CHAPTER 6

RESEARCH METHODOLOGY

6.1 INTRODUCTION

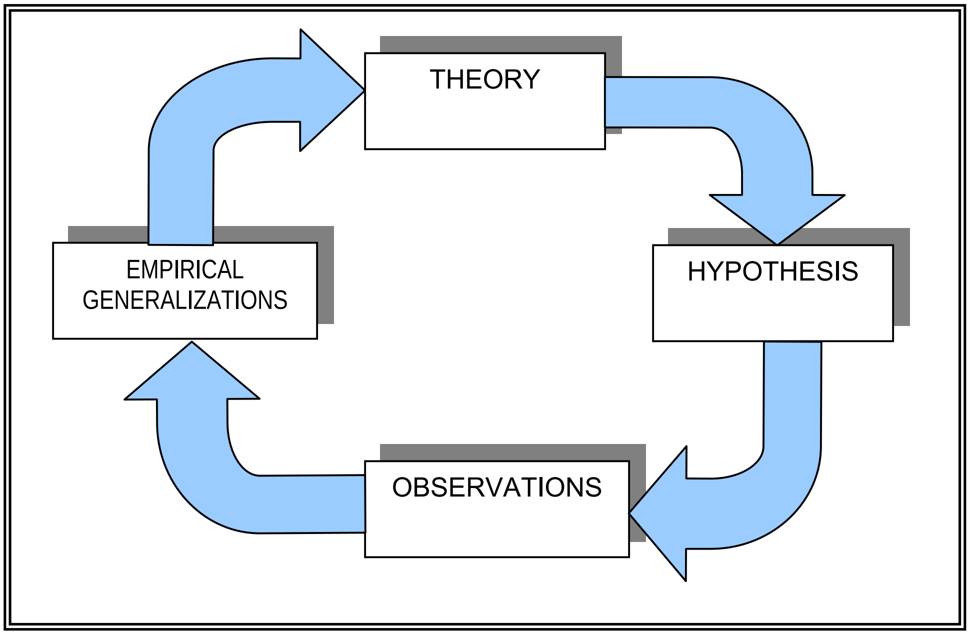
The research process consists of a set of controlled steps which the researcher follows in order to investigate a certain phenomenon (De la Rey, 1978:7). Statistics plays an important part in this process and is an indispensable tool for social sciences research. Statistics is concerned with the collection and analysis of data in order to obtain a better understanding of phenomena. It provides the scientist with useful techniques for evaluating ideas, testing theory, and discovering scientific truths (Healey, 1999:2). Chapter 6 aims to discuss the relevant methodology and approach used in the empirical aspect of this study.

6.2 RESEARCH STRATEGY

According to Zikmund (2000:59), a research project is a specific research investigation; a study that completes or is planned to follow stages in the research process, as illustrated in Figure 6.1.

Research goals pertaining to this project were identified in the research proposal and in Chapter 1. They can be summarised as follows: the investigation of historical data and current world aviation trends, the development of a reliable and valid attitude measurement instrument, the collection of empirical data regarding gender issues in aviation, the analysis and interpretation of this information, and the making of suggestions regarding the practical implications of this research project. Chapters 2 to 4 concentrate on the history and contributions of women in aviation, legislative aspects influencing gender issues in aviation, stereotypes, attitudes and prejudices regarding the above, as well as the clinical definition and understanding of the concepts of stereotypes, attitudes and prejudices. Chapter 5 provided an introduction to research design and a brief understanding of the statistics employed in this research project. This chapter looks more closely at the actual research project. A discussion of the measurement instrument, the research group and the statistical methods are set out in this chapter.

Figure 6.1: The wheel of science



Source: Healey (1999:2)

6.3 THE QUESTIONNAIRE

The survey method was used for the purpose of this study, and the survey took the form of a questionnaire. De la Rey (1978:14) states that the survey method can be used when a researcher wants to gain more information regarding a certain phenomenon, as well as when information about a certain phenomenon is to be analysed. Comparisons and associations can be made in order to explore whether relationships exist between phenomena.

The Aviation Gender Attitude Questionnaire (AGAQ) was designed in order to determine whether attitudes, stereotypes and prejudices exist with regard to women in aviation, with specific reference to female pilots. The questionnaire was further designed to gather specific information about attitudes concerning the following issues: attitudes regarding female aviators' learning ability and learning speed, general piloting skills, opinions on leadership ability, and general prejudices and stereotypes.

A further goal of this research was to determine whether male and female pilots agree (converge) or disagree (diverge) on the above gender related topics.

Questions 1 to 13 of Section I of the AGAQ contain questions of a biographical nature where respondents are asked to answer personal information. This information was used to determine and define the nature of the research group. The data was also used to define and compare the level of skills and experience of the male and female sample population of pilots in the United States, South Africa, and various other countries. Furthermore, this information was vital in determining where items converge and diverge between male and female pilots, as well as where there are similarities and/or differences in opinions expressed in a cross-cultural analysis of the answers.

Questions 1 to 72 of Section II of the AGAQ contain questions specifically designed to probe the respondent's opinions on various gender-related issues in the realm of aviation:

- Questions requiring respondents' opinions on the learning ability and learning speed of female aviators can be found in items 1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61, 65 and 69 of Section II.
- Questions related to opinions of female aviators' piloting skills can be found in items 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42, 46, 50, 54, 58, 62, 66 and 70 of Section II.
- Questions seeking responses to the leadership and decision-making ability of female aviators are posed in items 3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43, 47, 51, 55, 59, 63, 67 and 71 of Section II.
- Finally, questions on whether general prejudices and stereotypes exist are items 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68 and 72 of Section II.

This information can also be found in Table 6.1.

The directions of the questions in Section II of the AGAQ have also been determined and can be categorised as having either a positive or negative bearing with regard to female aviators. Individual item directions are indicated in Table 6.1 where a (+) indicates a positive orientation and a (-) indicates a negative orientation. This feature is especially necessary in the analysis of the data, as respondents were asked to identify the answer best suited to their opinion, using a Likert scale. Each item therefore had a range of five possible answers from which the respondent could choose. As is usual, a Likert scale was used. These possible choices were indicated as follows:

1. SD – Strongly Disagree
2. D – Disagree
3. N – Neither Agree nor Disagree
4. A – Agree
5. SA – Strongly Agree

Table 6. 1: Category items and directions of AGAQ questions

	LEARNING ABILITY & LEARNING SPEED	PILOTING SKILLS	LEADERSHIP & DECISION-MAKING	GENERAL PREJUDICES & STEREOTYPES
Question	1 -	2 -	3 +	4 +
Question	5 +	6 -	7 +	8 +
Question	9 -	10 -	11 -	12 +
Question	13 -	14 +	15 -	16 -
Question	17 -	18 -	19 -	20 -
Question	21 +	22 -	23 +	24 -
Question	25 +	26 -	27 +	28 -
Question	29 -	30 -	31 -	32 -
Question	33 +	34 -	35 -	36+
Question	37 -	38 -	39 -	40 -
Question	41 -	42 -	43 -	44 +
Question	45 +	46 -	47 +	48 +
Question	49 -	50 +	51 -	52 -
Question	53 -	54 +	55 +	56 -
Question	57 -	58 +	59 -	60 +
Question	61 -	62 +	63 -	64 +
Question	65 -	66 -	67+	68 -
Question	69 -	70 +	71 +	72 +

Reverse coding was done on all the items with a negative sign to change the direction of the scoring, so that high scores indicate a positive attitude, while low scores point to negative attitudes towards female pilots.

6.4 THE POPULATION

A population can be described as all persons, animals, or objects that have a determined characteristic, and that can be found in a determined place at a determined time. According to Clarke and Cooke (1992:38), it is useful to further define a population into two categories: the *target population* is the population about which the researcher wants information, and the *study population* is the population about which the researcher can obtain information.

The research described in this study was solely aimed at current pilots in two countries, namely the United States of America and the Republic of South Africa. The term 'current' implies that the pilots asked to respond had to hold a valid pilot's licence in their respective countries at the time of the study. No restrictions were placed on the type rating; in other words, all pilots, regardless of the type and size of aircraft they fly, could be deemed part of the population for this study.

6.4.1 Defining the sample population

According to Malhotra (1996:359), the basic principle of sampling is that by selecting some of the elements in a population, a researcher may draw conclusions about the entire population. Sampling is thus appropriate when the population size is large and if the cost and time associated with obtaining information from the population is high.

The study population of this research was defined as male and female pilots holding current and valid aerial licences in their respective countries. As the entire population of pilots in the United States and South Africa is very large in number, random sampling was envisaged. In the United States, the questionnaire was distributed by various means: the AGAQ was made available on a website dedicated solely to the collection of data (www.aviatrices.org). The questionnaire was also made available on the website of the 'International Society of Women Airline Pilots' (www.iswap.org) and was published in *Waypoint*, a quarterly magazine of The Ninety-Nines, Inc. published in the Mid-western United States. In addition to this, the questionnaire was distributed both electronically and in printed format to various military, professional and private pilots. In South Africa, the questionnaire was distributed to various airlines, training academies and charter companies. Department heads were asked to distribute the questionnaire, a cover letter and a prepaid envelope to pilots. The completed questionnaires were collected both manually and via mail. Attempts were made to involve the Airline Pilots Association (ALPA) and the South African Airline Pilots Association, but both declined, because members of their executives did not want to get involved in 'gender issues'.

The sample population included in this study is described in more detail in the following sections.

6.4.1.1 Nationality

As was pointed out in Section 6.4.1, participating pilots' nationality was United States and South African. As is apparent from Table 6.2, the majority of the participants are residents of South Africa, making up 68.6 per cent of the total sample group. United States participants equal 23.8 per cent of the sample group. It is also evident from the table that a variety of participants from other countries also participated in the study. This can be attributed to the fact that the questionnaire was distributed electronically. Participants from these miscellaneous countries include Australia and Canada amongst others, and they are included in the 'other' section of Table 6.2. For the purposes of this investigation, only pilots from the United States and South Africa were analysed and compared.

Table 6.2: Frequency distribution – nationality

NATIONALITY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
United States	184.0	23.8	23.8	23.8
South Africa	530.0	68.6	68.6	92.4
Australia	7.0	0.9	0.9	93.3
Other	52.0	6.7	6.7	100.0
Total	773.0	100.0	100.0	

6.4.1.2 Gender

As it was of great importance to understand whether males and females differ in their opinions regarding the gender issues as discussed in this study, it was significant that both men and women responded to the study. Table 6.3.1 depicts the distribution of male and female respondents. From the table, it is evident that the majority of respondents in this study were male, representing a total of 76.2 per cent, while 23.8 per cent represented female respondents. It is further possible to determine that the majority of the respondents in the United States are female (Table 6.3.2), while the respondents in South Africa were mainly male (Table 6.3.3). This may possibly be ascribed to the method of questionnaire distribution – using the Ninety Nines, Inc. as a distributor would arguably tend to attract female respondents to reply.

Table 6.3.1: Frequency distribution – gender (total)

GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Male	544.0	76.2	76.2	76.2
Female	170.0	23.8	23.8	100.0
Total	714.0	100.0	100.0	

Table 6.3.2: Frequency distribution – gender (USA)

GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Male	43.0	23.4	23.4	23.4
Female	141.0	76.6	76.6	100.0
Total	184.0	100.0	100.0	

Table 6.3.3: Frequency distribution – gender (RSA)

GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Male	501.0	94.5	94.5	94.5
Female	29.0	5.5	5.5	100.0
Total	530.0	100.0	100.0	

6.4.1.3 Age

Respondents were asked to identify their age. Table 6.4.1 depicts answers in this regard. The majority of respondents were in the age group from 31 to 40 years old, represented by 30.8 per cent of the total population. Another 26 per cent of the total population fell into the 18 to 30 year old category, while the age categories of 41 to 50 year olds and 51 and older were equally represented by 21 per cent each. Within the United States age demographics (Table 6.4.2), the majority of the respondents fell into the 51 years and older category, followed by the 31 to 40 and 41 to 50 year-olds with an equal distribution of 25.5 per cent each. Respondents in South Africa (Table 6.4.3) fell mainly in the 31 to 40 year old category followed by the 18 to 30 year old category with 30.9 per cent. This information along with the information depicted in Section 6.4.1.2 leads the researcher to believe that the majority of the respondents in the United States were older females, while the majority of the respondents in South Africa were younger males. The average age of the United States and South African respondents were 46,10 years and 37,36 years respectively.

Table 6.4.1: Frequency distribution – age (total)

AGE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
18 - 30	179.0	25.0	26.0	26.0
31 - 40	212.0	29.7	30.8	56.8
41 - 50	149.0	20.9	21.6	78.4
51+	149.0	20.9	21.6	100.0
Total	689.0	96.5	100.0	
Missing	25.0	3.5		
Total	714.0	100.0		

Table 6.4.2: Frequency distribution – age (USA)

AGE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
18 - 30	23.0	12.5	12.5	12.5
31 - 40	47.0	25.5	25.5	38.0
41 - 50	47.0	25.5	25.5	63.5
51+	67.0	36.5	36.5	100.0
Total	184.0	100	100	

Table 6.4.3: Frequency distribution – age (RSA)

AGE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
18 - 30	156.0	29.4	30.9	30.9
31 - 40	165.0	31.1	32.7	63.6
41 - 50	102.0	19.2	20.2	83.8
51+	82.0	15.5	16.2	100.0
Total	505.0	95.3	100.0	
Missing	25.0	4.7		
Total	530.0	100.0		

6.4.1.4 Level of education

It is apparent from the Table 6.5.1 that more than half (50.6 per cent) of pilots tested hold a high school diploma, while 49.4 per cent of respondents hold a technical diploma or higher. The level of education displayed by respondents coincides with the idea that a certain level of intellect is required to pilot aircraft. Although this study does not seek to understand the relationship between intellect and education, the researcher does find the level of education amongst participants to be of interest. Table 6.5.1 depicts the breakdown of the education level for the total sample group, while Table 6.5.2 depicts the education levels of participants in the United States, and Table 6.5.3 depicts the education levels of participants in South Africa. Table 6.5.2 indicates that respondents in the United States have a generally higher level of education than respondents in South Africa. As many as 84.2 per cent of the North American participants hold a bachelors or graduate degree, while only 20.9 per cent of the South African participants (Table 6.5.3) hold this level of education. This may be related to the generally older subpopulation of the United States' participants.

Table 6.5.1: Frequency distribution – highest educational level (total)

HIGHEST EDUCATIONAL LEVEL	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
High School Diploma	361.0	50.6	50.6	50.6
Technical Diploma	86.0	12.0	12.1	62.7
Bachelors Degree	153.0	21.5	21.5	84.2
Graduate Degree	113.0	15.8	15.8	100.0
Total	713.0	99.9	100.0	
Missing	1.0	0.1		
Total	714.0	100.0		

Table 6.5.2: Frequency distribution – highest educational level (USA)

HIGHEST EDUCATIONAL LEVEL	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
High School Diploma	16	8.7	8.7	8.7
Technical Diploma	13	7.1	7.1	15.8
Bachelors Degree	77	41.8	41.8	57.6
Graduate Degree	78	42.4	42.4	100.0
Total	184	100.0	100.0	

Table 6.5.3: Frequency distribution – highest educational level (RSA)

HIGHEST EDUCATIONAL LEVEL	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
High School Diploma	345.0	65.1	65.2	65.2
Technical Diploma	73.0	13.8	13.8	79.0
Bachelors Degree	76.0	14.3	14.4	93.4
Graduate Degree	35.0	6.6	6.6	100.0
Total	529.0	99.8	100.0	
Missing	1.0	0.2		
Total	530.0	100.0		

6.4.1.5 Years of experience as a pilot

The total sample population's years of experience as pilots are indicated in Table 6.6.1. A total number of 714 respondents participated in the study. The majority of pilots have been flying between one and eight years (34.4 per cent). Both the North American and South African participants (Tables 6.6.2 and 6.6.3) share this level of experience. Following this, the second largest group (26.8 per cent) of the sample population hold between nine and 16 years of experience as a pilot. The average years of experience as pilot were 13.08 years for the United States and 16.11 years for the South African participants.

Table 6.6.1: Frequency distribution – years of experience (total)

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
1 - 8	245.0	34.3	34.4	34.4
9 - 16	191.0	26.8	26.8	61.2
17 - 24	118.0	16.5	16.6	77.8
25 +	158.0	22.1	22.2	100.0
Total	712.0	99.7	100.0	
Missing	2.0	0.3		
Total	714.0	100.0		

Table 6.6.2: Frequency distribution – years of experience (USA)

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
1 - 8	75.0	40.8	40.8	40.8
9 - 16	52.0	28.3	28.3	69.0
17 - 24	29.0	15.8	15.8	84.8
25 +	28.0	15.2	15.2	100.0
Total	184.0	100.0	100.0	

Table 6.6.3: Frequency distribution – years of experience (RSA)

YEARS OF EXPERIENCE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
1 - 8	170.0	32.1	32.2	32.2
9 - 16	139.0	26.2	26.3	58.5
17 - 24	89.0	16.8	16.9	75.4
25 +	130.0	24.5	24.6	100.0
Total	528.0	99.6	100.0	
Missing	2.0	0.4		
Total	530.0	100.0		

6.4.1.6 Flying time

Flying time denotes the number of hours that a pilot had accumulated by the time of the survey. For the total population, the mean number of flying time is 5358.0 hours. For the United States population, this number is significantly lower, at 1960.64 hours, than for the South African population, at 6535.51 hours. This may be due to the fact that the majority of United States respondents in this study were largely flying in a recreational capacity, while most of the respondents from South Africa were flying in a professional capacity. It is assumed that this number will most likely be adjusted with the inclusion of a representative sample of professional pilots in the United States.

Table 6.7.1: Frequency distribution – flying time (total)

FLYING TIME IN HOURS	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
40 – 300	100	14.0	14.2	14.2
301 - 1000	99	13.9	14.0	28.2
1001 - 2600	94	13.2	13.3	41.5
2601 - 4800	108	15.1	15.3	56.8
4801 – 6900	100	14.0	14.2	71.0
6901 - 11000	104	14.6	14.7	85.7
11001-23400	101	14.2	14.3	100.0
Total	706	99.0	100.0	
Missing	7	1.0		
Total	713	100.0		

Mean: 5358.0 hours flying time

Table 6.7.2: Frequency distribution – flying time (USA)

FLYING TIME IN HOURS	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
40 - 300	57	31.1	31.7	31.7
301 - 1000	53	29.0	29.4	61.1
1001 - 2600	28	15.3	15.6	76.7
2601 - 4800	30	10.9	11.1	87.8
4801 – 6900	9	4.9	5.0	92.8
6901 - 11000	9	4.9	5.0	97.8
11001-23400	4	2.2	2.2	100.0
Total	180	98.4	100.0	
Missing	3	1.6		
Total	183	100.0		

Mean: 1960.64 hours flying time

Table 6.7.3: Frequency distribution – flying time (RSA)

FLYING TIME IN HOURS	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
40 - 300	43	8.1	8.2	8.2
301 - 1000	46	8.7	8.7	16.9
1001 - 2600	66	12.5	12.5	29.5
2601 - 4800	88	16.6	16.7	46.2
4801 – 6900	91	17.2	17.3	63.5
6901 - 11000	95	17.9	18.1	81.6
11001-23400	97	18.3	18.4	100.0
Total	526	99.2	100.0	
Missing	4	0.8		
Total	530	100.0		

Mean: 6535.51 hours flying time

6.4.1.7 Pilot certification

In order to gain a better understanding of the sample population, the researcher included a category referencing the type of aerial certifications held by respondents. These ratings include all types of licences that can be held by a pilot, from private pilot certifications to airline transport pilot certifications. Table 6.7.1 clearly indicates that the majority of respondents (52.5 per cent) in this research study hold Airline Transport ratings, followed by 19.7 per cent of pilots who hold Commercial Pilot ratings. The North American and South African sub-samples differ in that the majority of pilots (40.8 per cent) in the United States' sample (Table 6.7.2) hold private pilot ratings, while the majority of pilots (66.6 per cent) in the South African sample (Table 6.7.3) hold Airline Transport Pilot ratings.

Table 6.8.1: Frequency distribution – pilot certification (total)

PILOT CERTIFICATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	107.0	15.0	15.0	15.0
Commercial Pilot	141.0	19.7	19.7	34.7
Flight Instructor	91.0	12.8	12.8	47.5
Airline Transport Pilot	375.0	52.5	52.5	100.0
Total	714.0	100.0	100.0	

Table 6.8.2: Frequency distribution – pilot certification (USA)

PILOT CERTIFICATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	75.0	40.8	40.8	40.8
Commercial Pilot	60.0	32.6	32.6	73.4
Flight Instructor	27.0	14.7	14.7	88.0
Airline Transport Pilot	22.0	12.0	12.0	100.0
Total	184.0	100.0	100.0	

Table 6.8.3: Frequency distribution – pilot certification (RSA)

PILOT CERTIFICATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	32.0	6.0	6.0	6.0
Commercial Pilot	81.0	15.3	15.3	21.5
Flight Instructor	64.0	12.1	12.1	33.4
Airline Transport Pilot	353.0	66.6	66.6	100.0
Total	530.0	100.0	100.0	

6.4.1.8 Aircraft category and classification

Of further interest to this research and for the processing of future related research is the aircraft category and classification of the respondents. These aircraft categories have been defined and classified as set out in Table 6.8.1. The majority of respondents (68.9 per cent) in the total sample population fly Multi Engine Land type aircraft. This coincides largely with the above pilot certification classification in that Multi Engine pilots tend to be, for the large part, airline transport pilots. Within the United States classification (Table 6.8.2), the majority of pilots (63 per cent) tend to fly Single Engine Land type aircraft. This type of aircraft category is usually associated with private pilots. Section 6.4.1.8 investigates the main area of operation. The largest number of South African respondents (83 per cent) fly Multi Engine Land type aircraft (see Table 6.8.3).

Table 6.9.1: Frequency distribution – aircraft category (total)

AIRCRAFT CATEGORY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Single Engine – Land	182.0	25.5	25.5	25.5
Multi Engine – Land	491.0	68.8	68.9	94.4
Rotorcraft	26.0	3.6	3.7	98.1
Lighter-than-air	1.0	0.1	0.1	98.2
Single Engine – Sea	5.0	0.7	0.7	98.9
Multi Engine – Sea	3.0	0.4	0.4	99.3
Glider	2.0	0.3	0.3	99.6
Other	3.0	0.4	0.4	100.0
Total	713.0	99.9	100.0	
Missing	1.0	0.1		
Total	714.0	100.0		

Table 6.9.2: Frequency distribution – aircraft category (USA)

AIRCRAFT CATEGORY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Single Engine – Land	116.0	63.0	63.0	63.0
Multi Engine – Land	52.0	28.3	28.3	91.3
Rotorcraft	6.0	3.3	3.3	94.6
Lighter-than-air	0.0	0.0	0.0	94.6
Single Engine – Sea	5.0	2.7	2.7	97.3
Multi Engine – Sea	1.0	0.5	0.5	97.8
Glider	2.0	1.1	1.1	98.9
Other	2.0	1.1	1.1	100.0
Total	184.0	100.0	100.0	

Table 6.9.3: Frequency distribution – aircraft category (RSA)

AIRCRAFT CATEGORY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Single Engine – Land	66.0	12.5	12.5	12.5
Multi Engine – Land	439.0	82.8	83.0	95.5
Rotorcraft	20.0	3.8	3.8	99.2
Lighter-than-air	1.0	0.2	0.2	99.4
Single Engine – Sea	0.0	0.0	0.0	99.4
Multi Engine – Sea	2.0	0.4	0.4	99.8
Glider	0.0	0.0	0.0	99.8
Other	1.0	0.2	0.2	100.0
Total	529.0	99.8	100.0	
Missing	1.0	0.2		
Total	530.0	100.0		

6.4.1.9 Main area of operation

The main area of operation of the respondents refers to the overall function in which the pilot is involved. Table 6.9.1 depicts the frequency distributions of these categories. The largest group of respondents function as National Airline pilots, at 49 per cent of the total sample population. This is followed by Private Pilot operation (20.4 per cent). The United States' respondents (Table 6.9.2) were predominantly private pilots (64.1 per cent), while South African respondents (Table 6.9.3) were largely national airline pilots (63 per cent).

Table 6.10.1: Frequency distribution – main area of operation (total)

AREA OF OPERATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	146.0	20.4	20.4	20.4
Military Pilot	95.0	13.3	13.3	33.7
Charter Pilot	54.0	7.6	7.6	41.3
National Airline Pilot	349.0	49.0	49.0	90.3
Government Pilot	5.0	0.7	0.7	91.0
Corporate Pilot	11.0	1.5	1.5	92.5
Freight Pilot	3.0	0.4	0.4	92.9
Instructor	46.0	6.4	6.4	99.3
Other	5.0	0.7	0.7	100.0
Total	714.0	100.0	100.0	

Table 6.10.2: Frequency distribution – main area of operation (USA)

AREA OF OPERATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	118.0	64.1	64.1	64.1
Military Pilot	28.0	15.2	15.2	79.3
Charter Pilot	3.0	1.6	1.6	81.0
National Airline Pilot	15.0	8.2	8.2	89.1
Government Pilot	2.0	1.1	1.1	90.2
Corporate Pilot	4.0	2.2	2.2	92.4
Freight Pilot	1.0	0.5	0.5	92.9
Instructor	8.0	4.3	4.3	97.3
Other	5.0	2.7	2.7	100.0
Total	184.0	100.0	100.0	

Table 6.10.3: Frequency distribution – main area of operation (RSA)

AREA OF OPERATION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Private Pilot	28.0	5.3	5.3	5.3
Military Pilot	67.0	12.6	12.6	17.9
Charter Pilot	51.0	9.6	9.6	27.5
National Airline Pilot	334.0	63.0	63.0	90.6
Government Pilot	3.0	0.6	0.6	91.1
Corporate Pilot	7.0	1.3	1.3	92.5
Freight Pilot	2.0	0.4	0.4	92.8
Instructor	38.0	7.2	7.2	100.0
Other	0.0	0.0	0.0	100.0
Total	530.0	100.0	100.0	

6.4.1.10 Nature of flight duty

The nature of flight duty of the sample population refers to the actual profession of the respondents. This differs from the area of operation, which is a more vague and an all-encompassing term. While a respondent may be a military pilot, his/her flight duty may involve one of a variety of tasks such as transportation, combat or flight instruction. Table 6.10.1 depicts the frequency distribution of the nature of flight duty of the respondents involved in this research. The greatest number of pilots (60.4 per cent) in the sample population are involved in Passenger Transportation. Amongst United States' respondents (Table 6.10.2), personal flying was most prevalent (55.2 per cent), while South African respondents (Table 6.10.3) were predominantly involved in passenger transportation (76.7 per cent). In both the United States (14.8 per cent) and South Africa (11.3 per cent), personal flying and passenger transportation were followed by pilot training and/or flight instruction.

Table 6.11.1: Frequency distribution – nature of flight duty (total)

NATURE OF FLIGHT DUTY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Passenger Transportation	430.0	60.2	60.4	60.4
Agricultural	1.0	0.1	0.1	60.5
Pilot Training/Flight Instruction	87.0	12.2	12.2	72.7
Personal Flying	124.0	17.4	17.4	90.1
Experimental / Test Flight	3.0	0.4	0.4	90.5
Air Freight	8.0	1.1	1.1	91.6
Industrial / Construction	1.0	0.1	0.1	91.7
Aerial Pilot	26.0	3.7	3.7	95.4
Combat	12.0	1.7	1.8	97.2
Other	20.0	2.8	2.8	100.0
Total	712.0	99.7	100.0	
Missing	2.0	0.3		
Total	714.0	100.0		

Table 6.11.2: Frequency distribution – nature of flight duty (USA)

NATURE OF FLIGHT DUTY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Passenger Transportation	24.0	13.0	13.1	13.1
Agricultural	0.0	0.0	0.0	13.1
Pilot Training/Flight Instruction	27.0	14.7	14.8	27.9
Personal Flying	101.0	54.9	55.2	83.1
Experimental / Test Flight	2.0	1.1	1.1	84.3
Air Freight	5.0	2.7	2.7	86.9
Industrial / Construction	0.0	0.0	0.0	86.9
Aerial Pilot	3.0	1.6	1.6	88.5
Combat	10.0	5.4	5.5	94.0
Other	11.0	6.0	6.0	100.0
Total	183.0	99.5	100.0	
Missing	1.0	0.5		
Total	184.0	100.0		

Table 6.11.3: Frequency distribution – nature of flight duty (RSA)

NATURE OF FLIGHT DUTY	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Passenger Transportation	406.0	76.6	76.7	76.7
Agricultural	1.0	0.2	0.2	76.9
Pilot Training/Flight Instruction	60.0	11.3	11.3	88.3
Personal Flying	23.0	4.3	4.3	92.6
Experimental / Test Flight	1.0	0.2	0.2	92.8
Air Freight	3.0	0.6	0.6	93.4
Industrial / Construction	1.0	0.2	0.2	93.6
Aerial Pilot	23.0	4.3	4.3	97.9
Combat	2.0	0.4	0.4	98.3
Other	9.0	1.7	1.7	100.0
Total	529.0	99.8	100.0	
Missing	1.0	0.2		
Total	530.0	100.0		

6.4.1.11 Position

Position refers to the actual designation within aviation that the participant held at the time when he/she completed the questionnaire. As the target population was only pilots, respondents could only hold one of the following positions: Captain or First Officer. Of the sample population, 38.3 per cent fell into the category of captain, 31 per cent of respondents were single Pilots in Command and 28 per cent fell into the first officer category. Table 6.11.1 illustrates the designations of respondents in this research. Amongst United States' respondents (Table 6.11.2), the majority (71.9 per cent) of pilots were single Pilots in Command – usually indicating smaller type aircraft, while amongst South African candidates (Table 6.11.3), respondents (46.3 per cent) were mostly captains of multi-crew flights.

Table 6.12.1: Frequency distribution – position (total)

POSITION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Captain: Multi-crew	271.0	38.0	38.3	38.3
Single Pilot in Command	219.0	30.7	31.0	69.3
First Officer: Multi-crew	198.0	27.7	28.0	97.3
Other	19.0	2.7	2.7	100.0
Total	707.0	99.1	100.0	
Missing	7.0	0.9		
Total	714.0	100.0		

Table 6.12.2: Frequency distribution – position (USA)

POSITION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Captain: Multi-crew	26.0	14.1	14.6	14.6
Single Pilot in Command	128.0	68.6	71.9	86.5
First Officer: Multi-crew	18.0	9.8	10.1	96.6
Other	6.0	3.3	3.4	100.0
Total	178.0	96.7	100.0	
Missing	6.0	3.3		
Total	184.0	100.0		

Table 6.12.3: Frequency distribution – position (RSA)

POSITION	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Captain: Multi-crew	245.0	46.2	46.3	46.3
Single Pilot in Command	91.0	17.2	17.2	63.5
First Officer: Multi-crew	180.0	34.0	34.0	97.5
Other	13.0	2.5	2.5	100.0
Total	529.0	99.8	100.0	
Missing	1.0	0.2		
Total	530.0	100.0		

6.4.1.12 CRM course

As the results of this research has direct implications for the fields of Human Factors in Aviation and CRM, it is of interest to know how many of the respondents in this research hold knowledge of the field of CRM. Of the sample population, 75.1 per cent had undergone training in CRM, while 24.9 per cent had not. Within the United States' sample (Table 6.12.2), only 36.8 per cent of respondents had attended CRM training. This may be a result of the largely private pilot contingency amongst the American respondents. CRM training is usually only provided to airline transport pilots and no provision is made for the training of private pilots in this area. Amongst the South African respondents (Table 6.12.3), 88.3 per cent of the respondents had undergone CRM training.

Table 6.13.1: Frequency distribution – CRM course (total)

PARTICIPATION IN CRM COURSE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Yes	534.0	74.8	75.1	75.1
No	177.0	24.8	24.9	100.0
Total	711.0	99.6	100.0	
Missing	3.0	0.4		
Total	714.0	100.0		

Table 6.13.2: Frequency distribution – CRM course (USA)

PARTICIPATION IN CRM COURSE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Yes	67.0	36.4	36.8	36.8
No	115.0	62.5	63.2	100.0
Total	182.0	98.9	100.0	
Missing	2.0	1.1		
Total	184.0	100.0		

Table 6.13.3: Frequency distribution – CRM course (RSA)

PARTICIPATION IN CRM COURSE	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Yes	467.0	88.1	88.3	88.3
No	62.0	11.7	11.7	100.0
Total	529.0	99.8	100.0	
Missing	1.0	0.2		
Total	530.0	100.0		

6.4.1.13 Flying with the opposite gender

Though the research is focused primarily on the identification of attitudes, stereotypes and prejudices toward female aviators, it is of interest to see what percentage of the sample population shares the cockpit with the opposite gender. Table 6.13.1 depicts that the majority of the sample population flew with the opposite gender only rarely (56.2 per cent). Within the United States' sample (Table 6.13.2), 31.1 per cent of respondents fly often with the opposite gender, followed by 30.1 per cent flying mostly with respondents of the opposite gender. As previously defined, the American contingent of the sample population consists mainly of female aviators. Amongst South African respondents (Table 6.13.3), pilots rarely (67.2 per cent) flew with members of the opposite gender. These statistics reflect to the contention that the majority of female pilots still participate in aviation on a non-professional scale while male pilots perform in more professional capacities.

Table 6.14.1: Frequency distribution – flying with the opposite gender (total)

FLYING WITH THE OPPOSITE GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Never	75.0	10.5	10.5	10.5
Rarely	401.0	56.2	56.2	66.7
Sometimes	87.0	12.2	12.2	78.9
Often	71.0	9.9	10.0	88.9
Mostly	79.0	11.1	11.1	100.0
Total	713.0	99.9	100.0	
Missing	1.0	0.1		
Total	714.0	100.0		

Table 6.14.2: Frequency distribution – flying with the opposite gender (USA)

FLYING WITH THE OPPOSITE GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Never	4.0	2.2	2.2	2.2
Rarely	45.0	24.5	24.6	26.8
Sometimes	22.0	12.0	12.0	38.8
Often	57.0	31.0	31.1	69.9
Mostly	55.0	29.9	30.1	100.0
Total	183.0	99.5	100.0	
Missing	1.0	0.5		
Total	184.0	100.0		

Table 6.14.3: Frequency distribution – flying with the opposite gender (RSA)

FLYING WITH THE OPPOSITE GENDER	FREQUENCY	PERCENTAGE	VALID PERCENTAGE	CUMULATIVE PERCENTAGE
Never	71.0	13.4	13.4	13.4
Rarely	356.0	67.2	67.2	80.6
Sometimes	65.0	12.3	12.3	92.8
Often	14.0	2.6	2.6	95.5
Mostly	24.0	4.5	4.5	100.0
Total	530.0	100.0	100.0	

The information in the above tables is summarised in the graphs in Appendix H.

6.5 STATISTICAL ANALYSIS

6.5.1 Introduction

In this study, it was decided to use a complex research approach, combining descriptive, comparative and associational statistics to analyse the data. Appropriate statistical procedures were selected on the basis of guidelines provided and discussed by various authors (Morgan & Griego, 1998; Clark & Watson, 1995; Cooper & Emory, 1995; Kanji, 1999; Steyn, 1999; Steyn, 2000; Van de Vijver & Leung, 1997). The SPSS for Windows Statistical Package (Release 11) was applied to complete all statistical procedures.

A particular set of statistical procedures, as discussed later in this chapter, was also chosen on the basis of the level of measurement achieved in the research. In this study, nominal and ordinal scales were used as measures to collect the biographic and demographic data (the independent variables). According to Morgan and Griego (1998), data measured by either nominal or ordinal scales should be analysed by means of non-parametric statistical methods.

A five-point Likert scale was used to measure the perceptions of pilots with regard to gender issues in aviation (the dependent variable) at a given interval level, despite some flaws inherent in this method. Due to the inherent limitations of scaling psychological measurements (particularly equal intervals between successively higher levels), the level of measurement can only be regarded as reflecting approximately equal intervals (Kerlinger, 1986; Morgan & Griego, 1998). Nevertheless, it was deemed appropriate to use familiar and powerful parametric statistics such as the Pearson correlation and analysis of variance to ascertain the relationships between variables.

6.5.2 Factor analysis

In the behavioural sciences, factor analysis is frequently used to uncover the latent structure (dimensions) of a set of variables and to assess whether given instruments measure substantive constructs (Cortina, 1993). Hence, Hatcher (1994) has recommended that researchers use the Exploratory Factor Analysis (EFA) procedure when they attempt to determine the number and content of factors measured by an instrument. For the purposes of this research, four exploratory categories of assumptions were therefore proposed: Learning Ability and Learning Speed, General Piloting Skills, Leadership and General Prejudices and Stereotypes. However, EFA is designed to uncover the underlying structure of relatively large sets of variables, because it is based on an '*a priori* assumption that any variable in the questionnaire may be associated with any factor. There is no prior theory and one uses factor loadings to intuit the factor structure of the data' (North Carolina State University, 2002).

In the present study, Principal Factor Analysis (PFA) with varimax rotation was used to establish the internal structure and factor validity of the AGAQ, which was developed for this study. PFA is also referred to as Principal Axis Factoring (PAF) or Common Factor Analysis. PFA is a form of factor analysis that seeks the least number of factors that can account for the common variance of a set of variables (North Carolina State University, 2002).

6.5.3 Structural equivalence (Tucker's phi)

In analogy with studies by Pienaar and Rothmann (2003:81-90) and Naudé and Rothmann (2003:92-100), the factor structures of the AGAQ for the different cultural groups included in the study were compared using construct (structural) equivalence. As suggested by Van de Vijver and Leung (1997), Exploratory Factor Analysis and Target (Procrustean) Rotation were used to determine the construct equivalence of the factors. Van de Vijver and Leung (1997) argue that it is not acceptable to conduct factor analyses for different cultural groups to address the similarity of factor-analytic solutions, because the spatial orientation of factors in factor analysis is arbitrary. Instead, as suggested by Pienaar and Rothmann (2003:81-90) and Naudé and Rothmann (2003:92-100), before an evaluation of the agreement of factors in different cultural groups was done, the matrices of loadings were rather rotated in relation to one another (in other words, target rotations were done). The factor loadings of the individual groups were rotated to a joint common matrix of factor loadings. After completing the target rotation for this study, Tucker’s coefficient of agreement (phi) was used to estimate factorial agreement. Tucker’s phi is not sensitive to multiplications of the factor loadings, but is sensitive to a constant added to all the loadings of a factor (Pienaar & Rothmann, 2003; Naudé & Rothmann, 2003). The following formula is used to compute Tucker’s phi (Van de Vijver & Leung, 1997):

$$p_x = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2 y_i^2}}$$

The sampling distribution for this index is not known; therefore, one cannot establish confidence intervals. Values that are higher than 0.95 are regarded as substantiation for factorial similarity, whereas values lower than 0.85 indicate non-negligible incongruities. This index is, however, accurate enough to examine factorial similarity at a global level (Van de Vijver & Leung, 1997).

6.5.4 Analysis of item bias

Item bias was identified using an extension of Cleary and Hilton's (1968) analysis of variance, as suggested by Van de Vijver and Leung (1997). Bias for each item was examined separately. The item score was chosen as the dependent variable; nationality (two groups) and score levels were chosen as the independent variables. The total score on the different factors of the AGAQ was used to compose the score. Four score levels were obtained by using an equal grouping procedure of the SPSS description. Score groups with at least 50 persons each could therefore be used. Two effects were tested by means of analysis of variance, namely the main effect of culture and the interaction of score level and culture, as suggested by Naudé and Rothmann (2003) and Van de Vijver (2002). In cases where both the main effect of culture and the interaction of the score level and culture are significant, the item is regarded as biased. However, with large samples, while groups may be found to differ significantly with regard to a dependent variable, these differences in terms of their effect may be small. Therefore eta-square was used as a level of association for significant effects. Cohen (1988) refers to eta-square as 'large' when $\eta^2 > 0,15$, as 'medium' when $\eta^2 = 0.06$ to 0,14, and as 'small' when $\eta^2 = 0.01$ to 0.03; and without effect if $\eta^2 < 0.01$.

6.5.5 Reliability analysis

The Cronbach alpha coefficient and inter-item correlation coefficients were used to assess the internal consistency of the measuring instrument, as suggested by Clark and Watson (1995). The coefficient alpha reflects important information about the proportion of error variance contained in a scale. Due to the multiplicity of the items measuring the factors, the Cronbach alpha coefficient was considered to be the most suitable coefficient for use in this study, since it has the most utility of multi-item scales at the internal level of measurement (Cooper & Emory, 1995). Alpha is a sound measure of error variance and can be used to confirm the unidimensionality of a scale, or to measure the strength of a dimension once the existence of a single factor has been determined (Cortina, 1993).

According to Clark and Watson (1995), the mean inter-item correlation coefficient (which is a straightforward measure of internal consistency) is also a useful index to supplement information supplied by the coefficient alpha. They recommended that the average inter-item correlation must fall within the range of 0.15 to 0.50 to be acceptable and/or desirable. For a valid measure of a narrow construct such as attitudes towards a specific phenomenon, a much higher mean inter-item correlation (0.40 to 0.50) is required. However, focusing on the mean inter-item correlation cannot ensure the unidimensionality of a scale – it is also necessary to examine the range and distribution of values (Pienaar and Rothmann, 2003).

6.5.6 Analysis of item distribution

Descriptive statistics (for example, means, standard deviations, skewness and kurtosis) were used to analyse the distribution of the values of each item included in the different factors. Measures of location (mean), spread (standard deviation), and shape (skewness and kurtosis) were calculated. According to Cooper and Schindler (2003:472-477), the mean and standard deviation are called dimensional measures (in other words, expressed in the same units as the measured quantities). By contrast, skewness (sk) and kurtosis (ku) are regarded as non-dimensional measures. Skewness is an index that only characterises the shape of the distribution. When sk is approximately 0, a distribution approaches symmetry. Kurtosis is a measure of a distribution's 'peakness or flatness'. According to Cooper and Schindler (2003:472), there are three different types of kurtosis:

- peaked or leptokurtic distributions - scores cluster heavily in the centre (a positive ku value);
- flat or platykurtic distributions - evenly distributed scores and facts flatter than a normal distribution (a negative ku value); and
- intermediate or mesokurtic distributions - neither too peaked nor too flat (a ku value close to 0).

As with skewness, the larger the absolute value of the index, the more extreme the characteristic of the index.

6.5.7 Analysis of compliance with specific assumptions

6.5.7.1 Sampling adequacy

In order to establish whether the item intercorrelation would comply with the criterion of sample adequacy set for factor analysis, the Kaiser-Meyer-Olkin test was conducted. Kaiser-Meyer-Olkin statistics are based on partial correlation and the anti-image correlation of items. Linked to the anti-image correlation matrix is the measure of sampling adequacy (MSA). The scores of MSA can range from Zero to One, but the overall score must be higher than 0.70 if the data are likely to factor well (Morgan & Griego, 1998). Hair *et al*. (1998) propose the following guidelines in interpreting the Kaiser-Meyer-Olkin sampling adequacy:

- Outstanding : MSA > 0.90 - 1
- Meritorius : MSA > 0.80 – 89
- Middling : MSA > 0.70 – 79
- Mediocre : MSA > 0.60 – 69
- Miserable : MSA > 0.50 – 59
- Unacceptable : MSA < 0.50

If the KMO score is less than 0.50 there is no systematic covariation in the data and the variables are essentially independent.

6.5.7.2 Sphericity

Sphericity means that data is uncorrelated. Factor analysis, however, assumes that a set of variables are associated with each other. Moderate significant inter-correlations between items are required to uncover the latent structure of a set of variables. Bartlett's test of Sphericity measures the absence of correlations between variables. Bartlett's statistics test whether a correlation matrix is an identity matrix, in other words, whether the items are unrelated. A high Chi-square value with a low p value ($p<0.001$) indicates a significant relationship between the items, which suggests that the data are suitable for factor analysis (Morgan & Griego, 1998).

6.5.7.3 Homogeneity of variance and co-variance

- Homogeneity of variance

The Analysis of Variance (ANOVA) assumes equal variances, across groups or samples. Levene's test of homogeneity of variance can be used to verify the assumption that the variances of groups are equal. Levene's test statistic is designed to test whether the variance of a single metric variable (dependent variable) is equal across any number of groups. If Levene's F is statistically significant ($p<0.05$), then variances are significantly different and the assumption of equal variances is violated (Morgan & Griego, 1998).

- Equality of covariance

The assumption for a multivariate approach is that the vector of the dependent variables follow a multivariate normal distribution, and the variance-covariance matrix is equal across the cells formed by the between – subject effects (SPSS help function).

The Box's M tests the multiple Analysis of Variance's (MANOVA's) assumption of homoscedasticity using the F distribution. If $p(M)<0.05$, the covariances are significantly different and the assumption of equality of co-variance is violated (North Carolina State University, 2002).

6.5.7.4 Association

Association refers to coefficients that measure the strength of a relationship. High levels of association among independent variables may lead to misinterpretation of results and research inferences. For example, if other variables also affect or cause the dependent variable, than any covariance they share with the given independent variable in an analysis of variance will be falsely attributed to that independent variable.

The Phi-coefficient is a Chi-square based measure of association. Although Phi was designed for use with nominal data it can handle larger tables and may be computed for ordinal data (North Carolina State University, 2002). Phi is sometimes called Pearson's coefficient of mean-square contingency and is computed as the square root of the Chi-square value divided by the total group (n). Phi defines perfect association as predictive monotomicity and defines the null relationship as statistical independence. The Phi-value

(φ) indicates the practical significance of the strength of a relationship rather than a statistical significance of the relationship. Cohen (1988) suggested the following guidelines for interpreting the effect size and practical significance.

- $\varphi=\omega$ = 0.0 – 0.099 No effects
- $\varphi=\omega$ = 0.1 – 0.299 Small effect
- $\varphi=\omega$ = 0.3 – 0.499 Medium effect
- $\varphi=\omega$ = 0.5 – 1.000 Large effect

For the purposes of this research, $\omega \geq 0.3$ is regarded as practically significant.

6.5.8 Analysis of variance

T-tests and one-way analyses of variance (ANOVAs) were used in order to determine the differences between the mean scores of the subgroups with regard to Factor 1 and Factor 2. The one-way ANOVA tests for differences in a single interval dependent variable among three or more groups formed by categories of a single independent variable. It compares the means of the sub-groups formed by the categories in order to make inferences about the population means. The key statistics in an analysis of variance are the t-test and F-test of difference of group means. The statistics indicate the means of sub-groups formed by values of the independent variable are different enough not to have occurred by chance (North Carolina State University, 2002).

In instances where statistical significance was found, the practical significance of differences was calculated. According to Steyn (2000), a small p-value does not prove practical or meaningful significance, since the value of p is highly dependent on sample size. Several other authors (for example, Cohen, 1988; Falk & Greenbaum, 1995; Kirk, 1996, Thompson, 1996 and Thompson, 1998) have questioned the reporting of only statistical significance without assessing the effect size of the outcomes. They provide ample reasons why researchers must also report on the practical significance of their findings.

The formula suggested by Steyn (2000) was used to measure the effect size of difference between two means.

$$d = \frac{Mean_A - Mean_B}{SD_{\max}}$$

where

$Mean_A$ = Mean of the first group
$Mean_B$ = Mean of the second group
SD_{MAX} = Highest standard deviation of the two groups

The following formula was used to determine the practical significance of means of more than two groups (Steyn, 1999; Naudé & Rothmann, 2003):

$$d = \frac{Mean_A - Mean_B}{RootMSE}$$

where

$Mean_A$ = Mean of the first group
$Mean_B$ = Mean of the second group
Root MSE = Root Mean Square Error

Cohen (1988) recommends the following cut-off points for practical significance:

- d = 0,20 - small effect
- d = 0,50 - medium effect
- d = 0,80 - large effect

6.5.9 N-way univariate ANOVA

The SPSS programme help function provides the following description of the n-way univariate ANOVA:

> The GLM Univariate procedure provides regression analysis and analysis of variance for one dependent variable by one or more factors and/or variables. The factor variables divide the population into groups. Using the General Linear Model procedure, it is possible to test the effects of other variables on the means of various groupings of a single dependent variable. The interactions between factors as well as the effects of individual factors can be investigated.

> Additionally, after an overall F test has shown significance, between factors (groups) post hoc tests to evaluate differences among specific means can be applied. Estimated marginal means can be calculated to predict mean values for the cells in the model. Profile plots (interaction plots) of the means will be used to visualize some of the relationships.
>
> (SPSS help function GLM Univariate).

6.5.10 Multivariate analysis of variance

Multiple analysis of variance (MANOVA) was used to determine the main and interaction effects of categorical variables on the multiple dependent interval variables. The MANOVA uses one or more categorical independents as predictors (like the ANOVA), but there is more than one dependent variable (unlike with the ANOVA). The ANOVA tests the differences in the means of the interval dependent for various categories of the independent variable(s), while the MANOVA tests the differences in the centroid (vector) of means of the multiple interval dependents, for various categories of the independent variable(s). Researchers may also perform *post hoc* comparisons in order to determine which values of a factor contribute most to the explanation of dependents (North Carolina State University, 2002).

According to the SPSS programme help function

> GLM Multivariate procedure provides regression analysis and analysis of variance for multiple dependent variables by one or more factor variables or covariates. The factor variables divide the population into groups. Using this general linear model procedure, you can test null hypotheses about the effects of factor variables on the means of various groupings of a joint distribution of dependent variables. You can investigate interactions between factors as well as the effects of individual factors. In addition, the effects of covariates and covariate interactions with factors can be included. For regression analysis, the independent (predictor) variables are specified as covariates.
>
> Commonly used a priori contrasts are available to perform hypothesis testing. Additionally, after an overall F test has shown significance, you can use post hoc tests to evaluate differences among specific means.

> Estimated marginal means give estimates of predicted mean values for the cells in the model, and profile plots (interaction plots) of these means allow you to visualize some of the relationships easily. The post hoc multiple comparison tests are performed for each dependent variable separately.
>
> (SPSS help function GLM Multivariate)

6.6 INTEGRATED CONCLUSION

This chapter focused largely on the statistical applications involved in the processing of the AGAQ. It also provided an in-depth discussion of the relative population and sample population on which this study focused (respondents for this research were from the United States and South Africa). The majority of pilots were male and performed pilot duties in some form of professional role, while female aviators tended to fly more for leisure. Pilots surveyed in the United States tended to be older, while the South African pilots tended to be in a younger demographic. The aircraft classifications for the United States pilots were generally single-engine land type aircraft, while aircraft classification in South African was mostly multi-engine land type aircraft. Of the pilots surveyed in this study, many of the United States (predominantly female) participants had not had the opportunity to partake in a CRM course, while the South African (predominantly male) participants had, for the most part, attended CRM training. (This data is analysed in more detail in Chapter 7.)

The types of statistical analysis (factor analysis, structural equivalence, analysis of item bias, reliability analysis, analysis of item distribution and analysis of variance) used in this research were examined in order to provide a basis for the discussion of the results (see Chapter 7).

The following chapter (Chapter 7) sets out the results of Section II of the AGAQ and their interpretation. Chapter 8 discusses the conclusions regarding the research questions formulated in Chapter 1.