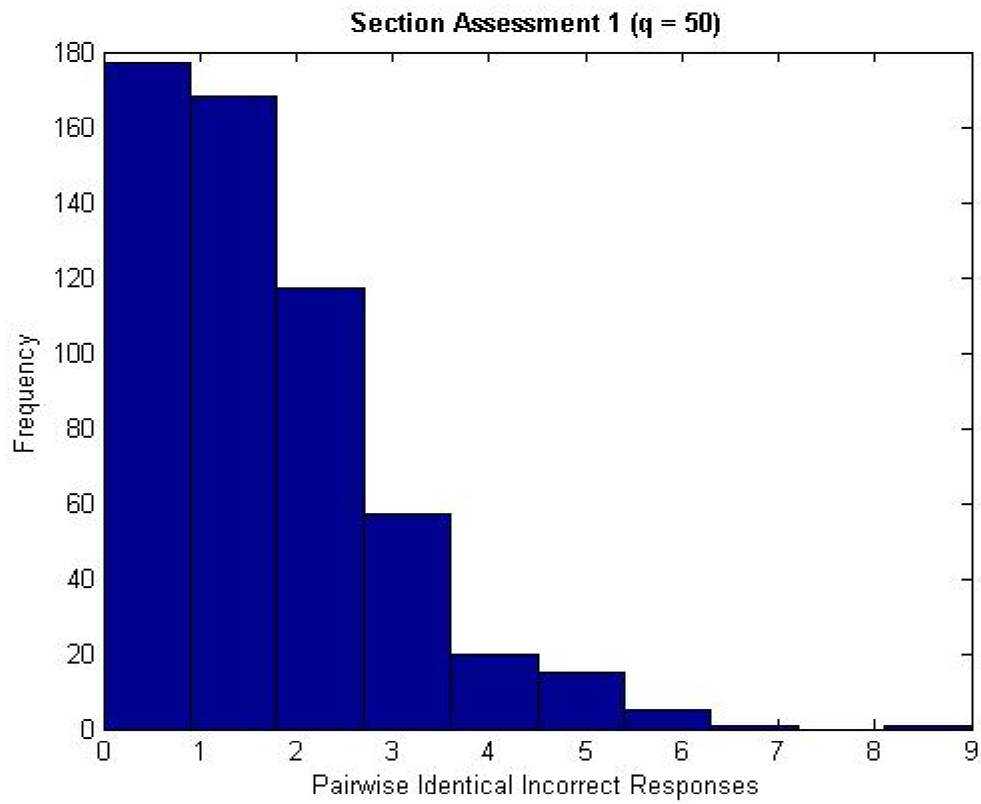

Figure 1. Pairwise identical incorrect responses, Section Assessment 1.

Study parameter values for Section Assessment 1 were an allowed test time, t, of 1.5 hours, a non-random question order (meaning that all students received the same questions in the same order), and allowed revisitation.

The calculated mean, μ, is 1.3797. The skewness, γ, calculated from the dataset is 1.3109, while the skewness in the ideal case with no cheating, that is, the skewness of the Poisson distribution of mean μ, is $\frac{1}{\sqrt{\mu}}$, or 0.8535. The disparity between the two skewness values (Δ = 0.4574) suggests that some degree of cheating occurred, and this is substantiated by the chi-square calculation, which yields a value of χ^2 = 5.02. The 9 degree-of-freedom values, or confidence limits, corresponding to the 97.5% confidence interval are 2.7 and 19.0, and χ^2 falls well within the range, so this demonstrates that the Pólya distribution is a good fit for the data. The values of p and r for the model, calculated using the nonlinear programming method, are p = 0.7061 and r = 3.3155.

The second section assessment was also taken by 34 students (n = 34) and consisted of 50 multiple-choice questions (q = 50). The total number of unique pairwise comparisons is 561. The corresponding distribution is shown in Figure 2.

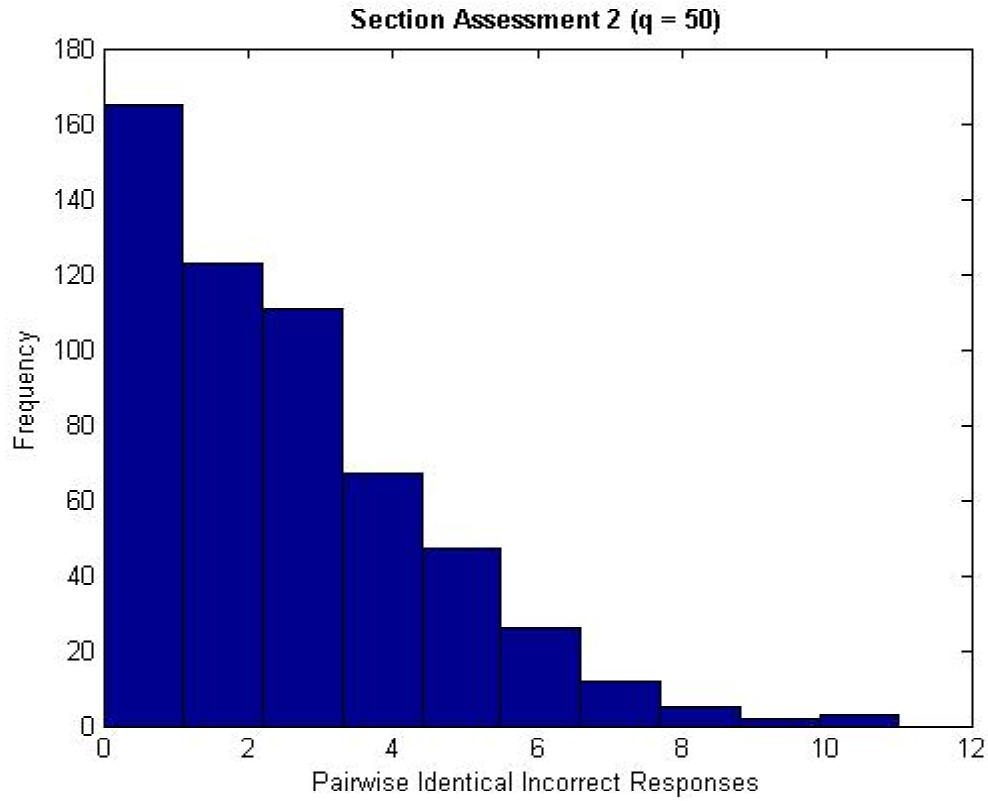

Figure 2. Pairwise identical incorrect responses, Section Assessment 2.

Study parameter values for Section Assessment 2 were t = 1.5 hours, a random order of questions presented on the assessment, and allowed revisitation.

The calculated mean, μ, is 2.7291. The calculated value of γ is 0.9254, while the ideal skewness is 0.6053. The fact that the two skewness values are somewhat closer (Δ = 0.3201) suggests that, while some degree of cheating was present, less occurred than in the first case. This is demonstrated by the chi-square calculation, which yields a value of $\chi^2 = 5.675$. The confidence limits corresponding to the 97.5% confidence interval are again 2.7 and 19.0, and χ^2 falls well within the range, so this demonstrates that the Pólya distribution is a good fit for the data. The model parameter values are p = 0.8564 and r = 16.2701. Note that the higher value of r, as mentioned previously, indicates that the fitted Pólya distribution is closer in nature to the ideal Poisson distribution, and as such implies less cheating.

The first final assessment was taken by 33 students (n = 33) and consisted of 100 multiple-choice questions (q = 100). The total number of unique pairwise comparisons is 528. Figure 3 shows the corresponding distribution.

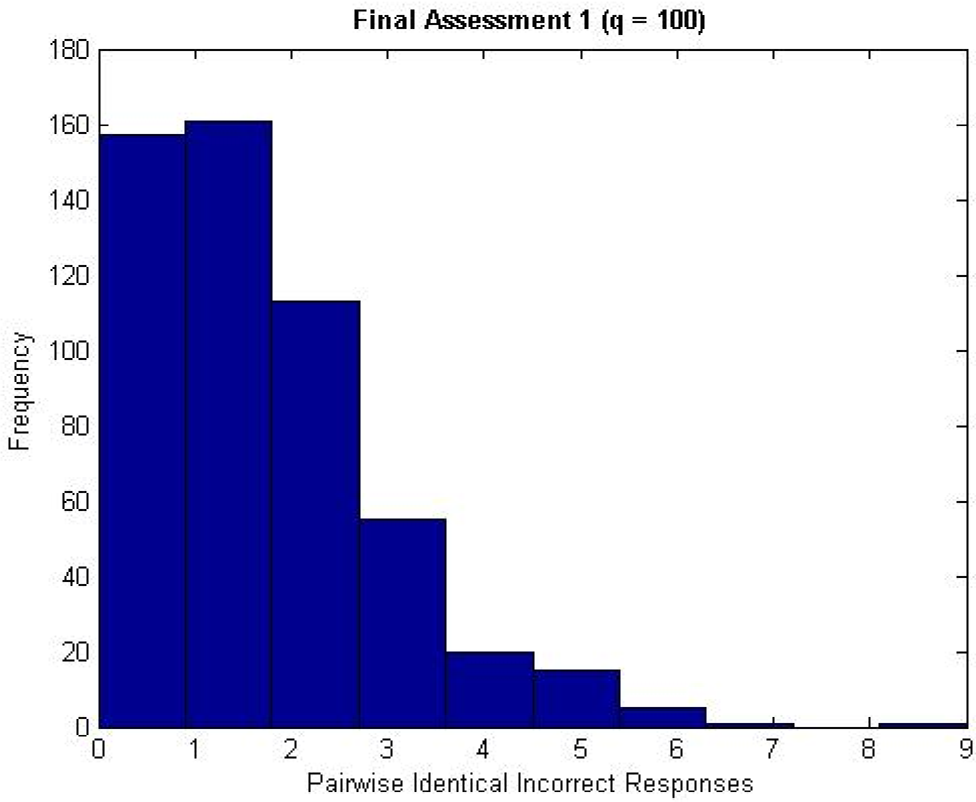

Figure 3. Pairwise identical incorrect responses, Final Assessment 1.

Study parameter values for Final Assessment 1 were t = 2.0 hours, a non-random order of questions presented on the assessment, and allowed revisitation.

The calculated mean, μ, is 1.4261. The calculated value of γ is 1.2895, and the ideal skewness is 0.8374. The fact that the difference between the two skewness values (Δ = 0.4521) is greater indicates that some degree of cheating was present, and in fact close to that in the case of the first section assessment. This is demonstrated by the chi-square calculation, which yields a value of $\chi^2 = 4.97$, again close to that of the 5.02 value in the first case. The confidence limits corresponding to the 97.5% confidence interval are again 2.7 and 19.0, and χ^2 again falls well within the range, so the Pólya distribution is a good fit for the data. The model parameter values are $p = 0.7293$ and $r = 3.8424$. Note that the model parameter values are also quite close to those found with Section Assessment 1, and note, as well, that the study parameter values in both cases were a non-random question order and allowed revisitation. The difference between the two cases was the extra time allowed for the final assessment, and it is interesting to see that, because χ^2 is slightly less in the case of the final, the implication is that slightly more cheating occurred on the final assessment than on the first.

The third section assessment (the first assessment of the second course) was taken by 18 students (n = 18) and consisted of 50 multiple-choice questions (q = 50). The total number of unique pairwise comparisons is this case is 153. Figure 4 shows the corresponding distribution.

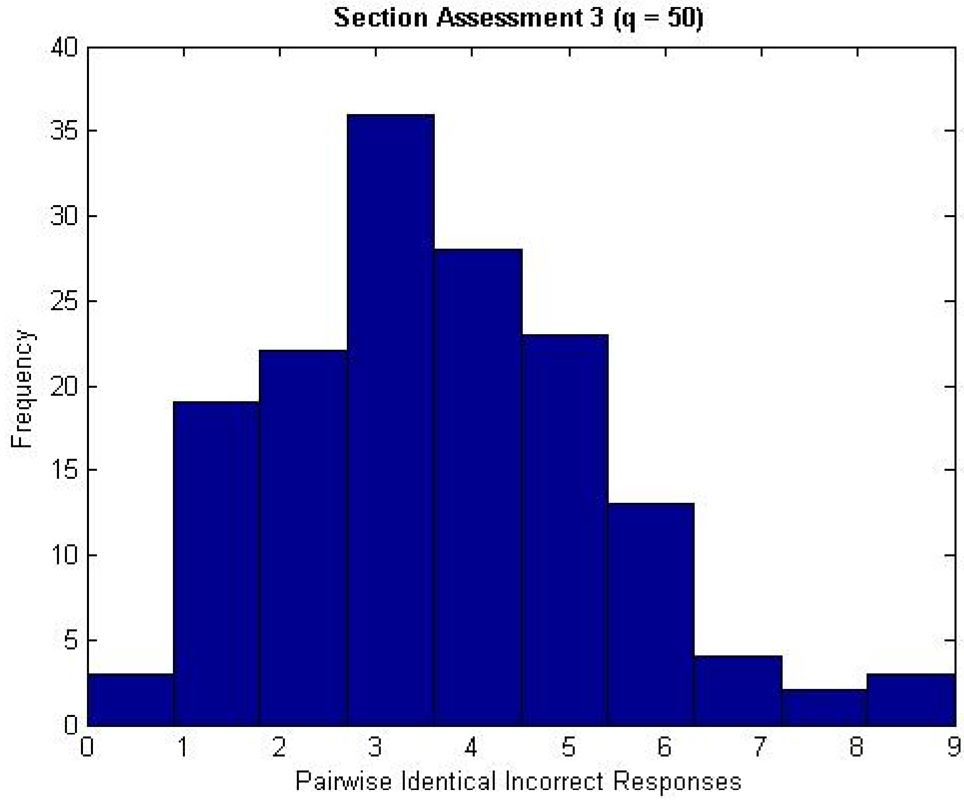

Figure 4. Pairwise identical incorrect responses, Section Assessment 3.

Study parameter values for Section Assessment 3 were t = 1.0 hours, a random order of questions presented on the assessment, and allowed revisitation. Note that the value of t was decreased in each of the remaining assessments.

The calculated mean, μ, is 3.5752. The calculated value of γ is 0.5146, and the ideal skewness is 0.5288. The difference between the two skewness values is quite small (Δ = -0.142), and indicates that minimal cheating was present. The initial attempt to fit the data to the Pólya distribution failed due to the lack of convergence of the nonlinear program to calculate the values of p and r, but algorithm convergence was achieved using a nonzero value of k. The chi-square calculation then yielded a value of $\chi^2 = 20.3$. The confidence limits corresponding to the 97.5% confidence interval are again 2.7 and 19.0, but χ^2 falls outside this range, so while the Pólya distribution does not fit the data within these limits, the fit becomes acceptable if we increase the confidence level to the 99%.

The fourth section assessment (the second assessment of the second course) was taken by 17 students (n = 17) and consisted of 50 multiple-choice questions (q = 50). The total number of unique pairwise comparisons is 136. The corresponding distribution is shown in Figure 5.

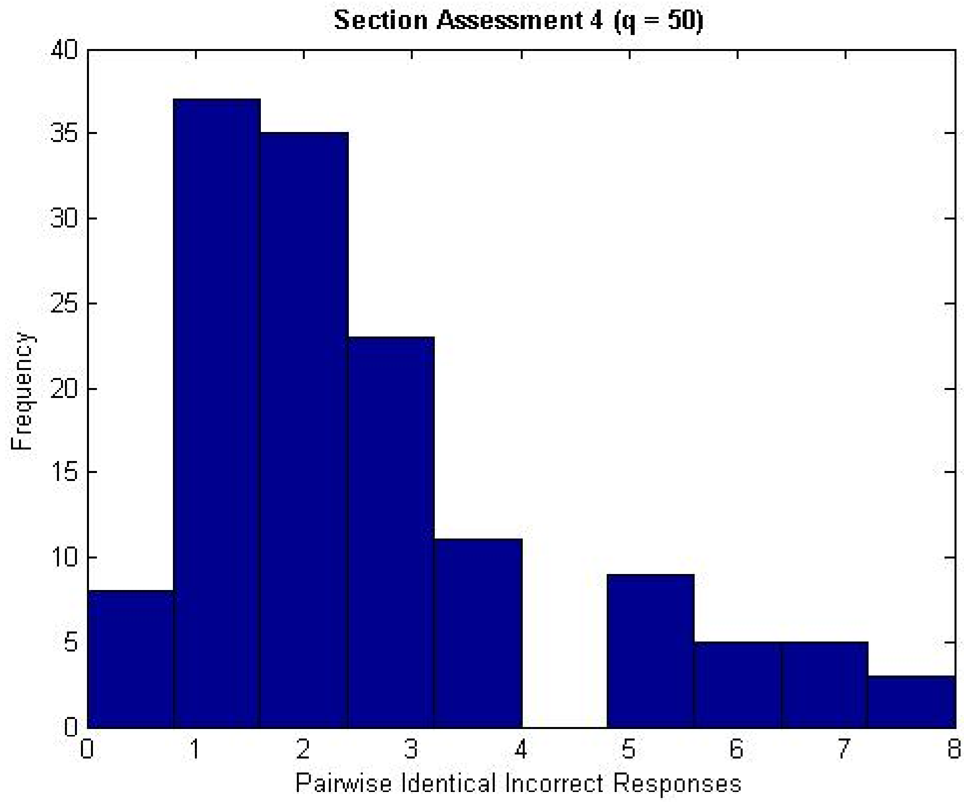

Figure 5. Pairwise identical incorrect responses, Section Assessment 4.

Study parameter values for Section Assessment 4 were t = 1.0 hours, a random order of questions presented on the assessment, and disallowance of question revisitation.

The calculated mean, μ, is 2.6029. The calculated value of γ is 1.0483, and the ideal skewness is 0.6198. The difference between the two skewness values (Δ = 0.4285) is greater than that seen in the case of Section Assessment 3, and, as was the case with that assessment, the initial attempt to fit the data to the Pólya distribution failed due to the lack of convergence of the nonlinear program. Algorithm convergence was again achieved using a nonzero value of k. The chi-square calculation, however, yields a value of χ^2 = 233.7, which widely exceeds the 97.5% confidence level, indicating that the Pólya distribution does not fit the data acceptably.

The second final assessment was taken by 17 students (n = 17) and consisted of 100 multiple-choice questions (q = 100). The total number of unique pairwise comparisons in this last assessment of the study is, again, 136. Figure 6 shows the corresponding distribution.

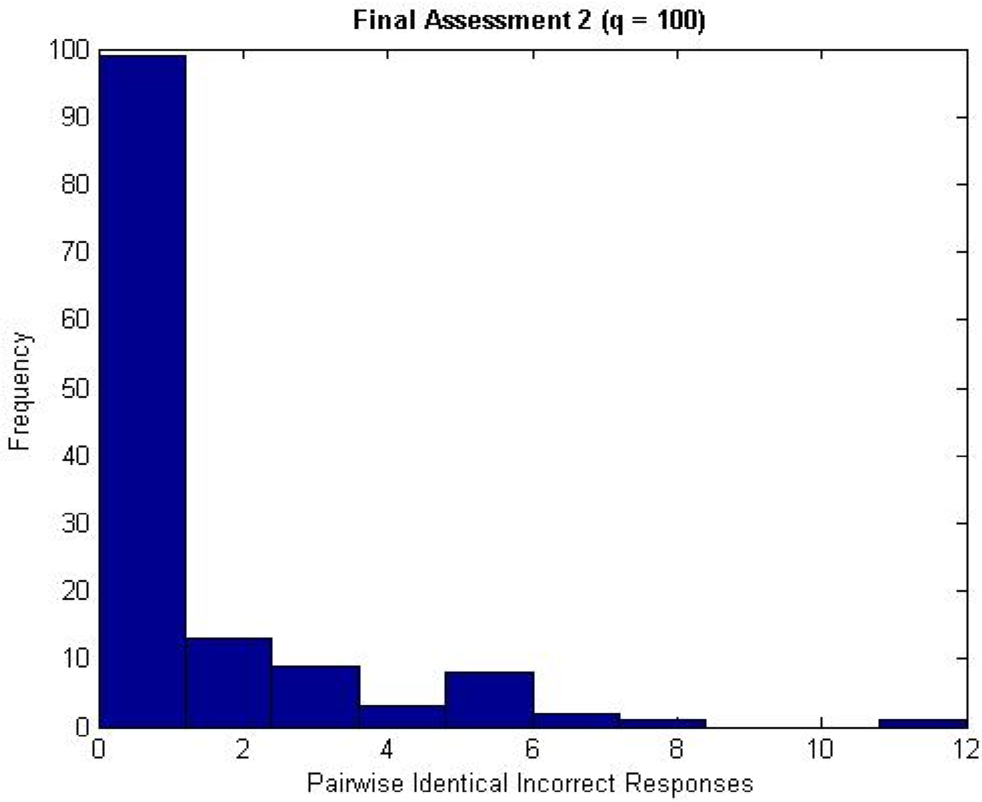

Figure 6. Pairwise identical incorrect responses, Final Assessment 2.

Study parameter values for Final Assessment 2 were t = 1.5 hours, a non-random order of questions presented, and disallowance of question revisitation.

The calculated mean, μ, is 1.2868. The calculated value of γ is 2.3856, and the ideal skewness is 0.8815. The fact that the difference between the two skewness values is rather large (Δ = 1.5041) indicates that a significant degree of cheating was present. This is demonstrated by the chi-square calculation, which yields a value of $\chi^2 = 13.67$. The confidence limits corresponding to the 97.5% confidence interval are again 2.7 and 19.0, and χ^2 falls within the range, so the Pólya distribution fits the dataset well. The model parameter values are $p = 0.048$ and $r = 0.1348$. The low value of r substantiates the inference that significant cheating occurred on this exam; as noted earlier, the Pólya probability mass function converges to that of the Poisson distribution as $r \rightarrow \infty$.

The study parameters and χ^2 values are summarized for ease of reference in Table 1 below.

Table 1. *Summary of Study Parameters and Goodness-of-fit Results.*

Assessment	***t* (hours)**	**Random**	**Revisitation**	χ^2
S. A. 1	1.5	No	Yes	5.02
S. A. 2	1.5	Yes	Yes	5.68
F. A. 1	2.0	No	Yes	4.97
S. A. 3	1.0	Yes	Yes	20.3
S. A. 4	1.0	Yes	No	233.7
F. A. 2	1.5	No	No	13.67

ANALYSIS

Given the structure of the study as it was conducted, it is both possible and instructive to compare the effects of variation of the three parameters of interest by examining the section assessments. We first examine changes in the parameter t; specifically, a reduction in that parameter with the other parameters held constant. One can readily do this by comparing the results from Section Assessments 2 and 3. The reduction in the allowed test time by half an hour (33.3%) led in this case to an increase in χ^2 by a factor of 3.6, indicating that the degree of cheating decreased, since a higher value of χ^2 implies a poorer fit of the data to an ideal Pólya distribution. From a more empirical viewpoint, in general, the reduction of allowed test times between the first course (Section Assessments 1 and 2 and Final Assessment 1) and the second (Section Assessments 3 and 4 and Final Assessment 2) led to considerable increases in each relevant value of χ^2. This makes good sense, since unauthorized collaboration between students requires time, and is less possible when less time per question is allowed for the assessment.

Next, we examine a change from a non-random order of question presentation to a random order. It should be noted again that the question pool sizes for the random-ordered assessments were the same as the number of questions in the assessments; in other words, all available questions were presented to each student. Section Assessments 1 and 2 may be compared to provide an insight to the value of randomization. It can be seen from this comparison that use of randomization, all other parameters being constant, leads to an increase in χ^2, and thus a decrease in cheating, as expected.

Lastly, we examine the disallowance of question revisitation by comparing Section Assessments 3 and 4. Note that a substantial increase in χ^2 occurs (by a factor of 11.5) when revisitation is disallowed. Note also, though, that the skewness actually increases as a result of the disallowance, and when this is taken in the context that the programming methods for fitting each of these two assessments originally failed to converge to solutions for the Pólya distribution parameters, it is evident that this comparison is not particularly useful. A more valid comparison can be made between Final Assessments 1 and 2, in which the disallowance of revisitation led to an increase in χ^2 as calculated for Final Assessment 2. This occurred, however, with a corresponding decrease in the time allowed for the assessment, so while this provides an indication that the disallowance of revisitation leads to a decrease in cheating, the results are not entirely conclusive.

CONCLUSION AND FURTHER INVESTIGATION

The study presented here demonstrates that a strong positive correlation exists between time allowed for the online assessment and frequency of cheating, and that randomization of question order is also moderately to strongly correlated with reduced cheating. Also, while indications are that disallowing question revisitation reduces cheating, especially when coupled with reduced testing times, numerical results related to this parameter are inconclusive.

Two potential items for further research are an additional study of the revisitation parameter so that it may be decoupled from the test time parameter, and the inclusion of additional parameters in the study; of particular interest are the effects of the immediate release of the results to the student (and the determination of whether this affects the mean of the actual assessment scores), and the effects of the broadening and narrowing of the assessment availability window.

Additional research in this area might include a study to see whether a correlation exists between exam scores and the degree of cheating present on subsequent exams; i.e., whether lower exam scores lead to increased cheating later in the course due to a sense of desperation on the part of some students. Finally, further study in a somewhat different direction might address the question of what we as instructors can actually do when cheating is detected by the methods suggested herein; how the problem students should be handled, and how the perpetrators might be separated from the victims.

While the benefits of using online assessments in fully-online, hybrid, and traditional methods of course delivery are many, it is important that the distance educator become aware of the opportunities for academic dishonesty that exist in the online delivery environment, understand how to minimize those opportunities, and avail himself or herself of the technology to detect dishonesty when it does in fact occur. Only then will the integrity of the environment reach the level that it must in order for the promise of distance learning to realize its fullest potential.

REFERENCES

Abbott, L., Siskovic, H., Nogues, V., & Williams, J. (2000). Learner assessment in multimedia instruction: considerations for the instructional designer. Paper presented at the Society for Information Technology & Teacher Education International Conference, San Diego, CA. Retrieved from http://eric.ed.gov. (ED444516)

Burlak, G., Hernández, J., Ochoa, A., & Muñoz, J. (2006). The use of data mining to determine cheating in online student assessment. In *Proceedings of the 2006 Electronics, Robotics and Automotive Mechanics Conference*, 1, 161-166. Washington, DC: IEEE Computer Society.

California State University, Sacramento. (n.d.). Online exams: strategies to minimize cheating. Sacramento: California State University System. Retrieved from http://www.csus.edu/webct/faculty/online-exams-best-practices.pdf

Cooper, L. (2000). Online courses: tips for making them work. *THE Journal* [Online], 27(8), 86-92. Retrieved from http://thejournal.com/Articles/2000/03/01/Online-Courses--Tips-for-Making-Them-Work.aspx

Crown, D., & Spiller, M. (1998). Learning from the literature on college cheating: a review of empirical research. *Journal of Business Ethics*, 17, 683-700.

Dick, M., Sheard, J., Bareiss, C., Carter, J., Joyce, D., Harding, T., & Laxer, C. (2003). Addressing student cheating: Definitions and solutions. *ACM SIGCSE Bulletin*, 35(2), 172-184.

Dirks, M. (1998). How is assessment being done in distance learning? Paper presented at the Northern Arizona University Web '98 Conference, Flagstaff, AZ. Retrieved from http://eric.ed.gov. (ED423273)

Eplion, D., & Keefe, T. (2005, April*)*. On-line exams: strategies to detect cheating and minimize its impact. Paper presented at the Tenth Annual Instructional Technology Conference, Murfreesboro, TN. Retrieved from http://frank.mtsu.edu/~itconf/presentations/eplion.html

Illinois Online Network. (n.d.). Strategies to minimize cheating online. Champaign-Urbana: University of Illinois System. Retrieved from http://www.ion.uillinois.edu/resources/tutorials/assessment/cheating.asp

Kaczmarczyk, L. (2001). Accreditation and student assessment in distance education: why we all need to pay attention. In *Proceedings of the 6th Annual Conference on Innovation and Technology in Computer Science Education*, 113-116. New York, NY: Association for Computing Machinery.

Kim, N., Smith, M., & Maeng, K. (2008). Assessment in online distance education: a comparison of three online programs at a university. *Online Journal of Distance Learning Administration* [Online], 11(1). Retrieved from http://www.westga.edu/~distance/ojdla/spring111/kim111.html.

Mason, D., & Woit, D. (1998). Integrating technology into computer science examinations. In *Proceedings of the Twenty-Nonth SIGCSE Technical Symposium on Computer Science Education*, 140-144. New York, NY: Association for Computing Machinery.

Meyen, E.L., Aust, R. J., Bui, Y. N., & Isaacson, R. (2002). Assessing and monitoring student progress in an e-learning personnel preparation environment. *Teacher Education and Special Education*, 25(2), 187-198.

McMurtry, K. (2001). E-cheating: combating a 21st century challenge. *T.H.E. Journal* [Online], 29(4), 36-38, 40-41. Retrieved from http://eric.ed.gov. (EJ641503)

Olt, M. (2002). Ethics and distance education: strategies for minimizing academic dishonesty in online assessment. *Online Journal of Distance Learning Administration* [Online], 5(3). Retrieved from http://www.westga.edu/~distance/ojdla/fall53/olt53.html.

Pain, D., & Le Heron, J. (2003). WebCT and online assessment: the best thing since SOAP? *Educational Technology & Society*, 6(2), 62-71.

Rogers, C. (2006). Faculty perceptions about e-cheating during online testing. *Journal of Computing Sciences in Colleges*, 22(2), 206-212.

Rowe, N. (2004). Cheating in online student assessment: beyond plagiarism. *Online Journal of Distance Learning Administration* [Online], 7(2). Retrieved from http://www.westga.edu/~distance/ojdla/summer72/rowe72.html.

Aviation Student Involvement in Campus Based Extracurricular Organizations at a Midwestern University

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ABSTRACT

The purpose of this study was to investigate aviation student involvement in campus based extracurricular organizations at a large Midwestern university. Since 2002, the researchers have noted a steady decline in aviation student involvement, and recently surveyed students with the use of a descriptive survey questionnaire developed for this study to determine the cause of decreased student involvement. The survey was also used to investigate aviation student attitudes and beliefs about various student organizations in addition to soliciting demographic information about the students who completed the survey. The study found that a substantial number of aviation students did not perceive involvement in aviation student organizations as particularly meaningful to their lives. Furthermore, students were not aware of opportunities, through active involvement in campus and civic organizations, to network with aviation industry representatives for internships and employment during school or after graduation. Students also cited various reasons regarding their lack of active involvement in organizations including work, other obligations, and lack of time. Students indicated that some organizations had student leaders who lacked a sense of direction and purpose. Recommendations were made to assist faculty advisors in providing guidance to student leaders of organizations and to develop opportunities to educate students about the benefits of organizational involvement.

INTRODUCTION

Student involvement in campus-based student organizations contributes to the overall personal development of students engaged in the college life experience in many ways that cannot be measured. According to Huang and Chang (2004), “The concept of campus involvement may transcend the bounds of colors and cultures” (para. 2). The benefits of involvement, for all college students, correlate strongly to success in college. The effect of student’s involvement on their academic and personal growth is well known and has been widely studied. College students who are involved internalize a greater feeling of engagement, have higher rates of retention, and manage their time better (Astin, 1984). Researchers have found that active student involvement is a central dynamic in student learning and development (Pascarella & Terenzini, 1991). The more college students are involved in campus life, the more benefits they receive in terms of learning and personal development. The complexity of college student involvement is often difficult to measure and quantify because assessing personal growth and development can be subjective. According to Pascarella and Terenzini (1998), studies that correlate the effects of experiences or interventions to the characteristics of the student or institution are limited.

One key component in the life of college students is involvement that is consistent, meaningful, and well balanced. Adequate and meaningful involvement is subjective and somewhat ill-defined however Astin (1984) defined it as “the amount of physical and psychological energy that students invest in the college experience” (p. 518). Involvement can take on many forms including both academic and extra-curricular. The researchers are trying to distinguish what environmental and psychological influences are affecting student involvement. This will eventually lead faculty and administrators to achieve a more effective learning environment for the students within the aviation department.

REVIEW OF LITERATURE

Effective student involvement is often ill-defined, subjective, and complex. According to Astin (1984), there are many theories that are used to frame student involvement: subject-matter (content), resource, and individualized (eclectic). The content theory is based on the assumption that "student learning and development depend primarily on exposure to the right subject matter" (Astin, 1984, p. 520). In this theory, the students have a passive role in the learning process and this is a serious limitation according to Astin. The resource theory justifies student success or failure based on the available physical resources. "The resource theory maintains that if adequate resources are brought together in one place, student learning and development will occur" (Astin, 1984, p. 520). The resource theory does not account for the specific use or allocation of these resources and this is a limitation. The individualized theory "attempts to identify the curricular content and instructional methods that best meet the needs of the individual student" (Astin, 1984, p. 521). Any faculty member who has taught a class with more than one student can see some serious limitations with this theory having expensive, time consuming, and limitless pedagogies.

One resource that is not accounted for in the aforementioned theories is the limited amount of uncommitted time the student has available for extra-curricular involvement. In order to maximize student life, it is imperative that students engage in meaningful, relevant, and well orchestrated activities that will enhance their learning and college experience. Astin's theory of student involvement "suggests that the most precious institutional resource may be student time" (Astin, 1984, p. 522).

Researchers Pascarella and Terenzini (2005), in their book *How College Affects Students: A Third Decade of Research* analyze the multiple impacts of the college experience on students through a metanalysis of the literature. One of the conclusions they draw is significant:

> Interaction with peers is probably the most pervasive and powerful force in student persistence and degree completion. It is critical for students to be psychologically engaged to get the most out of college. Other things being equal, the more the student is psychologically engaged in activities and tasks that reinforce the formal academic experience, the more he or she will learn. (p. 119)

Simply showing up at student organization meeting or activity is not truly effective unless there is meaningful active involvement. According to Astin (1999), "Involvement has both quantitative and qualitative features. The extent of a student's involvement in academic work, for instance, can be measured quantitatively (how many hours the student spends studying) and qualitatively (whether the student reviews and comprehends reading assignments or simply stares at the textbook and daydreams)" (p. 519). Likewise, student involvement in non-academic pursuits (extracurricular activities) also has quantitative and qualitative features.

The weakness of this study is the multitude of variables that influence college student involvement were not measured by the survey instrument. Other researchers have explored the phenomena of how students become excessively self-centered. For example, the 2006 Pew Survey of 15-18 year old people "found that only 31% said 'helping people who need help' was an important goal of their generation, coming in a distant third behind 'getting rich' (81%) or 'becoming famous' (51%)" (Twenge & Campbell, 2009, p. 253). Some authors, scholars, and consultants (Lancaster & Stillman, 2005) have studied the differences between traditionalists, baby boomers, generation X'ers, and millenials and its effects in the workplace. Another variable that is beyond the scope of this study is the negative effect of excessive involvement: How much is too much? Student involvement in college (or lack of) is not an easy phenomenon to express or quantify. Astin's theory of involvement states: "For a particular curriculum to achieve the effects intended, it must elicit sufficient student effort and investment of energy to bring about the desired learning and development" (1984, p. 522). The underlying assumption of Astin's theory of student development is motivation and in the context of student success, motivation is a powerful force.

METHODOLOGY

Participants

The participants for this study included 123 aviation students from a large Midwestern university. A descriptive type survey questionnaire was developed by the authors to solicit opinions and comments from the aviation students relative to student organizational involvement. Two key assumptions were made about the participants during the study: (a) The representative samples from the aviation students had reasonable knowledge about aviation student organizations whose views reasonably represent the majority of the entire aviation student body and (b) the students responded to the questionnaire with the intent on assisting the authors of this study with minimal bias in determining why aviation student involvement has decreased.

Research Instrument

The research instrument used to collect the data was a survey questionnaire developed specifically for this study. The survey was distributed to 123 aviation students on campus in the aviation department. The survey was comprised of two sections. The first section utilized a series of questions that solicited the students' views about active involvement in aviation student and civic organizations. The survey questionnaire also asked what frustrates the students who are involved in a student/civic organization. The second section of the survey instrument incorporated a demographic section to develop a profile of student responses based on age, gender, major, full/part time school status, full/part time employment, length of time attending school, and highest pilot certificate held. Responses left blank by the respondents were indicated by *N/R (No Report)*. In evaluating the data presented in the following tables, rounding errors should be taken into consideration.

DATA ANALYSIS

Demographics and Analysis

Data from the survey questionnaires were compiled from the software program, Statistical Package for Social Sciences (SPSS) (2007). The research data were analyzed by using cross tabulations, chi-square, and Pearson's correlation of ranks scores. After performing a Pearson chi square test, it was found that some of the data results were extremely skewed or expected frequencies were less than five (SPSS Reference Guide, 1990). As a result, the cells were collapsed into a 3 x 4 contingency table and an additional chi-square test was used to examine the significance of the association between the two variables (SPSS Statistics Base 17.0 User's Guide, 2007). The most prominent demographic characteristic was gender. Of the usable 123 respondents reporting gender, 104 students (84.6%) were male, 15 students (12.2%) were female, and 3 students (3.3%) did not report their gender so any type of statistical inference between gender and student responses was inconclusive.

Cross Tabulations

The data in Table 1 show cross tabulation results between the respondents' current involvement in student organizations and the organization. It should be noted that out of the total respondents (n =123) several individuals were reported to have been actively involved in more than one student organization. Over one-half of all the respondents (n= 64, 52.0%) reported they were not actively involved in any aviation organization however the organization with the most active members is the Aero Club (n=45, 36.6%). The next active organization takes a distant second place with eight members (6.5%) being involved with the Aviation Ambassadors. Fifty-nine students (48.0%) were not involved in any student organization at all.

Table 1: *Comparison Between Student Organization Type and Student Involvement*

	Current Involvement in a Student Organization					
	Active Involvement		Not Involved		Totals	
Organization	*n*	%	*n*	%	*n*	%
Alpha Eta Rho	6	4.9%	117	95.1%	123	100.0%
Aero Club	45	36.6%	78	63.4%	123	100.0%
AAAE	7	5.7%	116	94.3%	123	100.0%
Women in Aviation	7	5.7%	116	94.3%	123	100.0%
Aviation Ambassadors	8	6.5%	115	93.5%	123	100.0%
Other Organizations	5	4.1%	118	95.9%	123	100.0%
None	64	52.0%	59	48.0%	123	100.0%
No Answer	2	1.6%	121	98.4%	123	100.0%

Table 2: *Comparison Between Student Organization Membership and Level of Education*

	Education Level						
	Freshman	Sophomore	Junior	Senior	5th Year or More	No Response	Total
Organization	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Alpha Eta Rho	0 (0.0)	1 (0.8)	2 (1.6)	3 (2.4)	0 (0.0)	0 (0.0)	6 (4.9)
Aero Club	5 (4.1)	11 (8.9)	12 (9.8)	15 (12)	1 (0.8)	1 (0.8)	45 (36.6)
AAAE	0 (0.0)	1 (0.8)	2 (1.6)	2 (1.6)	1 (0.8)	1 (0.8)	7 (5.7)
Women in Aviation	0 (0.0)	1 (0.8)	3 (2.4)	2 (1.6)	0 (0.0)	1 (0.8)	7 (5.7)
Aviation Ambassadors	1 (0.8)	2 (1.6)	2 (1.6)	3 (2.4)	0 (0.0)	0 (0.0)	8 (6.5)
Civil Air Patrol	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Other	2 (1.6)	1 (0.8)	0 (0.0)	1 (0.8)	0 (0.0)	1 (0.8)	5 (4.1)
None	14 (11.)	18 (15)	19 (15.4)	8 (6.5)	3 (2.4)	2 (1.6)	64 (52.0)
No Response	0 (0.0)	1 (0.8)	1 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.6)

Note. Percentage values shown are based on *n* =123 respondents.

The illustration in Table 2 shows cross tabulation results between the respondents' educational level and the student organization and the organization. The highest concentration of students involved are seniors in Aero Club (*n*=15, 12.2%) followed by juniors in Aero Club (*n*=12, 9.8%). Conversely, there is a relatively high number of juniors (*n* =19, 15.4%), sophomores (*n* =18, 14.6%), and freshman (*n* =14, 11.4%) for a combined total of 51 students (41.1%) who reported they were not involved in any organization.

Table 3: *Comparison Between Student Degree Program and Active Involvement in Student Organizations*

	Current Involvement in an Aviation Student Organization			
	Yes	No	Non-Member	Total
Degree Program	*n* (%)	*n* (%)	*n* (%)	*n* (%)
BS Aviation (Pro Flight)	15 (12.2)	10 (8.1)	12 (9.8)	37 (30.1)
BS Aviation (Operations)	10 (8.1)	7 (5.7)	11 (8.9)	28 (22.8)
BS Aviation (Management)	7 (5.7)	3 (2.4)	5 (4.1)	15 (12.2)
BAS Aviation (MX Mgmt.)	0 (0.0)	1 (0.8)	1 (0.8)	2 (1.6)
Non-AVIT Major/AVIT Minor	1 (0.8)	4 (3.3)	3 (2.4)	8 (6.5)
Elective Studies	0 (0.0)	1 (0.8)	1 (0.8)	2 (2.4)
Other	0 (0.0)	8 (6.5)	16 (13.0)	24 (19.5)
No Response	3 (2.4)	1 (0.8)	3 (2.4)	7 (5.7)
Total	36 (29.2)	35 (28.5)	52 (42.3)	123 (100.8)

Table 3 shows a comparison between current involvement in aviation student organizations and the student degree program. Fifteen students (12.2%) who reported they are actively involved in a student organization are working towards a Bachelor of Science degree in Aviation with an emphasis in Professional Flight followed by 10 students (8.1%) who are working on a Bachelor of Science degree in Aviation with an emphasis in Operations. Note there were no actively involved students in student organizations who are working on a Bachelor of Applied Science degree in Aviation Maintenance Management. Due to the small number of enrolled students in this degree program (who all have prior work experience and are typically older than traditional aged students) the data appears to reinforce the researchers' views of low student involvement in this particular major. Almost one-fifth of the students are inactive and non-member students (*n*=24, 19.5%) who reported *Other* for their major. The researchers suspect that most of these students are probably first and second year students who are either undecided or in a non-aviation major.

Table 4: *Comparison Between Active Student Involvement in Student Organizations and Level of Education*

Current Active Involvement	Freshman *n* (%)	Sophomore *n* (%)	Junior *n* (%)	Senior *n* (%)	5th Year or More *n* (%)	No Response *n* (%)	Total *n* (%)
	Education Level						
Yes	4 (3.3)	7 (5.7)	10 (8.1)	11 (8.9)	1 (0.8)	3 (2.4)	36 (29.2)
No	4 (3.3)	16 (13.0)	6 (4.9)	9 (7.3)	0 (0.0)	0 (0.0)	35 (28.4)
Non-Member*	13 (10.6)	10 (8.1)	17 (13.8)	8 (6.5)	3 (2.4)	1 (0.8)	52 (42.2)
Total	21 (17.1)	33 (26.8)	33 (26.8)	28 (22.8)	4 (3.2)	4 (3.2)	123 (99.8)

Note. Four respondents did not indicate their education level although they specified their current involvement.
*Student is not a member of any aviation student organization.

The data in Table 4 show an overall comparison between education level and current active involvement in an organization. Almost one-half of the respondents (*n*=52, 42.2%) are non-members which is a very significant increase from the year 2002. Over one-quarter of the students (*n*=35, 28.4%) reported they are members of at least one organization however they are not actively involved. Collectively, this accounts for a total of 87 surveyed students (70.6%) who are not actively involved. This finding is also consistent with the trend for decreased student involvement since 2002.

Table 5: *Comparison Between Student Employment Status and Active Involvement in Student Organizations*

Employment Status	Yes *n* (%)	No *n* (%)	Non-Member *n* (%)	Total *n* (%)
	Current Involvement in an Aviation Student Organization			
Not Working	10 (8.1)	10 (8.1)	16 (13.0)	36 (29.3)
Work P/T Off Campus	20 (16.3)	21 (17.1)	26 (21.1)	67 (54.5)
Work F/T Off Campus	1 (0.8)	3 (2.4)	4 (3.3)	8 (6.5)
Work Study	3 (2.4)	2 (1.6)	5 (4.1)	10 (8.1)
Total	34 (27.6)	36 (29.3)	51 (41.5)	121 (98.4)

Note. Two respondents did not indicate their employment status and were not included in the table.

In Table 5, current student involvement is compared with employment status. Note that 21 students (17.1%) are not actively involved and work part time off campus while 26 students (21.1%) are non-members and also work off campus. Cumulatively, this translates into 47 students (38.2%) surveyed work part time off campus and are actively involved. Ironically, slightly less than one-quarter of the students (*n*=26, 21.1%) are not actively involved and also do not work. For this group of students, how they are spending their free time is unclear however the data clearly indicate that students are not spending time being actively involved in a student organization.

Table 6: *Comparison Between Non-Member Involvement and Level of Education*

	Education Level						
Consider Getting Involved?	Freshman *n* (%)	Sophomore *n* (%)	Junior *n* (%)	Senior *n* (%)	5^{th} Year or More *n* (%)	No Response *n* (%)	Total *n* (%)
Won't Get Involved	4 (3.3)	12 (9.8)	8 (6.5)	4 (3.3)	0 (0.0)	1 (0.8)	29 (23.6)
Consider Getting Involved	11 (8.9)	7 (5.7)	12 (9.8)	6 (4.9)	2 (1.6)	1 (0.8)	39 (31.7)
Already a Member	4 (3.3)	10 (8.1)	10 (8.1)	8 (6.5)	0 (0.0)	1 (0.8)	33 (26.8)
No Response	2 (1.6)	4 (3.3)	3 (2.4)	10 (8.1)	2 (1.6)	1 (0.8)	22 (17.9)
Total	21 (17)	33 (27)	33 (27)	28 (23)	4 (3)	4 (3)	123 (100)

Table 6 shows a comparison between the students' educational level and whether (or not) students would consider getting actively involved in a student organization. From the surveyed students, there appeared to be a normal distribution of total student responses ranging from freshman to seniors (freshman: *n*=21, 17.1%; sophomores: *n*=33, 26.8%; juniors: *n*=33, 26.8%; seniors: *n*=28, 22.8%). The researchers seemed hopeful that almost one-third of the students (*n*=39, 31.7%) indicated they would consider getting involved in a student organization. Most of the students who expressed interest in getting involved were freshman (*n*=11, 8.9%) and juniors (*n*=12, 9.8%). Unfortunately, almost one-quarter of the students (*n*=29, 23.6%) indicated they would not consider getting involved. For unknown reasons, ten students (8.1%) did not respond to the question about getting involved in a student organization.

Table 7: *Comparison Between Student Degree Program and Willingness to Get Involvement in Student Organizations*

	Non-Member Willingness to Get Involved				
	No	Yes	Already a Member	No Response	Total
Degree Program	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
BS Aviation (Pro Flight)	1 (0.8)	14 (11.4)	17 (13.8)	5 (4.1)	37 (30.1)
BS Aviation (Operations)	0 (0.0)	11 (8.9)	10 (8.1)	7 (5.7)	28 (22.8)
BS Aviation (Management)	0 (0.0)	4 (3.3)	4 (3.3)	7 (5.7)	15 (12.2)
BS Aviation (MX Mgmt.)	0 (0.0)	1 (0.8)	0 (0.0)	1 (0.8)	2 (1.6)
Non-AVIT Major/AVIT Minor	4 (3.3)	3 (2.4)	1 (0.8)	0 (0.0)	8 (6.5)
Elective Studies	2 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.6)
Other	20 (16.3)	3 (2.4)	0 (0.0)	1 (0.8)	24 (19.5)
No Response	2 (1.6)	3 (2.4)	1 (0.8)	1 (0.8)	7 (5.7)
Total	29 (23.6)	39 (31.7)	33 (26.8)	22 (17.9)	123 (100.0)

The data in Table 7 show a comparison of non-member willingness to get involved to the students' degree program. Twenty students (16.3%) who are non-members indicated their major was *Other* (undeclared major) which may suggest their lack of interest in getting involved in an aviation student organization. Overall, the data in Table 7 does not appear overly robust. One other noteworthy observation is that 14 non-member students (11.4%) have a willingness to get involved are BS Aviation (Pro Flight) students. At this institution, the Pro Flight option is still the most popular which may account for more interest in this degree specialization.

Table 8: *Comparison Between Member Frustration in Student Organizations and Level of Education*

	Education Level						
Student Member Frustration	Freshman *n* (%)	Sophomore *n* (%)	Junior *n* (%)	Senior *n* (%)	5th Year or More *n* (%)	No Response *n* (%)	Total *n* (%)
Lack of Direction	6 (4.9)	7 (5.7)	6 (4.9)	10 (8.1)	1 (0.8)	1 (0.8)	31 (25.2)
Leaders Unorganized	2 (1.6)	4 (3.3)	3 (2.4)	6 (4.9)	1 (0.8)	1 (0.8)	17 (13.8)
Advisors Unorganized	1 (0.8)	1 (0.8)	2 (1.6)	1 (0.8)	0 (0.0)	1 (0.8)	6 (4.9)
Lack of Meaningful Activities	4 (3.3)	8 (6.5)	4 (3.3)	9 (7.3)	1 (0.8)	0 (0.0)	26 (21.1)
Lack of Funding	6 (4.9)	4 (3.3)	8 (6.5)	8 (6.5)	0 (0.0)	1 (0.8)	27 (22.0)
Little/No Industry Networking	2 (1.6)	1 (0.8)	1 (0.8)	5 (4.1)	1 (0.8)	0 (0.0)	10 (8.1)
Club Meets at a Bad Time	4 (3.3)	5 (4.1)	3 (2.4)	6 (4.9)	1 (0.8)	0 (0.0)	19 (15.4)
Other	0 (0.0)	4 (3.3)	5 (4.1)	4 (3.3)	1 (0.8)	1 (0.8)	15 (12.2)

In Table 8, educational level is cross-tabulated with student member frustration. Slightly over one-quarter of the member students (*n*=31, 25.2%) complained that student organizations lack direction followed by a lack of funding (*n*=27, 22.0%). The third complaint is a lack of meaningful activities (*n*=26, 21.1%) which is closely related to a lack of direction. Very few students complained that student organization advisors are unorganized (*n*=6, 4.9%). There were very few complaints that little or no industry networking opportunities occurred regardless of the students' year in school. This finding is somewhat peculiar as successful entrance into the aviation workplace is often reliant on the student's ability to network.

Table 9: *Frequencies and Chi-Square Test Comparison of Responses Between Year in School and Involvement in Student Organizations*

	Student Involvement in Organizations			
Year in School	**Active Member** *n* Expected Chi-Square	**Non-Active Member** *n* Expected Chi-Square	**Non Member** *n* Expected Chi-Square	**Total** *n*
Freshman	4 5.82 0.571	4 6.18 0.767	13 9.00 1.778	21
Sophomore	7 9.15 0.506	16 9.71 4.082	10 14.14 1.214	33
Junior	10 9.15 0.079	6 9.71 1.415	17 14.14 0.577	33
Senior	12 8.87 1.101	9 9.41 0.018	11 13.71 0.537	32
Total	33	35	51	119

Note. Chi-Square = 12.644, DF = 6, $p = .018$. *$p < .05$

In Table 9, a chi-square test was conducted between the student educational levels and their student organizational involvement status. The largest relationship (chi-square = 4.082) exists between the observed value of 16 sophomores who are non-active members compared to the expected value of 10 students. The second most significant cell (chi-square = 1.778) is the relationship between freshman who are non members resulting in an observed value of 13 students and an expected value of 9 students. The third cell of significance (chi-square = 1.415) has an observed value of 6 juniors who are non-active members compared to an expected value of 10 students. The fourth cell of significance (chi-square = 1.778) has an observed value of 10 non-member sophomores compared to an expected value of 15 students.

Table 10: *Pearson's Correlation of Ranks: Student Responses by Major Classification*

Student Response	Pro Flight (*n*=37) *n* (%)	Pro Flight Rank	BS Operations (*n*=28) *n* (%)	BS Operations Rank	Mgmt., MX Mgmt. Non-Avit/E-Studies (*n*=51) *n* (%)	Mgmt., MX Mgmt. Non-Avit/E-Studies Rank	Total (*n*=116) *n* (%)	Total Rank
Lack of Direction	11 (29.8)	2	9 (32.1)	1	9 (17.6)	2	29 (25.0)	1
Leaders Unorganized	6 (21.4)	5	6 (21.4)	5	4 (7.8)	5.5	16 (13.8)	5
Advisors Unorganized	2 (5.4)	7	1 (3.6)	8	2 (3.9)	8	5 (4.3)	8
No Meaningful Activities	9 (24.3)	3	6 (21.4)	5	10 (19.6)	1	25 (21.6)	2.5
Lack of Funding	12 (32.4)	1	7 (25.0)	2.5	6 (11.8)	3.5	25 (21.6)	2.5
Little/No Networking	3 (8.1)	6	4 (14.3)	7	3 (5.9)	7	10 (8.6)	7
Org. Meets at Bad Time	8 (21.6)	4	6 (21.4)	5	4 (7.8)	5.5	18 (15.5)	4
Other	1 (2.7)	8	7 (25.0)	2.5	6 (11.8)	3.5	14 (12.1)	6
No Response	16 (43.2)		7 (25.0)		30 (58.8)		53 (45.7)	

p=.029, one-tailed, level of significance=.97

In Table 10, a Pearson's Correlation of Ranks test was conducted between the various student majors (who are members of at least one student organization) and their responses. Due to the low number of students who indicated they were majoring in aviation maintenance management, non-aviation major minoring in aviation, elective studies, or other non-aviation majors, these responses were combined prior to the test. There is a significant relationship (*p*=.029, one-tailed) between the responses from operations majors (see column 2 in Table 10) vs. the other aviation majors indicated in column 3. Specifically, there is a significant difference as *No Meaningful Activities* reported by the Operations students is ranked number five however; the third category of majors (Aviation Management, Maintenance Management, Non-Aviation students, and Elective Studies students) ranked *No Meaningful Activities* as number one. Although the data does not suggest why there is a significant difference between the two groups, it is possible that significant differences may result from the fact that Operations students are traditional aged students between 18 and 23 years old while many of the Maintenance Management and Elective Studies students are much older than their traditional age counterparts.

Complaints in the *Other* category include one student each citing the following reasons: bad morale, bad event times, vague meeting locations, advisors not involved, board members have big heads, poor attendance at meetings, one student did not list anything, two students cited lack of motivation, and four students cited lack of participation/decreasing members.

CONCLUSIONS

This research paper attempted to determine some of the underlying reasons for a steady decline in aviation student involvement. The results of this study suggest a student's time is a limited resource and this is substantiated by a review of the literature. Of the respondents, 69.1% of the students surveyed are working part-time or full time. This study also revealed the majority of students are involved or willing to be involved given the opportunity. In addition, 26.8% of the students surveyed were currently involved in extra-curricular activities and an additional 31.7% would consider getting involved. This study also supported the notion that students are looking for extra-curricular activities that have direction and are meaningful, as 46.6% of the students surveyed considered a lack of direction and lack of meaningful activities a source of frustration.

There is no magic formula for motivating students to become involved. Achieving 100% student involvement is not a realistic goal. Reaching the 31.7% of students that would consider becoming involved is a realistic goal for faculty advisors and student leaders to achieve. According to Astin (1984), students need a motivating factor to become involved. This motivation may be based on a student's chief concern—obtaining employment after graduation. In light of an unfavorable economy adversely affecting the aviation industry, job prospects after graduation can be daunting and perhaps more than ever, meaningful involvement in student organizations may give a student a strong competitive edge in gaining employment in the aviation industry after graduation.

RECOMMENDATIONS

There are many demands on a student's time that influence their ability to be involved in campus based extra-curricular activities. Faculty advisors and student organization leaders need to recognize this constraint and plan events that are convenient and valuable for students. After reviewing the results of this survey, a few recommendations can be considered. Faculty advisors and student leaders need to plan events that have intrinsic value to a student's academic and future career. Although bowling and broomball activities can be fun, other value added activities for resume building should be considered like community volunteer work, working with local area K-12 students, CPR/ first aid training, high altitude endorsement training, providing access to industry mentors, etc.

An additional recommendation is that faculty and student organization leaders develop a better understanding of what is important for today's college students and the aviation industry and make recommendations to various student organizations. The goals of faculty and students need to align to a common goal—providing students with a well-rounded and academically challenging educational experience that best prepares them for future employment in the aviation industry. Motivating students to participate in this process beyond the classroom is a challenge that needs to be evaluated in light of the specific needs and concerns of today's college student; however, the responsibility for the level and quality of involvement is also on the student. According to Pascarella and Terenzini (1991), "The impact of college is not simply the result of what a college does for or to a student. Rather, the impact is a result of the extent to which an individual student exploits the people, programs, facilities, opportunities, and experiences that college makes available" (pp. 610-611). The students have a responsibility to engage in meaningful experiences during college that will positively impact their future. Faculty and administrators are also charged with the responsibility to constantly evaluate opportunities to ensure that students have the opportunity to not only receive an education but to actively participate in their education.

REFERENCES

Astin, A. W. (1984). Student involvement: a developmental theory for higher education. Retrieved September 8, 2009 from http://www.middlesex.mass.edu/TutoringServices/AstinInvolvement.pdf

Huang, Y., & Chang, S. (2004). Academic and cocurricular involvement: their relationship and the best combinations for student growth. *Journal of College Student Development.* Retrieved September 8, 2009 from http://findarticles.com/p/articles/mi_qa3752/is_200407/ai_n9457044/

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly, 24,* 602-611.

Lancaster, L. C. & Stillman, D. (2005). *When generations collide: Who they are, why they clash. How to solve the generational puzzle at work.* New York, NY: HarperCollins Publishers.

Pascarella, E. T., & Terenzini, P. T. (1998). Studying college students in the 21st century: meeting new challenges. *The Review of Higher Education, 21,* 151-165.

Pascarella, E. T., & Terenzini, P. T. (1991). *How college affects students: findings and insights from twenty years of research.* San Francisco: Jossey-Bass.

Pascarella, E. T., Terenzini, P. T., (2005). *How college affects students: a third decade of research.* San Francisco, CA: Jossey-Bass.

SPSS reference guide. (1990). Chicago: SPSS, Inc.

SPSS statistics base 17.0 user's guide. (2007). Chicago: SPSS, Inc.

Statistical Package for Social Sciences (SPSS) (Version 12.0) [Computer Software]. (2007). Chicago, IL: Polar Engineering and Consulting.

Twenge, J. M. & Campbell, W. K. (2009). *Living in the age of entitlement: the narcissism epidemic.* New York, NY: Free Press.

The Use of Test Anxiety Assessment and Anxiety Reduction Training to Predict and Improve Performance of Collegiate Pilot Trainees

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ABSTRACT

Written, oral, and practical flight tests, along with challenging flying tasks, place pilot trainees in stressful situations. The initial goals of this research were to determine assessment tools for identifying pilot trainees who might perform poorly in stressful flight testing environments, and measure the efficacy of a test anxiety (TA) workshop on anxiety levels and Federal Aviation Administration (FAA) knowledge assessments of pilot trainees. The researchers determined that: Scholastic Achievement Test (SAT) scores marginally predict facilitating anxiety levels, and FAA knowledge tests, taken in authentic testing environments, correlate significantly with debilitating anxiety, facilitating anxiety, and FAA exam scores. The researchers recommend continuing longitudinal assessment of freshman flight students that potentially links anxiety and performance on low-risk assessments with these measures on higher-risk practical flight tests. Further study is needed to determine if a more intense anxiety treatment can lower debilitating anxiety, raise facilitating anxiety, or improve performance on FAA exams.

INTRODUCTION

To ensure satisfactory pilot performance and safe flight operations, flight training involves continuous evaluation of aeronautical knowledge and piloting skills. At the researchers' institution, for example, the Department of Aviation provides a stringent curriculum which includes approved ground and flight training conducted under Title 14 Code of Federal Regulations Part 141. The Department's Federal Aviation Administration (FAA) approved curriculum requirements dictate a minimum passing score of 80% on ground school stage and end-of-course examinations. Failure to meet these requirements or failure to satisfactorily complete flight training lessons and check rides within the approved time-frame constitute grounds for termination from the flight training program.

Consequences for poor performance on flight evaluations can also be severe. Pilot trainees who perform poorly incur the expense of additional training and check rides and risk termination from the flight training program. Clearly, failed check rides threaten aviation careers, especially in light of new legislation. The Airline Safety and Pilot Training Improvement Act of 2009 (H.R. 3371, 111th Cong., 2009) amended the Pilot Records Improvement Act of 1996 (1997) to require the FAA to maintain records of all failed attempts by a pilot regarding practical flight tests for obtaining a certificate or type rating (Section 6 (b) (2) (i) (2) (A) [ii]). H.R. 3371 states that air carriers must access and evaluate information from pilot records regarding practical flight test failures before allowing pilots to begin service with the carrier (Section 6 (b) (2) (i) [1]), and that they may use such records to assess the qualifications of the individual in deciding whether or not to hire the individual as a pilot (Section 6 (b) (2) (i) (9) [A]). In preparation for a career as an air carrier pilot, Section 11 (c) (2) of H.R. 3371 will require "sufficient flight hours… in difficult operational conditions that may be encountered by an air carrier to enable a pilot to operate safely in such conditions". Ultimately, then, the pressure to perform well during flight training presents pilot trainees with the challenge of learning efficiently while overcoming barriers to that learning.

One such barrier faced by pilot trainees is test anxiety (TA). In a previous, more comprehensive literature review, Sloan and Wilson (2009) cited foundational studies in test anxiety. In part, they found that TA can be defined as "an unpleasant feeling or emotional state that has both physiological and behavioral concomitants and that is experienced in formal testing or other evaluative situations" (Dusek, 1980, p. 88). Sarason, Mandler, and Craighill (1952) hypothesized:

> When a stimulus situation contains elements which specifically arouse test or achievement anxiety, this increase in anxiety drive will lead to poorer performance in individuals who have test-irrelevant [incompatible or interfering] anxiety responses in their response repertory. For individuals without such response tendencies, these stimulus elements will raise their general drive level and result in improved performance (p. 561).

Formalizing the dual nature of TA suggested above, Alpert and Haber (1960) divided TA into two types: *debilitating* TA (DTA) which reduces performance, and *facilitating* TA (FTA) which improves performance. They devised the Achievement Anxiety Test (AAT) to measure an individual's predilection for either or both FTA and DTA. They concluded, "…that the incorporation of items designed to measure facilitating anxiety into a scale which already effectively measures debilitating anxiety can significantly increase the prediction of academic performance scores" (p. 215). The AAT has withstood the test of time. Wright State University and the University of Adelaide provide the AAT on their counseling websites. More recent research also incorporates the use of the AAT (Brewer, 2002; Haynes, 2003; Erickson, Horan, & Hackett, 1991; Fischer & Corcoran, 2007; Moyer, 2008; Robinson, 2008; Roney & Woods, 2003).

In their 2009 literature review, Sloan and Wilson concluded that "students who suffer from debilitating TA often match the performance of their peers in non-testing situations" (p. 12). They also stated that DTA can be self-perpetuating: when students do poorly on one test, they can develop a reduced feeling of self-efficacy which can negatively impact performance on future tests.

Observations by faculty from the host institution, in concert with testimonies of test-anxious pilot trainees, affirm the negative impact of debilitating test anxiety on assessments. Additionally, the faculty noted that debilitating test anxiety manifests itself in physiological and emotional symptoms, such as excessive nervousness or expressions of frustration and inadequacy.

Retaining qualified students in flight programs is desirable. In an introduction to Sloan and Wilson's 2009 literature review, Kohlruss (2009) suggests:

> If we can assist our students in succeeding with their FAA check rides we can help them stay in our programs. This of course will motivate them to stay in our industry and not stray off to other disciplines other than aviation. Our industry needs the best and the brightest. We cannot afford to lose them due to stress interfering with their successful performance on a check ride (p. 7).

Consequently, strategies that help pilot trainees cope with anxiety should also help them perform better during program assessments. Better test performance and anxiety coping skills should lead to increased retention in aviation programs and build stronger candidates who continue to withstand the rigors of HR3371 well into their careers.

Regarding training designed to reduce DTA, Sloan and Wilson (2009) also concluded "the progression of TA research shows that no single treatment method was superior, and a combination approach of cognitive, behavioral, and study skills treatments had the greatest effectiveness" (p. 12). They proposed that, "a single day workshop appeared to be as effective as sessions conducted over a longer period and is more apt to attract both participants and facilitators" (p. 12).

The purpose of this present study is: (a) to determine if the AAT, when adjusted with total Scholastic Assessment Test (SAT) scores (a long standing predictor of success in college [The College Board, n.d.]), is an accurate predictor of performance; and (b) to see if a TA workshop reduces DTA, increases FTA, or increases performance on aviation knowledge assessments.

METHOD

Participants

Out of 103 pilot trainees enrolled in a flight technology major at the host institution and actively pursuing flight training (91 men and 12 women, mean age = 20.95 years), 33 volunteered to participate in the study (27 men and 6 women). Volunteers' academic and flight experience ranged from freshmen to senior class standing and from student pilot to commercial pilot. Volunteers were assessed for DTA using the AAT. Positive DTA scores were identified as ranging from 21 through 36 (-1/+1.5 sd from the mean of 26.6), and only those who tested positive (n = 26; 22 men and 4 women) were selected as participants. Six volunteers were identified as not being test anxious due to their scores, and one volunteer who scored high on the TA scale (38) was eliminated due to suspicion of faulty testing. Participants were assigned to one of four levels (private, instrument, commercial, or certified flight instructor [CFI] according to their last ground school enrollment). Each level was then randomly assigned to the treatment group (total n = 13; private n = 3, commercial n = 5; instrument n = 3; CFI n = 2) and control group (total n = 13; private n = 3; commercial n = 4; instrument n = 4; CFI n = 2).

Procedure

Following the selection of participants, both the control and treatment groups were administered the AAT and an FAA knowledge pre-test. One week later the treatment group participated in a three-hour TA workshop conducted by an experienced counseling psychologist employed by the University's Health and Counseling Center and trained in TA reduction techniques. The following week, participants from both groups retook the AAT and completed a second appropriate FAA knowledge post-test.

The key elements of the performance anxiety workshop included psychoeducation and experiential exercises. The psychoeducational element included discussing the nature and function of anxiety, how anxious thoughts are related to anxious feelings, how anxiety undermines attention and performance, and the futility of struggling to make anxiety go away. The experiential exercises included a self-assessment of anxious experiences, metaphors emphasizing the idea that the more an individual struggles with anxiety the more present it is, and a mindfulness exercise. The workshop concluded with the recommendation that the participants practice self-observation and mindful acceptance in situations that provoke anxious experiences other than test situations. The last recommendation was made in order to enhance self-regulation.

Instruments

In addition to the AAT, the researchers employed other measures of college readiness and aviation knowledge in their analysis. These measures included FAA aeronautical knowledge test (AKT) scores from the most recent FAA exam taken by the participants, SAT scores, and the host institution’s Admissions Index (AI) – a probability of success indicator that takes into account high school grade point average (GPA) and standardized test scores. Notably, AKT scores came from four different tests, depending on participants' level: private pilot, instrument pilot, commercial pilot, or CFI. SAT scores were not available for 5 transfer students.

Additionally, four levels of AKTs, consisting of 15 questions each, were created from the FAA knowledge test-question data base. More specifically, the researchers constructed pre- and post-treatment private, instrument, commercial, and CFI tests for two reasons: to instigate authentic test-taking scenarios, and to measure change in performance levels after treatment. The post-treatment tests consisted of different questions on the same general knowledge areas used on the pre-treatment tests.

RESULTS

The researchers' goals were: (1) to determine assessment tools for identifying pilot trainees who might perform poorly in stressful flight testing environments, and (2) to measure the efficacy of a test anxiety workshop treatment on pilot trainees' anxiety levels and their performance on FAA knowledge assessments. The level of significance for all statistical tests herein was $\alpha = .05$.

Identifying Pilot Trainees Prone to Poor Flight Testing Performance Due to Anxiety

The researchers took two courses of action toward identifying DTA prone pilot trainees: First, they identified college readiness test data that might correlate with anxiety levels, and second, they issued pre- and post-debilitating and facilitating anxiety tests, respectively, before and after treatment. To tease out relationships among college readiness measures, anxiety measures, and knowledge measures, the researchers ran a 10 x 10 bivariate correlation matrix (Table 1) with variables: facilitating anxiety pre-treatment test (FTA1), facilitating anxiety post-treatment test (FTA2), debilitating anxiety pre-treatment test (DTA1), debilitating anxiety post-treatment test (DTA2), FAA knowledge pre-treatment test (FAA1), FAA knowledge post-treatment test (FAA2), Admissions Index (AI), Scholastic Achievement Test (SAT), FAA class final (CF), and FAA aeronautical knowledge test (AKT). Results indicated that SAT correlated marginally with FTA1 and FTA2 measures, and significantly with the FAA2 variable. AI, the host institution's measure of college readiness, correlated (highly) with only one measure of importance: the FAA1 variable. Furthermore, neither DTA1 nor DTA2 variables correlated significantly with either SAT or AI. The researchers concluded that SAT scores may help predict FTA due to positive but marginally significant correlation.

The AKT provided an authentic benchmark against which to profile by correlation other knowledge variables (see Table 1). The AKT correlated significantly (and with correct valences) with debilitating anxiety measures, FAA knowledge pre- and post-treatment test scores, CF scores, and AI. Evidently, FAA2 was the more realistic testing situation from which to measure anxiety, compared with the FAA1. The FAA2 correlation profile in Table 1 affirms its authentic testing character, comparing favorably with that of the benchmark AKT. In contrast, the FAA1 correlated significantly but highly ($p < .001$, $r = .798$) only with the AI variable, the preferred predictor of first-year performance at the host institution. Because AI is a linear combination of SAT and high school GPA measures, the researchers inferred that the GPA component "dropped out" as a predictor of performance for FAA2. Such an assumption suggests that FAA2 experience was beyond the high school core, affirming the FAA2 test-taking scenario to be more anxiety producing and therefore, more authentic. In any case, the above statistical results led researchers to conclude that the FAA2 testing scenario was authentic, while the FAA1 scenario lacked authenticity.

Table 1. *Bivariate Correlation Profiles for Anxiety, Knowledge, and Predictor Variables*

		FTA1	FTA2	DTA1	DTA2	FAA1	FAA2	AI	SAT	CF	AKT
FTA1	Pearson Correlation	1	.835**	-.631**	-.529**	.024	.498*	-.125	.392	-.062	.187
	Sig. (2-tailed)		.000	.000	.005	.896	.011	.633	.079	.764	.371
	N	33	26	33	26	32	25	17	21	26	25
FTA2	Pearson Correlation	.835**	1	-.324	-.575**	-.102	.457*	.013	.386	.063	.286
	Sig. (2-tailed)	.000		.106	.002	.628	.022	.961	.084	.759	.166
	N	26	26	26	26	25	25	17	21	26	25
DTA1	Pearson Correlation	-.631**	-.324	1	.772**	-.244	-.404*	-.255	-.273	-.171	-.408*
	Sig. (2-tailed)	.000	.106		.000	.178	.045	.323	.231	.403	.043
	N	33	26	33	26	32	25	17	21	26	25
DTA2	Pearson Correlation	-.529**	-.575**	.772**	1	.092	-.451*	-.045	-.150	-.192	-.322
	Sig. (2-tailed)	.005	.002	.000		.662	.024	.864	.515	.348	.117
	N	26	26	26	26	25	25	17	21	26	25
FAA1	Pearson Correlation	.024	-.102	-.244	.092	1	.181	.795**	.228	.408*	.352
	Sig. (2-tailed)	.896	.628	.178	.662		.398	.000	.333	.043	.092
	N	32	25	32	25	32	24	16	20	25	24
FAA2	Pearson Correlation	.498*	.457*	-.404*	-.451*	.181	1	.360	.540*	-.169	.469*
	Sig. (2-tailed)	.011	.022	.045	.024	.398		.171	.014	.419	.021
	N	25	25	25	25	24	25	16	20	25	24
AI	Pearson Correlation	-.125	.013	-.255	-.045	.795**	.360	1	.321	.111	.473
	Sig. (2-tailed)	.633	.961	.323	.864	.000	.171		.209	.671	.064
	N	17	17	17	17	16	16	17	17	17	16
SAT	Pearson Correlation	.392	.386	-.273	-.150	.228	.540*	.321	1	-.173	.142
	Sig. (2-tailed)	.079	.084	.231	.515	.333	.014	.209		.454	.549
	N	21	21	21	21	20	20	17	21	21	20
CF	Pearson Correlation	-.062	.063	-.171	-.192	.408*	-.169	.111	-.173	1	.438*
	Sig. (2-tailed)	.764	.759	.403	.348	.043	.419	.671	.454		.029
	N	26	26	26	26	25	25	17	21	26	25
AKT	Pearson Correlation	.187	.286	-.408*	-.322	.352	.469*	.473	.142	.438*	1
	Sig. (2-tailed)	.371	.166	.043	.117	.092	.021	.064	.549	.029	
	N	25	25	25	25	24	24	16	20	25	25

(** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level [2-tailed].)

Measuring the Efficacy of the Anxiety Workshop on Pilot Trainees' Knowledge Assessments

The researchers decided against attempting to capture the effects of the anxiety workshop on knowledge assessments, based on too little data. The number who participated in the TA workshop was low (n = 13). A larger sample may have yielded different results. Moreover, FAA1 and FAA2 scores spanned four different levels, making any conclusions about significant improvements suspect. Initially, FAA1 and FAA2 were thought to capture enough information to reflect the efficacy of the anxiety workshop. However, statistical scans of the data showed little evidence for including pre-treatment or post-treatment knowledge test variables into a main model. Instead the main linear model, discussed below, included only anxiety measures as dependent variables.

Measuring the Efficacy of the Anxiety Workshop on Pilot Trainees' Anxiety Levels

The researchers wished to determine if participants' facilitating or debilitating anxiety levels significantly changed as a result of treatment when their responses to anxiety assessments were factored by pre- or post- levels and treatment or control levels (see Table 2). Dependent variables were anxiety measures FTA and DTA and independent variables were FTA Factor, DTA Factor, and Group Factor. FTA factor had pre- and post- levels, respectively: FTA1 and FTA2. DTA had pre- and post- levels, respectively: DTA1 and DTA2. The Independent variable Group had two levels: Treatment and Control. There was a single covariate SAT, chosen because it correlated with the most variables of interest: AI, FAA2, and measures of facilitating anxiety (FTA1 and FTA2).

Table 2. *Factorial Model*

Dependent Variables	Independent Variables	Covariate
FTA	Within-Subjects Factor Levels	SAT
DTA	FTA1 (pre-test)	
	FTA2 (post-test	
	DTA1 (pre-test)	
	DTA2 (post-test)	
	Between-Subjects Factor Levels	
	Group	
	Treatment	
	Control	

Results of LMRMA Omnibus Test

To test for the significance of contributions of variables, the researchers employed a Linear Multivariate Repeated-Measure Analysis (LMRMA). Table 3 shows descriptive statistics for the sample, disaggregated by eight factor levels. The multivariate Wilk's Lambda test indicated significant contributions to the linear model by FTA and interaction variables FTA*SAT and FTA*Group only (see Table 4). Notably, the dependent variable DTA made no significant contribution to the LMRMA model (Wilk's $\Lambda = .993$, $F(1, 18) = .135$, and $p = .717$), nor did interactions of DTA*Group or DTA*SAT. Importantly, the significant interaction FTA*SAT suggested inequitable adjustments to FTA values when comparing the contributions of FTA1 and FTA2. Such adjustments by the covariate at unequal rates to levels FTA1 and FTA2 compromise any conclusions about the change in facilitating anxiety before and after treatment. Finally, the significant interaction of FTA*Group pointed to the need for more analysis.

Table 3. *Descriptive Statistics for the Factorial Model*

Factor/Level	Mean	Std. Deviation	N
FTA1			
Control	24.00	4.295	10
Treatment	27.82	5.510	11
FTA2			
Control	24.70	6.038	10
Treatment	27.27	4.519	11
DTA1			
Control	28.80	4.211	10
Treatment	27.82	4.468	11
DTA2			
Control	29.00	5.375	10
Treatment	28.18	3.737	11

Keeping with best practice, the covariate SAT was removed from the LMRMA model, because the pathological interaction FTA*SAT suggested inequitable adjustments to means. Hence, conclusions about significant differences, suggested in Table 4 lacked validity. Without covariate adjustment, however, *all* LMRMA significance collapsed upon rerunning the model. The collapse of significance upon removal of the SAT covariate suggested an association between SAT and FTA variables. This evidence, coupled with the positive correlations between SAT and Facilitating Anxiety variables adds credence to a conjecture: SAT scores predict facilitating anxiety.

Table 4. *Significant Statistics from the LMRMA*

	Wilks Λ	F (1, 18)	p
FTA	.700	7.725	.012
FTA*SAT	.732	6.581	.019
FTA*Group	.792	4.740	.043
DTA	.993	.135	.717

DISCUSSION

The shorter periods between pre-tests, treatment, and post-tests may not have provided the time needed to practice the strategies that had been taught in the workshop nor sufficient time for forgetting. The length of the workshop was reduced from one-day to three hours (the research originally was marketed with a one day workshop, but even fewer volunteers [n = 6] agreed to enter the research). Regardless, the researchers believe the duration and intensity of an effective workshop warrants further study. Finally, one researcher suggested that the lack of efficacy of the treatment might be related to three personal factors: (a) appropriate study skills, (b) cognitive ability, and (c) motivation to sacrifice in order to successfully reach goals. Students with high motivation and moderate ability may be successful, whereas students with high motivation but low ability might not be successful despite their efforts. The effect of personal factors on performance and anxiety levels warrants further study.

SAT scores were positively associated with FTA test scores, but marginally so. Although SAT scores significantly correlated with FTA, as a covariate in the main linear model of this study, they adjusted FTA1 and FTA2 scores at different rates. Consequently, SAT scores were removed from the main model. When SAT scores were removed as a covariate, the main model of this study no longer showed any significant differences between variables of interest. However, clear evidence exists that SAT scores are related marginally to FTA1 and FTA2 and significantly to FAA2. More research is needed to sort out the complex interaction among college preparation, anxiety and performance measures. Evidence herein begs for such a study, hinting that SAT scores rise and fall with students' facilitating anxiety levels.

Authentic testing situations are important when attempting to discern anxiety levels. Authenticity is in part detected by correlation among the variables of interest. Researchers found that the post-treatment knowledge test (FAA2) significantly correlated with both the pre- and post-facilitating test anxiety (FTA1 and FTA2) scores, both pre- and post-debilitating test anxiety (DTA1 and DTA2) scores, SAT scores, and, most importantly, the FAA aeronautical knowledge test (AKT). By association, then, the researchers deemed the FAA2 testing scenario as authentic. However, the FAA1 test only associated with the AI, lacking associations with other variables that would affirm its authenticity in a testing scenario. The important lesson here is that authentic testing scenarios are necessary to glean information about treatment effects during further studies.

These results suggest that the AAT, combined with the SAT, can be used by collegiate aviation educators to identify flight training students predisposed to high DTA and low FTA. Early identification of vulnerable students through the use of these assessments and effective mitigation strategies designed to help them overcome the deleterious effects of DTA could help pilot trainees achieve their educational and flight training goals. Importantly, AAT screening should be done in the context of authentic testing scenarios to guarantee that anxiety reactions are appropriate to stressors.

RECOMMENDATIONS

The researchers recommend and plan further research to confirm their conclusion that the SAT and AAT are accurate predictors of performance. In order to incorporate more authentic anxiety-producing test methods, they recommend administering the AAT to all incoming freshmen private pilot students during authentic testing scenarios. AATs should be administered before each of three ground training stage checks. The results of these AATs will be compared with pilot trainees' ground and flight stage check scores to determine correlations between test anxiety and performance, both in the classroom and in the cockpit. Testing should be repeated over a two to three year period.

In conclusion, anxiety and flight test performance are inextricably linked. However, that link is complex. Further study should result in more accurate detection and intervention treatments for test-anxious pilot trainees. The researchers hope to establish a program of TA detection and intervention, documenting the positive effects of a treatment on classroom, ground, and flight performance.

REFERENCES

Airline Safety and Pilot Training Improvement Act of 2009, H.R. 3371, 111th Cong. (2009). Retrieved from http://www.govtrack.us/congress/billtext.xpd?bill=h111-3371

Alpert, R., & Haber, R. N. (1960). Anxiety in academic achievement situations. *Journal of Abnormal and Social Psychology, 61(2), 107-215.*

Brewer, T. (2002). Test taking anxiety among nursing and general college students. *Journal of Psychosocial Nursing, 40(11), 23-29.*

Dusek, J. B. (1980). The development of test anxiety in children. In I. G. Sarason (Ed.), *Test anxiety: Theory, research, and applications* (pp. 87-110). Hillsdale, NJ: Erlbaum.

Erickson, C. D., Horan, J. J., & Hackett, G. (August 1991). *On thinking and feeling bad: Do client problems derive from a common irrationality or specific irrational beliefs?* Paper presented at the annual meeting of the American Psychological Association, San Francisco, CA.

Fischer, J. & Corcoran, K. (2007). *Measures for clinical practice and research: a sourcebook. (4th ed).* Oxford, England: Oxford University Press.

Haynes, S. E. (2003). The effect of background music on the mathematics test anxiety of college algebra students. (Doctoral dissertation). Retrieved from http://wvuscholar.wvu.edu:8881//exlibris/dtl/d3_1/apache_media/6747.pdf

Kohlruss, W. A. (2009). The editor's forum. *The Journal of Aviation/Aerospace Education and Research, 19(1), 7.*

Moyer, K. H. (2008). Debilitating and facilitating anxiety effects on identification. *Journal of Undergraduate Psychological Research.* 3, 6-20.

Pilot Records Improvement Act of 1996, 49 U.S.C. § 44703 (h). (1997).

Robinson, D. H. (2008). Evaluation (test) anxiety. In E. M. Anderman & L. Anderman (Eds.), *Psychology of classroom learning: an encyclopedia* (pp. 387-390). Farmington Hills, MI: Thomson Gale.

Roney, S. D. & Woods, D. R. (2003). Ideas to minimize exam anxiety. *Journal of Engineering Education,* 92(3), 249-256.

Sarason, S. B., Mandler, G., & Craighill, P. G. (1952). The effect of differential instructions on anxiety and learning. *Journal of Abnormal Psychology, 47, 561-565.*

Sloan, T. A. & Wilson, D. (2009). Assessment and intervention strategies for test anxiety in aviation students. *The Journal of Aviation/Aerospace Education and Research, 19(1), 9-14.*

The College Board. (n.d). Retrieved from http://professionals.collegeboard.com/testing/sat-reasoning

University of Adelaide (n.d.). Retrieved from http://www.adelaide.edu.au/counselling)centre/Test.html

Wright State University Counseling Center (n.d.) Retrieved from http://www.wright-counseling.com/checklists/TestAnxietyAssessment.html

Factors That Influence an Undergraduate Student to Choose a Career in Aviation, and Enroll in the Aviation Science Program at Parks College of Engineering, Aviation and Technology

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ABSTRACT

A study was conducted in the Aviation Science Department, Parks College of Engineering, Aviation and Technology, Saint Louis University, to determine the factors that influence undergraduate students to choose aviation as a career field and Parks College as their choice for their aviation education. This information was gathered to assist Parks College in determining the most effective measures to recruit and retain undergraduate students and what other measures might be considered to improve a student's educational experience at Parks. A paper survey instrument consisting of eight pertinent demographic questions, 67 Likert scale questions, and five open-ended questions were given to a convenience sample of four aviation science classes: one freshman class, one sophomore class, one junior class, and one senior class. The survey population consisted of undergraduate aviation science and aviation management majors. The results of the survey and conclusions are discussed.

INTRODUCTION

The authors were requested to design, conduct, analyze, and report on a survey as a class project for a graduate sample survey methods class. Since the authors were aviation graduate students, they took advantage of the project and asked the Aviation Science department chair what information from a no cost survey would be of interest him. The chair stated that it would be useful to the department to determine why aviation science undergraduate students chose this particular university for their aviation education, and why these same students chose aviation as a career field. This information could be used by the Aviation Science Department to determine the best use of a limited budget to attract and retain undergraduate aviation science students.

REVIEW OF LITERATURE

A literature review was conducted to determine what types of other surveys had been conducted in the past that attempted to determine why undergraduate students picked their particular university for an aviation education. Saint Louis University survey results from 1991 (Wendt, 1991) were obtained from the Dean's office for review. Many of the questions from this 1991 survey were similar to the American National Norms 1990 project (Astin, Korn, & Berz, 1991). A comparison of these two surveys was performed. Many of the questions were demographic in nature, and explored what types of students were enrolling at the university, while some of the questions asked why they had chosen the university. We were unable to obtain the survey instrument to determine all of the questions asked, and many of the survey results reported just the top reasons, rather than ranking or reporting all of the responses. The top 3 reasons in 1991, which were also mirrored in the national survey, for students picking the university, were:

1. Good academic reputation
2. Graduates get good jobs
3. Size of the college

Top 3 reasons for their choice of aviation as a career were:

1. Work would be challenging
2. Job openings generally available
3. High anticipated earnings

Of the students surveyed, 86% said that Saint Louis University was their first choice of the universities offering aviation curriculums. A more recent survey by Clark (2004) that surveyed incoming freshmen at 23 collegiate aviation programs reported the top ten factors for choosing a four year post secondary aviation program (Table 1).

Table 1. *Clark (2004) Factor Ranking*

Table 9. The Ten Most Frequently Selected Factors Program and Institutional Characteristics that Attract Students to Collegiate Aviation (n=751).

Survey Item	Very Influential (%)	Influential (%)	Somewhat Influential (%)	Minimally Influential (%)	Not Influential (%)
Program Educational Quality	49.0	31.7	31.7	2.1	2.9
University Reputation	38.1	35.6	14.5	5.6	3.7
Condition of Equipment	33.6	37.8	17.6	5.2	4.1
Institutional Educational Quality	32.1	37.0	19.3	4.9	3.6
Location of Institution	29.6	28.2	20.9	9.3	8.9
Small Class Size	26.2	30.9	25.6	8.5	7.1
Safety Concerns	25.7	34.1	22.4	8.5	7.7
Program Characteristics	24.4	39.9	20.9	6.3	6.3
Student/Faculty Ratio	23.6	29.3	27	10.7	8.1
Distance from Home	22.0	24.4	19.8	12.5	18.5

Note. The values may not equal 100% due to missing data.

METHODOLOGY

The instrument chosen for the survey was a paper survey administered at the beginning of each undergraduate class selected for the survey. The survey (Appendix A) consisted of 37 Likert scale questions asking the student how influential each factor was in choosing Parks college, and 23 Likert scale questions asking both how influential each factor was in choosing aviation as a career and how much the student agreed or disagreed with the statement (1-strongly disagree, 2-disagree, 3-slightly disagree, 4-neutral, 5-slightly agree, 6- agree, 7-strongly agree). There were also five Likert scale questions asking the student's satisfaction with choice of career and choice of educational institution. Since there were no previous data on which to model the questions, the authors used a large number of questions in an attempt to capture as many factors as possible. Additionally, five open-ended questions were added that sought to capture influential factors the researchers might have overlooked.

Prior to distribution, the survey was reviewed by a focus group consisting of a broad spectrum of aviation industry professionals. The group consisted of representatives from engineering, corporate aviation, aircraft maintenance, the Federal Aviation Administration (FAA), and a major avionics manufacturer.

The purpose of the survey and the proposed methodology were discussed with the group. Comprehensive reviews of the major influences in the choice of a career in aviation along with those for choosing an educational institution were performed. Each of the survey questions was reviewed for relevance and understanding. Questions were changed or added with group concurrence, with a final review by the entire group.

The department chair allowed the researchers to administer the survey at the beginning of 4 different classes, each class being a different class year (freshman, sophomore, junior and senior). Because the researchers administered the survey, the researchers were able to insure that the survey was administered consistently across all four classes. This was essentially a convenience sample that allowed the authors to obtain 62 surveys from a population of about 100 students. This proved to be a fast and reliable way to collect data. Students were given the option of not completing the survey if they did not want to participate. Students completed the surveys anonymously and handed them to the researcher when completed. The survey took about 15-20 minutes to complete on average. The researchers then entered the demographic and Likert data into SPSS version 15 for analysis. The open-ended questions were categorized using a word cloud program to identify common themes in the responses.

DATA ANALYSIS

Demographics

A review of the demographics showed that the aviation science student body was 92% male (n=57), 92% white (n=57), and 98% U.S. citizens (n=61). The lack of international students was attributed to the increased security requirements imposed by the Transportation Security Administration (Transportation Security Administration, 2010) for foreign nationals to receive flight instruction in the United States. The sample size of each class was freshmen n=13, sophomores n=20, juniors n=14 and seniors n=13. Two students did not report their class standing. Due to the lack of racial, gender, and nationality diversity, no analyses were performed using those groups.

Overall Results

Initial analysis using SPSS version 15 included a mean ranking of the Likert scale questions for which the individual scores for each question from each respondent were totaled, and then divided by the number of responses. The questions were then ranked in descending order; with the highest average score answer being first, and the lowest average score being last. The responses were divided into two groups, answers for the Parks questions which were prefixed with a "P", and the aviation questions prefixed with an "A" (Appendix A). Table 2 shows the results of the Parks questions, while Table 3 shows the results of the aviation questions.

Table 2. *Parks College Factors Results*

Parks College Factors					
	N	Min.	Max.	Mean	Std. Deviation
Aviation reputation	62	4	7	5.95	0.95
Academic reputation	62	2	7	5.61	0.98
Obtaining job at graduation	62	2	7	5.32	1.33
Quality of curriculum	62	1	7	5.21	1.20
Campus visit	62	1	7	5.15	1.30
Graduation rate	62	2	7	5.13	1.27
Quality of faculty	61	1	7	5.11	1.28
Employee value	62	2	7	5.06	1.41
Classroom facilities	62	1	7	4.98	1.09
Education accreditation	62	1	7	4.95	1.29
University location	62	1	7	4.92	1.60
Class size	62	1	7	4.89	1.16
Information on Web	62	2	7	4.84	1.23
Aircraft maintenance	62	1	7	4.77	1.60
Scholarship availability	61	1	7	4.62	1.85
Campus life	62	1	7	4.60	1.31
Friend/relative recommendation	62	1	7	4.53	1.55
Athletic facilities	62	1	7	4.44	1.37
Safety record	62	1	7	4.40	1.46
Parents wanted	62	1	7	4.34	1.44
Job placement	62	1	7	4.34	1.57
Entrance requirements	62	1	7	4.31	1.25
Proximity to airport	62	1	7	4.31	1.64
Computer facilities	62	1	7	4.18	1.39
Financial aid	62	1	7	4.15	2.01
Jesuit university	62	1	7	3.95	1.74
Campus proximity to home	62	1	7	3.92	2.14
Aircraft fleet	62	1	7	3.90	1.42
Flight Simulators	62	1	7	3.90	1.43
Campus security	62	1	7	3.84	1.53
Student services	61	1	7	3.69	1.42
Flight team	62	1	7	3.61	1.49
HS guidance counselor	62	1	7	3.37	1.85
Living costs	62	1	7	2.74	1.41
Information on newspaper	62	1	5	2.55	1.28
Information on radio	62	1	5	2.53	1.28
Tuition costs	62	1	7	2.11	1.39
Valid N (listwise)	59				

Table 3. *Aviation Career Factor Results*

Aviation Career factors					
	N	Minimum	Maximum	Mean	Std. Deviation
Wanted to be a professional pilot	61	1	7	6.41	0.96
Wanted to be in aviation	61	1	7	6.13	1.44
Job satisfaction	61	2	7	5.93	1.06
Work with technology	61	3	7	5.72	0.97
Opportunity for career advancement	61	2	7	5.51	1.07
Prestige	61	2	7	5.49	1.13
Travel opportunities	61	1	7	5.44	1.43
Challenging career	61	3	7	5.41	0.97
Salary considerations	60	1	7	4.92	1.50
Employment opportunities	61	1	7	4.72	1.39
Attended airshow(s)	61	1	7	3.97	1.70
Working hours	61	1	7	3.72	1.69
Industry job forecast	61	1	7	3.56	1.58
Parent/Relative/Friend in aviation	61	1	7	3.54	2.16
Job stability	61	1	7	3.28	1.56
Easy entry career	61	1	7	3.20	1.38
Job security	61	1	6	3.00	1.45
SLU alumni influence	61	1	7	2.97	1.60
Physical demands	61	1	6	2.72	1.24
Easy major	61	1	6	2.66	1.47
HS counselor influence	61	1	6	2.39	1.32
Valid N (listwise)	60				

Analysis of the data showed minor omissions in some of the question responses, but there was an insufficient number and no pattern of missing data to affect the analysis. There were no outliers.

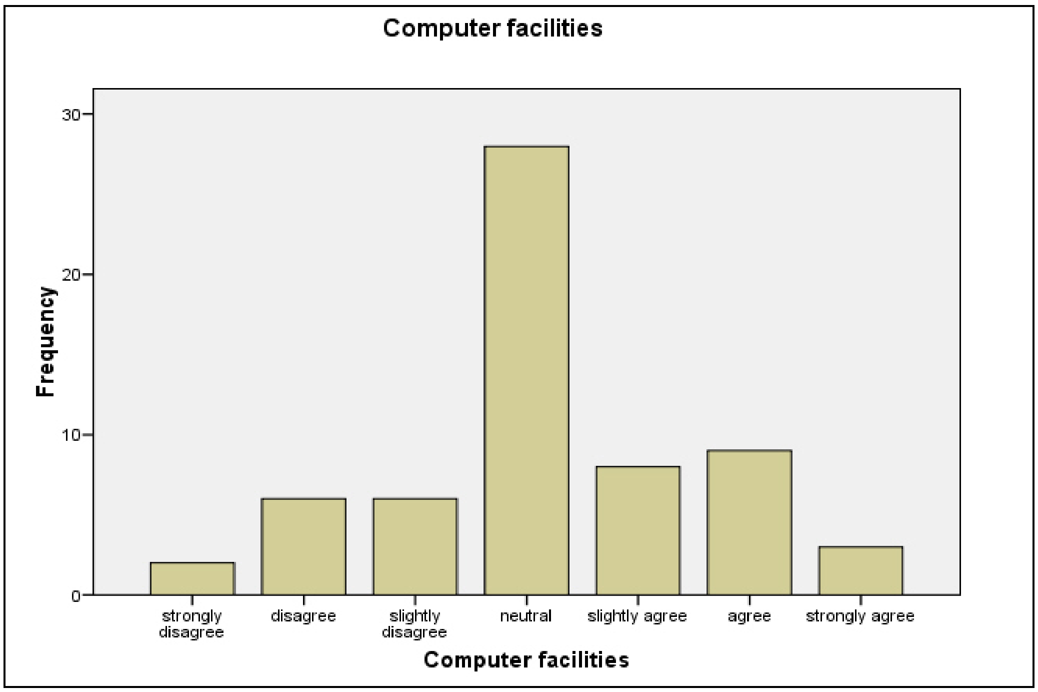
Parks College Analysis

The analysis of factors affecting enrollment at Parks showed the top two factors were aviation reputation (M=5.95) and academic reputation (M=5.61). Observing the minimum-maximum scores showed that no one rated aviation reputation lower than a “4”. Although these results replicated the top two factors in Clark’s survey (Table 1), our survey used the average of all rankings within the factor, while Clark’s study ranked the answers by only those answers in the “very influential” column, disregarding the results in the other columns. Clark chose to only report the top 10 factors in the “very influential” column. Because this was an exploratory survey, it was felt additional information could be obtained by reporting all factors.

Parks College does place an emphasis on campus visits by the parents and prospective student, and the survey results showed that “campus visit” is very influential (M=5.15), ranked as the 5th most influential factor out of 37 factors, confirming that this is apparently an effective recruitment tool. Parks College also works with high school counselors and invites them to campus for a tour of the facilities and faculty discussions. The college covers the entire cost of these visits. The low score in both the Parks (M=3.37) and aviation (M=2.39) survey was surprising and disappointing, pointing to the need to reassess this investment of resources.

Incorporation of bar charts yielded some surprising results. A chart of the responses for "computer facilities" (M=4.18) showed most of the responses as a "4," or "neutral" (Table 4). Conversation with the department chair revealed that approximately 98% of the students come to the university with their own computers, with most of these computers being newer and more powerful than those offered in the college's computer labs. It is felt that the respondents might have been confused and answered with a "neutral" response as opposed to a "highly disagree" response. This may also indicate that the question was irrelevant to the students. These results may also indicate the need to reword future surveys using the term "influential" as Clark did (Table 1) in the Likert scale as opposed to the words "agree" or "disagree". Several other factors that ranked near an average score of "4" had similar results, so the phenomena were not unique to this one factor.

Table 4. *Computer Facilities Responses*



Parks had recently completed a media campaign within the St. Louis metropolitan area, so respondents were asked about the effectiveness of various forms of media. Table 2 shows that newspaper and radio advertising were apparently not effective in influencing enrollment at Parks College.

Aviation Career Analysis

The top two responses for the aviation career part of the survey were "wanted to be a professional pilot" (M=6.41) and wanted to be in aviation (M=6.13). Many of the responses to the open-ended questions revealed the respondent had wanted to be a pilot and/or in aviation from an early age. These responses may warrant additional research to determine what factors influence students less than 18 years of age to become interested in aviation, and at what age that occurs. Surprisingly, factors that seemingly might have occurred at an earlier age to spark interest in aviation, including influence from a parent/friend/relative (M=3.54), Saint Louis University alumni (M=2.97) or high school counselor (M=2.39), scored relatively low versus some of the other factors.

Themes From Open-ended Questions

As mentioned earlier, there were five open-ended questions at the end of the survey. Three of these questions were intended to provide an opportunity for students to comment further on factors that influenced their choice of career and institution. The fourth was a general question that gave students the chance to comment on anything about the program. This question revealed some likes and dislikes the students had concerning the program.

The responses from these questions were reviewed with common themes identified. The comments were then coded and grouped into these themes. To visually depict the higher occurrences of these themes, the Wordle application (Feinberg, 2010) was used to create Word Clouds. These clouds create a visual scale of the common themes. Themes which occurred most often are depicted with larger, bolder type. Only themes which had three or more responses were captured in the word clouds.

Four of the questions with a summary of the findings and the corresponding Word Cloud are found below.

Question #1: Do you have any other comments regarding the Aviation Science program at Saint Louis University?

This question resulted in two predominate recurring themes (Figure 1). By far the most predominate was that students dislike the training aircraft because they are not certified to FAA regulations to be flown in actual instrument meteorlogical conditions (IMC). The other predominant theme was the high cost of flight training.

Figure 1. Question 1 recurring themes

Question #2: Are there any other factors that influenced your decision in selecting Saint Louis University?

The top themes from this question were the location of the university, reputation of Parks and SLU, and scholarship award (Figure 2). The influence of Parks College Air Force ROTC and Rifle team are themes that could be explored further in a subsequent survey.

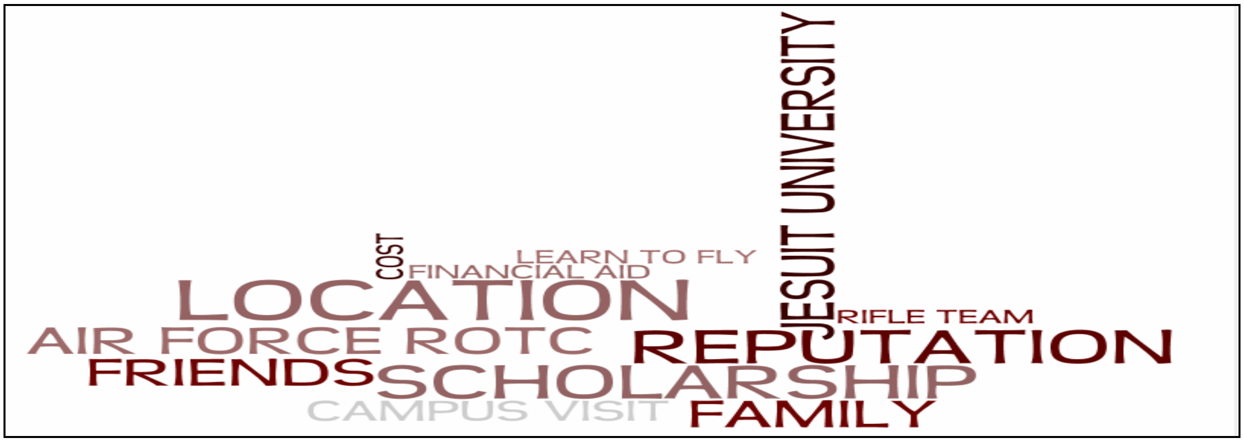


Figure 2. Question 2 recurring themes

Question #3: What other institutions did you consider before selecting Saint Louis University?

Embry Riddle University (n=21) and Purdue University (n=13) were by far the most cited institutions that students considered attending (Figure 3).

Figure 3. Question 3 recurring themes

Question #4: What other factors influenced your decision to pursue a career in aviation?

Love of flying was the dominant factor in why students chose a career in aviation (Figure 4). It was also interesting to note that some of the respondents indicated their love of flying started at an early age, which implies that recruitment for university flight programs should start prior to high school.

Figure 4. Question 4 recurring themes

DISCUSSION

This survey was a successful initial assessment of the factors that influenced students in choosing aviation as a career and Parks College for an aviation education. The survey was exploratory and uncovered additional areas of consideration that should be included in subsequent surveys. This includes further inquiry into career placement, flight training, aircraft fleet, and facilities. Overall, the survey determined current students are pleased with their choice to pursue a career in aviation as well as their selection of Parks College. The academic reputation of Saint Louis University, the reputation of Parks College in the aviation community, and the student's love of aviation were overwhelming selection factors.

A final analysis was presented to the aviation science faculty. The Aviation Science department has expressed an interest in making this an annual assessment to further improve the department and ultimately provide the best possible education and experience for students. Repeated measures will allow analysis of process improvements and the effect of any interventions over time. This information can be used to add or drop factors in future surveys, and to determine if factors become more or less important over time. The results of this survey also will help the school more effectively focus its limited marketing budget.

Improvements to be included in subsequent surveys include changing the Likert scale questions from an "agree/disagree" format to varying degrees of "influential" to avoid non-influential factors possibly being coded as "neutral". Future surveys will create new Likert scale questions reflecting the results of the open-ended questions, and Likert scale responses deemed as not being influential will be dropped. The results of this and future surveys provide valuable information for decisions involving strategic planning, financial considerations, and ultimately a valuable tool in the continuous improvement process at Parks College.

REFERENCES

Astin, A.W., Korn, W.S., & Berz, E.R. (1991). *The American freshman: national norms for fall 1990.* Los Angeles: Higher Education Research Institute, UCLA.

Clark, J. M. (2004*).* A descriptive research survey study that examined factors influencing selection of four-year post-secondary commercial aviation programs. Ph.D. dissertation, The University of Mississippi, United States -- Mississippi. Retrieved January 13, 2010, from Dissertations & Theses: Full Text. (Publication No. AAT 3136219).

Feinberg, J. (2010). *Wordle*. Retrieved May 3, 2010 from http://www.wordle.net/.

Transportation Security Administration (2010). Alien flight student program. Retrieved May 1, 2010 from: https://www.flightschoolcandidates.gov/afsp2/?acct_type=c&section=WN

Wendt, K.R. (1991). *Typical incoming Parks student: Spring 1991 college student inventory results (N=97)*. St. Louis, Missouri, Saint Louis University.

Appendix A

Survey instrument

Saint Louis University – Parks College

Aviation Sciences Student Survey

Please answer the following questions as accurately and honestly as possible. All responses will be kept strictly anonymous, **so please do not put your name on the questionnaire**. The results will only be reported in aggregate form.

Purpose of this survey: To research those factors that influence an undergraduate student to choose a career in aviation, and enroll in the Aviation Science program at Parks College of Engineering Aviation and Technology.

Investigators:

Richard Steckel: Principal Investigator, Doctoral Student and Research Assistant, Parks College of Engineering, Aviation and Technology

Damon Lercel: Investigator, Doctoral Student, Parks College of Engineering, Aviation and Technology

General Information

Questions 1 – 9. Circle the appropriate response or fill in the blank.

1 – Gender M F

2 – Age _________

3 – Major Aviation Management Flight Science Undeclared Other

4 – U.S. or international student U.S. International

5 – Year in college Freshman Sophomore Junior Senior

6– Ethnicity Asian/Pacific Islands Latino African American White Other

7 – Parent(s) attended SLU? Yes No

8 – Parent(s) employed by SLU? Yes No

For the following statements, please circle your level of agreement or disagreement from 1 (Strongly Disagree) to 7 (Strongly Agree). **In general, I selected Parks College Aviation Science program for the following reasons:**	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
P1. Academic reputation	1	2	3	4	5	6	7
P2. Parks College's reputation in Aviation	1	2	3	4	5	6	7
P3. My high school guidance counselor recommended SLU	1	2	3	4	5	6	7
P4. My parents wanted me to attend Saint Louis University	1	2	3	4	5	6	7
P5. Availability of financial aid	1	2	3	4	5	6	7
P6. Aircraft fleet used for flight training	1	2	3	4	5	6	7
P7. Safety record of the flight training program	1	2	3	4	5	6	7
P8. Campus security	1	2	3	4	5	6	7
P9. University location	1	2	3	4	5	6	7
P10. Reasonable tuition costs	1	2	3	4	5	6	7
P11. Level of student services (housing, food, health)	1	2	3	4	5	6	7
P12. Class size	1	2	3	4	5	6	7
P13. Campus visit	1	2	3	4	5	6	7
P14. Information from university web site/advertising/literature	1	2	3	4	5	6	7
P15. Information from a SLU radio advertisement	1	2	3	4	5	6	7
P16. Information from a SLU newspaper advertisement	1	2	3	4	5	6	7
P17. Recommendation from a friend or relative	1	2	3	4	5	6	7
P18. Competitive flight team	1	2	3	4	5	6	7
P19. Campus life/activities	1	2	3	4	5	6	7
P20. Educational accreditations	1	2	3	4	5	6	7
P21. Career placement program	1	2	3	4	5	6	7
P22. Employers value of a SLU degree	1	2	3	4	5	6	7

For the following statements, please circle your level of agreement or disagreement from 1 (Strongly Disagree) to 7 (Strongly Agree). **In general, I selected Parks College Aviation Science program over other university programs for the following reasons:**	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
P23. Ability to obtain a desirable job upon graduation	1	2	3	4	5	6	7
P24. Jesuit university	1	2	3	4	5	6	7
P25. Proximity of the airport to the campus	1	2	3	4	5	6	7
P26. Flight simulators	1	2	3	4	5	6	7
P27. Proximity of the campus to my home	1	2	3	4	5	6	7
P28. Quality of the faculty	1	2	3	4	5	6	7
P29. Classroom facilities	1	2	3	4	5	6	7
P30. Onsite aircraft maintenance	1	2	3	4	5	6	7
P31. Availability of scholarships	1	2	3	4	5	6	7
P32. Entrance requirements for the college	1	2	3	4	5	6	7
P33. Quality of the curriculum	1	2	3	4	5	6	7
P34. Four year graduation rate	1	2	3	4	5	6	7
P35. Computer facilities	1	2	3	4	5	6	7
P36. Athletic facilities	1	2	3	4	5	6	7
P37. Living costs (including housing)	1	2	3	4	5	6	7
P41. I am satisfied with the Aviation Science Program at Parks.	1	2	3	4	5	6	7
P42. I made the right choice in attending Parks.	1	2	3	4	5	6	7
P43. If I had to choose again, I would choose to attend Parks.	1	2	3	4	5	6	7

For the following statements, please circle your level of agreement or disagreement from 1 (Strongly Disagree) to 7 (Strongly Agree). **In general, I chose to pursue a career in aviation for the following reasons:**	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
A1. Salary considerations	1	2	3	4	5	6	7
A2. Always wanted to be in aviation	1	2	3	4	5	6	7
A3. Thought it would be an easier college major	1	2	3	4	5	6	7
A4. Wanted to be a professional pilot	1	2	3	4	5	6	7
A5. Parents/relatives/friends are involved in aviation	1	2	3	4	5	6	7
A6. Travel opportunities	1	2	3	4	5	6	7
A7. Employment Opportunities	1	2	3	4	5	6	7
A8. Low physical demands	1	2	3	4	5	6	7
A9. Attending an air show	1	2	3	4	5	6	7
A10. Job Security	1	2	3	4	5	6	7
A11. Challenging career	1	2	3	4	5	6	7
A12. Job Satisfaction	1	2	3	4	5	6	7
A13. Industry job forecast	1	2	3	4	5	6	7
A14. Prestige	1	2	3	4	5	6	7
A15. Working with sophisticated technology	1	2	3	4	5	6	7
A16. Opportunities for career advancement	1	2	3	4	5	6	7
A17. Reasonable work hours	1	2	3	4	5	6	7
A18. Job Stability	1	2	3	4	5	6	7
A19. Ease of entry into career field	1	2	3	4	5	6	7
A20. Influence from SLU alumni	1	2	3	4	5	6	7
A21. Influence from high school counselor	1	2	3	4	5	6	7
A23. I am satisfied with my decision to pursue a career in	1	2	3	4	5	6	7
A24. I made the right choice selecting an aviation career.	1	2	3	4	5	6	7
A25. If I had to choose again, I would again select a career in aviation.	1	2	3	4	5	6	7

A26. Are there any other factors that influenced your decision in selecting Saint Louis University?

A27. Which other institutions did you consider before selecting SLU?

A28. What other factors influenced your decision to pursue a career in aviation?

A29. Do you have any other comments regarding the Aviation Science Program at Saint Louis University?

A30. In your opinion, with a limited budget, what would be the most effective use of marketing resources to attract prospective aviation science students to attend Parks College of Engineering, Aviation and Technology?