CHAPTER 6

METHOD

6.1. Introduction

This chapter describes the method and procedures that were followed to obtain the data and information that was critical to this project. The chapter begins with a discussion about what took place in the qualitative and quantitative phase and the kind of sample that was used in this study. This is followed by a detailed discussion of the questionnaire design, and the reliability and validity measures of the scales and sub-scales that were calculated. Included in the discussion in this chapter are the factors of the scales that were identified through factor analysis. The chapter closes with a section that is devoted to discussion of two statistical tests that were considered or used to analyse the data.

6.2. Phase 1: The Qualitative Stage

The qualitative stage of the study involved the use of separate focus groups that included students, professionals and senior citizens. The purpose of the focus groups was to obtain information to be used later in the quantitative phase to develop a questionnaire.

The inclusion of students in the study was important for two reasons: (1) they are potential listeners to SAfm and, (2) because of their relatively young age, it was assumed that they were more likely to be receptive to a new multicultural radio station such as SAfm. The respondents identified as professionals may be described as the target audience for SAfm. They also form the bulk of the kind of audience that the station would want to sell to advertisers. These respondents were each trained in a specific field or area in which they are currently involved in their respective jobs. Senior citizens were included only for purposes of comparison.

The focus groups were specifically intended to obtain the following kind of information: (a) the kinds of programme respondents listened to the most or the least on their favourite radio station, and the reasons for this; (b) the aspects or elements of radio programming that respondents regard as important; (c) reasons for listening or not listening to SAfm; (d) aspects of radio programming that are liked or disliked by the respondents; (e) views and

opinions of the respondents on what SAfm can or should do to attract a culturally diverse audience.

The focus groups' activities were outsourced to an external research house. This company was chosen because of the vast experience it had acquired in conducting focus groups for the SABC radio division. The sample consisted of university and technikon students, senior citizens and professionals. The sample composition of the focus groups was as follows: (a) there was an equal number of males and females aged 16 and over; (b) respondents were resident in a metropolitan environment.

In an attempt to stimulate more discussion that was intended to elicit comments or views on SAfm, audio tapes that contained snippets of SAfm programme content were played for the respondents. The programme content on these tapes was chosen to represent two different versions of programme types: (1) the South African version of the BBC type of programme that used to be broadcast by the station before its relaunch in 1994; (2) the new version of SAfm programmes and programme formats that were adopted immediately after the relaunch of the station. The BBC-South African version programmes were stiff in terms of format and structure. Most of the programmes were imported from the BBC to be broadcast in South Africa. The latest version of SAfm programmes was laid-back. They also allowed the use of black presenters, and different accents and pronunciations.

6.3. Phase 2: The Quantitative Stage

A probability sample in the form of a simple random sample was drawn from the population of potential listeners to SAfm. A simple random sample is one in which all population members have the same probability of being selected, and the selection of each member is independent of the selection of all the other members (Hinkle et al, 1998).

In order to obtain as large a representative sample as possible, and to curtail the cost of distributing the questionnaire to certain parts of the country, the involvement of schools and institutions of higher learning was critical. School principals were approached to request the assistance of students in this project. In the case of universities, a letter asking for permission to involve students as participants in the research project was sent to the

dean of students.

As part of the effort by this researcher to involve participants from other parts of the country, beyond the Gauteng province, a letter asking for permission to request the participation of secondary schools' students to help in the research project was sent to the Superintendent General of Education in the Western Cape and KwaZulu-Natal provinces.

The KwaZulu-Natal Department of Education granted the researcher permission to make use of schools, and a predominantly Indian school was approached. The main reason for choosing this school was that it enabled the investigator to gain access to respondents in the Indian community. Permission to use schools in the Western Cape province was refused on the grounds that learners could not be used as conduits to their parents.

The schools that allowed participation by their students were as follows:

Pretoria area – a high school and a lower primary school that were both predominantly white
Johannesburg area – a predominantly black higher primary school in Melville and a mixed higher primary school at Ridgeway
Durban area – a predominantly Indian school at Reservoir Hills.

The guidelines for distribution of the questionnaires and the covering letter to learners in these schools were discussed either face-to-face or telephonically with the principals of the schools concerned. In the case of high schools, the questionnaires were distributed randomly – by the teacher assigned to this project by the school principal – to learners in at least four or five classes on different grade levels. A similar procedure was followed in higher primary schools, except that only those pupils in higher grades were given the questionnaire to take home. The completed questionnaires were returned to the principal's office in the school concerned. This researcher was able to collect the completed questionnaires from all the schools in Johannesburg and Pretoria. Special arrangements had to be made to transport the completed questionnaires from Durban to Johannesburg where the researcher was based.

The Student Representative Council that gave the researcher a verbal go-ahead for the project made the participation of students at Technikon Witwatersrand much easier. Two female research assistants were employed to help with a random distribution of the questionnaires among students who were resident at the technikon.

A simple random distribution of the questionnaires among student residents was done. A list of their names and room numbers was compiled to facilitate a collection of the questionnaires later. The respondents were given a maximum of three days to complete and return questionnaires. A high response rate was expected, given that the students had more than enough time at their disposal and were happy to fill in the questionnaire because it kept them busy.

The involvement of students enrolled at the University of Pretoria was made much easier by two professors in the Faculty of Arts who offered to help distribute the questionnaires. The questionnaires were handed out randomly to students for completion over the weekend. The completed questionnaires were collected from the students the following week when they attended their next lecture sessions. A little more than half the number of the questionnaires were returned. The less than overwhelming response to the request for completion of the questionnaires from these groups of students could be attributed to the fact that many of them were preparing for, or writing, their second-term exams at the time.

The questionnaires that had not been completed were distributed randomly among students at the cafeteria on the main campus of the University of Pretoria. Most of the respondents were in a relaxed mood, sitting round a table with a friend or group of friends, when they were approached by the investigator and asked to complete the questionnaire. Many of them agreed and were happy to do so on the spot.

Out of the total number of 1 000 questionnaires that were distributed to the respondents for completion, 746 were collected. This is equivalent to 74.6% questionnaire realisation. Non-response was limited to 25.4%. The figures of the respondents who participated was as follows: professionals, 391 (52.4%); students, 293 (39.3%); retired, 3 (0.4%); and 'other', 59 (7.9%).

The total number of respondents with a post-matric qualification was 231 (31%) and those with degrees 169 (22.7%).

6.4 The Questionnaire Design

The questionnaire design can be described as 'questionnaires within a questionnaire', because it comprises four different types of scale. The four scales are:

1. Broadcast component
2. Audience component
3. Embracing of other radio stations
4. Influence of English and European culture

6.4.1 Broadcast Component

The broadcast component scale is basically an attitudinal scale which is designed to measure attitudes to the various aspects of radio programming. The scale employs a Likert-type format and has a total of 44 items. Response options for each item range from strongly disagree (1) to strongly agree (5).

The items were specifically constructed to tap (a) attitudes to the general aspects of radio programming that are relevant to SAfm, especially those that appeal simultaneously to both blacks and whites, such as language, accents, music, and topics; (b) those that are critical to the success of any radio broadcast (e.g. an announcer with a good voice or sense of humour); (c) those that deal with the public duty of any radio station to society. The split-half reliability test was done on all 44 items of the scale. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.8039 and 0.8050, respectively. Cronbach's alpha and standardized item alpha were at 0.9176 and 0.9242, respectively. Inter-item total score correlation ranged from 0.0015 to 0.7725. The complete results of the reliability coefficients are presented in the table below.

Table 6.1 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 44	
Statistics	**Reliability coefficient**
Correlation between forms	0.6736
Guttman split-half	0.8039
Equal-length Spearman-Brown	0.8050
Unequal-length Spearman-Brown	0.8050
Alpha for part 1	0.8576
Alpha for part 2	0.8771
Number of items for part 1 = 22	
Number of items for part 2 = 22	
Cronbach alpha reliability coefficient Total number of items = 44	
Statistics	**Reliability coefficient**
Alpha	0.9176
Standardized item alpha	0.9242

The high reliability scores of this scale may be interpreted as some measure of validity, meaning that the scale measures the same construct. This researcher is also of the opinion that it is possible to ascertain the predictive validity of the scale in the light of the research data that is available on various audience studies that the author has conducted for the SABC public broadcasting radio services.

A rotated (varimax) factor analysis that was done on the scale has yielded the following 11 factors:

Table 6.2 Rotated factors and their eigenvalues for section 11 of the questionnaire

Factor	Eigenvalue	% Variance	Cummulative %
1	11.03	23.97	23.97
2	2.89	5.62	29.59
3	2.47	4.71	34.30
4	1.81	3.11	37.41
5	1.60	2.62	40.03
6	1.41	2.22	42.25
7	1.39	2.08	44.33
8	1.23	1.62	45.95
9	1.18	1.49	47.44
10	1.06	1.32	48.76
11	1.03	1.02	49.78

6.4.1.1 Factor I: Quality of Broadcasting Atmosphere

A total number of 14 items comprised this factor that was performed on a sample of 653 respondents. This factor contains items that seem to measure the kind of atmosphere that a radio announcer creates for his or her listeners. The atmosphere that the announcer creates is crucial in setting the mood for the programme in a way that could result in the listener developing positive or negative feelings towards the programme or the announcer concerned. The factor loadings are presented in Table 6.3.

Table 6.3 Factor loadings for factor I

Loading	Subscale
.78	A good announcer captures the imagination of listeners
.74	I like an announcer who can make me laugh
.71	A good sense humour is a mark of a good presenter
.69	I admire a creative radio announcer
.63	I love an announcer who is witty
.55	Giving a good but brief background on music, artists, celebrities and so on makes radio enjoyable
.47	Radio programmes that are interesting are important
.44	A good announcer must be himself or herself
.43	A good announcer comes across naturally on air
.39	A multicultural English radio station requires presenters who speak good English

Table 6.3 (Cont.) Factor loadings for factor I

Loading	Subscale
.39	An announcer with a well-modulated voice is good for radio
.36	An announcer who talks as if reading is annoying
.35	Music with universal appeal should feature prominently on a multicultural English radio station
.31	I don't like to hear too much of the same type of music, discussion or topic on radio

The reliability coefficients, alpha and standardized item alpha for the 14 items, were 0.8713 and 0.8759, respectively. Guttman split-half and equal length Spearman-Brown reliability coefficients were 0.8631 and 0.8632, respectively. Inter-item total score correlation for this factor ranged from 0.1527 to 0.6768. These and other reliability measures are contained in Table 6.4.

Table 6.4 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 14	
Statistics	**Reliability coefficient**
Correlation between forms	0.7593
Guttman split-half	0.8631
Equal-length Spearman-Brown	0.8632
Unequal-length Spearman-Brown	0.8632
Alpha for part 1	0.7857
Alpha for part 2	0.7634
Number of items for part 1 = 7	
Number of items for part 2 = 7	
Cronbach alpha reliability coefficient Total number of items = 14	
Statistics	**Reliability coefficient**
Alpha	0.8713
Standardized item alpha	0.8759

This factor accounted for 24 % of the variance.

6.4.1.2 Factor II: Emotional Reaction to an Announcer

This 6-item factor that was performed on a sample of 708 respondents has to do with the ability of a radio announcer to deal with listeners. The manner in which the announcer treats his or her listeners can evoke either a positive or negative feelings from them towards the programme or the presenter concerned. The factor loadings are presented in Table 6.5.

Table 6.5 Factor loadings for factor II

Loading	Subscale
0.69	I admire an announcer who is sensitive to listeners
0.69	I admire an announcer who is patient with listeners
0.65	I admire an announcer who is polite to listeners
0.41	It is pleasant to listen to an announcer with a good voice
0.40	It is difficult to tolerate a rude announcer
0.35	I always want to feel that a radio announcer is talking to me

The split-half and Cronbach alpha reliability tests yielded the following reliability scores: Guttman split-half, 0.7849; equal-length Spearman-Brown, 0.7875; and alpha and standardized item alpha 0.7642 and 0.7767, respectively. Inter-item total score correlation for this factor ranged from 0.2063 to 0.6113. The complete reliability coefficients for this factor are presented in table below.

Table 6.6 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 6	
Statistics	**Reliability coefficient**
Correlation between forms	0.6494
Guttman split-half	0.7849
Equal-length Spearman-Brown	0.7875
Unequal-length Spearman-Brown	0.7875
Alpha for part 1	0.6689
Alpha for part 2	0.5500
Number of items for part 1 = 3	
Number of items for part 2 = 3	

Table 6.6 (Cont.) Split-half reliability and Cronbach alpha reliability coefficients

Cronbach alpha reliability coefficient Total number of items = 6	
Statistics	**Reliability coefficient**
Alpha	0.7642
Standardized item alpha	0.7767

This factor accounted for 5.6% of the variance.

6.4.1.3 Factor III: Duty of the Public Broadcaster

This 3-item factor that was performed on a sample of 727 respondents refers to the duty or responsibility radio can undertake towards society at large. The factor loadings are presented in Table 6.7

Table 6.7 Factor loadings for factor III

Loading	Subscale
0.82	It is a radio station's duty to mould listeners to be responsible citizens
0.75	It is a radio station's responsibility to promote good societal values
0.72	It is a radio station's duty to teach listeners to behave in a way that is socially acceptable

The reliability coefficients, alpha and standardized item alpha, were 0.8477 and 0.8477, respectively. The reliability measures for Gutman split-half and unequal length Spearman-Brown were 0.7058 and 0.8223, respectively. Inter-item total score correlation for this factor ranged from 0.5897 to 0.7007. The complete results of the reliability coefficients are contained in Table 6.8.

Table 6.8 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 3	
Statistics	**Reliability coefficient**
Correlation between forms	0.6768
Guttman split-half	0.7058
Equal-length Spearman-Brown	0.8073
Unequal-length Spearman-Brown	0.8223
Alpha for part 1	0.8239
Number of items for part 1 = 2	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 3	
Statistics	**Reliability coefficient**
Alpha	0.8477
Standardized item alpha	0.8477

This factor accounted for 4.7% of the variance.

6.4.1.4 Factor IV: Over–and/or Underselling by Announcers

This 5-item factor was performed on a sample of 712 respondents. The items that are contained in this factor seem to refer to presenters who overdo or undersell themselves on air. It could also refer to broadcast material or content that borders on the extreme. The factor loadings are presented in the next table.

Table 6.9 Factor loadings for factor IV

Loading	Subscale
0.60	I cannot stand an announcer who sensationalizes issues on radio
0.56	Too much open sex talk puts me off
0.43	I cannot waste time listening to an announcer who does not know what he or she is talking about
0.35	Good announcers do not talk a lot about themselves on air
0.31	Broadcasting violence makes radio listening an unpleasant experience

The reliability measures alpha and standardized item alpha, were 0.6432 and 0.6475, respectively. Guttman split-half and unequal-length Spearman-Brown reliability

coefficients were 0.5217 and 0.5362, respectively. Inter-item total score correlation for this factor ranged from 0.0943 to 0.4327. Additional reliability measures are provided in the table below.

Table 6.10 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 5	
Statistics	**Reliability coefficient**
Correlation between forms	0.3599
Guttman split-half	0.5217
Equal-length Spearman-Brown	0.5293
Unequal-length Spearman-Brown	0.5362
Alpha for part 1	0.6264
Alpha for part 2	0.4657
Number of items for part 1 = 3	
Number of items for part 2 = 2	
Cronbach alpha reliability coefficient Total number of items = 5	
Statistics	**Reliability coefficient**
Alpha	0.6432
Standardized item alpha	0.6475

This factor accounted for 3% of the variance.

6.4.1.5 Factor V: Programme Relevance to Needs and Tastes of Listeners

A total of two items comprises this factor that was performed on a sample of 727 respondents. The wording of the two statements is the same, except for the phrase 'too white' or 'too black' that distinguishes one item from the other. This factor indicates one-sidedness or exclusivity in radio broadcasts that tend to cater for the needs and tastes of one group of listeners at the expense of the other. This factor accounted for 2.6% of the variance. The factor loadings are contained in Table 6.11.

Table 6.11 Factor loadings for factor V

Loading	Subscale
0.87	An announcer who is perceived to be too white will have difficulty attracting both black and white listeners
0.84	An announcer who is perceived to be too black will have difficulty attracting both black and white listeners

The reliability coefficients, alpha and standardized item alpha for the 2 items, were 0.8624 and 0.8625, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.8624 and 0.8625, respectively. Inter-item total score correlation for this factor was 0.7582. The complete reliability measures for this factor are presented in Table 6.12.

Table 6.12 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.7582
Guttman split-half	0.8624
Equal-length Spearman-Brown	0.8625
Unequal-length Spearman-Brown	0.8625
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.8624
Standardized item alpha	0.8625

6.4.1.6 Factor VI: Impartiality of Announcers

This 4-item factor was performed on a sample of 714 respondents. The factor appears to measure impartiality by announcers. Most of the items are characterised by a phrase that emphasises radio broadcasts or programmes that cater for the needs and tastes of both white and black listeners in a way that does not show one group of listeners to be favoured over the other. This factor accounted for 2.2% of the variance. The factor loadings are presented in Table 6.13.

Table 6.13 Factor loadings for factor VI

Loading	Subscale
0.59	A multicultural English station should broadcast issues that blacks and whites can relate to
0.56	Issues of national importance will arouse interest in black and white listeners
0.42	A multicultural English station should strive to broadcast programmes that black and white listeners can relate to
0.27	A good announcer should be impartial in his or her radio broadcasts

The reliability coefficients, alpha and standardized item alpha, were 0.6662 and 0.6794, respectively. Guttman split-half and equal-length Spearman-Brown reliability measures were 0.5780 and 0.5781, respectively. Inter-item total score correlation for this factor ranged from 0.1417 to 0.5229. The complete reliability measures are presented in the table below.

Table 6.14 Split-half reliability and Cronbach alpha reliability coefficients

Split-halfreliability coefficient Total number of items = 4	
Statistics	**Reliability coefficient**
Correlation between forms	0.4066
Guttman split-half	0.5780
Equal-length Spearman-Brown	0.5781
Unequal-length Spearman-Brown	0.5781
Alpha for part 1	0.6831
Alpha for part 2	0.4980
Number of items for part 1 = 2	
Number of items for part 2 = 2	
Cronbach alpha reliability coefficient Total number of items = 4	
Statistics	**Reliability coefficient**
Alpha	0.6662
Standardized item alpha	0.6794

6.4.1.7 Factor VII: Reaction to Known and Foreign Cultural Components

The two items that comprise this factor were performed on a sample of 729 respondents. The items that are contained in this factor appear to measure 'foreign' accents or pronunciation that could undermine the English spoken by White English-speakers. This factor accounted for 2.1% of the variance. The factor loadings are contained in Table 6.15.

Table 6.15 Factor loadings for factor VII

Loading	Subscale
0.77	I wouldn't mind an announcer who speaks with an accent, as long as the pronunciation of words in English is good
0.65	I wouldn't mind an announcer who speaks with an accent, as long as the English is good

The reliability coefficients, alpha and standardized item alpha for the two items, were 0.7339 and 0.7339, respectively. Guttman split-half and equal-length Spearman-Brown reliability measures were 0.7339 and 0.7339, respectively. Inter-item total score correlation for this factor was 0.7339. The following table contains complete reliability measures for this factor.

Table 6.16 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.5797
Guttman split-half	0.7339
Equal-length Spearman-Brown	0.7339
Unequal-length Spearman-Brown	0.7339
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.7339
Standardized item alpha	0.7339

6.4.1.8 Factor VIII: Getting Facts about Events that are Taking Place

This 2-item factor was performed on the sample of 731 respondents. Both items refer to 'on the spot or factual' news reporting, hence the name given to the factor. The factor loadings are contained in Table 6.17.

Table 6.17 Factor loadings for factor VIII

Loading	Subscale
0.68	I like reporting of events that have taken place, or are taking place, on the scene during news bulletins
0.64	It is important to me to get facts about events that have taken place, during news bulletins

The reliability coefficients, alpha and standardized item alpha for the two items, were 0.6945 and 0.6953, respectively. Guttman split-half and equal-length Spearman-Brown reliability measures were 0.6945 and 0.6953, respectively. Inter-item total score correlation for this factor was 0.5329. The complete results of the reliability coefficients are presented in Table 6.18.

Table 6.18 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.5329
Guttman split-half	0.6945
Equal-length Spearman-Brown	0.6953
Unequal-length Spearman-Brown	0.6953
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.6945
Standardized item alpha	0.6953

This factor accounted for 1.6% of the variance.

6.4.1.9 Factor IX: Knowledge and Professionalism of the Announcer

This 2-item factor was performed on the sample of 721 respondents. This factor appears to measure both the knowledge and professionalism of radio announcers. The factor loadings are contained in Table 6.19.

Table 6.19 Factor loadings for factor IX

Loading	Subscale
0.58	Professionalism as evidenced by good interviewing skills on the part of the radio announcer is important in any radio broadcast
0.49	A good radio announcer must be able to say something constructive to listeners

The reliability coefficients, alpha and standardized item alpha for the two items, were 0.7247 and 0.7253, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.7247 and 0.7253, respectively. Inter-item total score correlation for this factor was at 0.5689. The complete reliability measures of the two scale statistics are presented in the next table.

Table 6.20 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.5689
Guttman split-half	0.7247
Equal-length Spearman-Brown	0.7253
Unequal-length Spearman-Brown	0.7253
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.7247
Standardized item alpha	0.7253

This factor accounted for 1.5% of the variance.

6.4.1.10 Factor X: Reaction to Known and Foreign Aspects of Music

This 2-item factor was performed on the sample of 723 respondents. The two items appear to measure the reaction that black and white listeners would have to music that is traditionally European or African and broadcast on an English radio station that caters for a multicultural audience. The factor loadings are provided in Table 6.21.

Table 6.21 Factor loadings for factor X

Loading	Subscale
0.70	Music that is traditionally African would alienate any white or black person who listens to an English radio station that caters for black and white listeners
0.62	Music that is traditionally European would alienate any white or black person who listens to an English radio station that caters for black and white listeners

The reliability coefficients, alpha and standardized item alpha for the 2 items, were 0.6650 and 0.6654, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.6650 and 0.6654, respectively. Inter-item total score correlation for this factor was 0.4986. The complete reliability measures for this factor are contained in Table 6.22.

Table 6.22 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.4986
Guttman split-half	0.6650
Equal-length Spearman-Brown	0.6654
Unequal-length Spearman-Brown	0.6654
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.6650
Standardized item alpha	0.6654

This factor accounted for 1.3% of the variance.

6.4.1.11 Factor XI: Teaching or Educating the Audience

This 2-item factor was performed on the sample of 715 respondents. The items contained in the factor make reference to the formal education aspects of radio broadcasts, hence the name given to the factor. The factor loadings are presented in Table 6.23

Table 6.23 Factor loadings for factor XI

Loading	Subscale
0.52	I find it annoying to intellectualize about issues on radio
0.48	I hate to feel that I am in a lecture or classroom when listening to the radio

The reliability coefficients, alpha and standardized item alpha, were 0.4818 and 0.4821, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.4818 and 0.4821, respectively. Inter-item total score correlation for this factor was 0.3176. The complete results of the reliability coefficients are presented in Table 6.24.

Table 6.24 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.3176
Guttman split-half	0.4818
Equal-length Spearman-Brown	0.4821
Unequal-length Spearman-Brown	0.4821
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.4818
Standardized item alpha	0.4821

This factor accounted for 1% of the variance.

6.4.2 Audience Component

This scale was adapted from Rupert Brown et al's (1986) Group Identification Scale. This scale, which consists of ten items, measures the reaction of respondents to an English radio station. The applicability of the statements was rated on a 5-point scale, ranging from never (1) to always (5).

The split-half and Cronbach alpha reliability test was done on all ten items of the scale with a sample of 678 respondents. The alpha and standardized item alpha reliability coefficients were 0.9213 and 0.9216, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.8456 and 0.8465, respectively. Inter-item total score correlation ranged from 0.3584 to 0.7580. The high reliability scores of this scale suggest that the scale is valid, meaning that the scale is measuring the same construct. The complete results of the reliability coefficients are reported in Table 6.25.

Table 6.25 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 10	
Statistics	**Reliability coefficient**
Correlation between forms	0.7338
Guttman split-half	0.8456
Equal-length Spearman-Brown	0.8465
Unequal-length Spearman-Brown	0.8465
Alpha for part 1	0.8506
Alpha for part 2	0.9060
Number of items for part 1 = 5	
Number of items for part 2 = 5	
Cronbach alpha reliability coefficient Total number of items = 10	
Statistics	**Reliability coefficient**
Alpha	0.9213
Standardized item alpha	0.9216

A rotated (varimax) factor analysis that was conducted on the scale has yielded the following two factors:

Table 6.26 Rotated factors and their eigenvalues for section 12 of the questionnaire

Factor	Eigenvalue	% Variance	Cummulative %
1	5.89	55.15	55.15
2	1.00	6.31	61.46

6.4.2.1 Factor I: Emotional and Mental Experience of an English Radio Station that Serves a Multicultural Audience

This 6-item factor was performed on a sample of 708 respondents. The items that comprise this factor appear to assess the positive emotional and mental disposition to a multicultural English radio station. The use of words and phrases such as 'feel', 'strong tie', 'happy', 'regard' and 'feel a sense of great pleasure' suggests mental or emotional readiness or disposition that is expressed in the statements. The factor loadings are presented in Table 6.27.

Table 6.27 Factor loadings for factor I

Loading	Subscale
0.78	I will always feel that it is important to have an English radio station that serves black and white listeners
0.77	I will always regard a multicultural English radio station as a sign of progress in our country
0.73	I will always have strong ties with an English radio station that serves black and white listeners
0.72	I will always feel a sense of great pleasure to be one of the listeners of an English radio station that serves black and white listeners
0.71	I would be happy to see a multicultural English radio station succeed in this country
0.59	I will always have the highest regard for an English radio station that caters for the needs and tastes of a black and white audience

The reliability coefficients, alpha and standardized item alpha for the six items, were 0.9126 and 0.9127, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.8904 and 0.8922, respectively. Inter-item total score correlation for this factor ranged from 0.5269 to 0.7684. The complete results of the reliability coefficients are contained in Table 6.28.

Table 6.28 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 6	
Statistics	**Reliability coefficient**
Correlation between forms	0.8054
Guttman split-half	0.8904
Equal-length Spearman-Brown	0.8922
Unequal-length Spearman-Brown	0.8922
Alpha for part 1	0.8345
Alpha for part 2	0.8674
Number of items for part 1 = 3	
Number of items for part 2 = 3	
Cronbach alpha reliability coefficient Total number of items = 3	
Statistics	**Reliability coefficient**
Alpha	0.9126
Standardized item alpha	0.9127

This factor accounted for 55.2% of the variance.

6.4.2.2 Factor II: Identification with an English Radio Station

This factor contains four items that seem to measure the extent to which a person identifies with a multicultural English radio station in South Africa. The phrases 'to be part of', 'readily feel at home' and 'do not need to make excuses for being a loyal listener' indicate a certain level of affinity towards or identification with a multicultural English radio station. The sample on which this factor was performed comprised 698 respondents. The factor loadings are presented in Table 6.29.

Table 6.29 Factor loadings for factor II

Loading	Subscale
0.76	I would feel happy to be part of an English radio station that serves a multicultural audience
0.76	I would readily feel at home when listening to an English radio station that serves a multicultural audience
0.56	I would be glad to be part of the loyal listenership of an English radio station that unifies all South Africans through its programmes
0.53	I do not need to make excuses to anyone for being a loyal listener to an English radio station that caters for black and white listeners

The reliability coefficients, alpha and standardized item alpha, were 0.8212 and 0.8219, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.7892 and 0.7900, respectively. Inter-item total score correlation for this factor ranged from 0.4647 to 0.6681. These and other reliability measures are presented in Table 6.30.

Table 6.30 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 4	
Statistics	**Reliability coefficient**
Correlation between forms	0.6528
Guttman split-half	0.7892
Equal-length Spearman-Brown	0.7900
Unequal-length Spearman-Brown	0.7900
Alpha for part 1	0.8010
Alpha for part 2	0.6527
Number of items for part 1 = 2	
Number of items for part 2 = 2	
Cronbach alpha reliability coefficient Total number of items = 3	
Statistics	**Reliability coefficient**
Alpha	0.8212
Standardized item alpha	0.8219

This factor accounted for 6.3% of the variance.

6.4.3 Possibility of Embracing Other Radio Stations

This scale attempts to measure the extent to which respondents are willing to embrace or listen to other radio stations, especially a radio station that is designed to serve a multicultural audience. The scale consists of 11 items in a five-category Likert-type format. Response options for each item range from strongly disagree (1) to strongly agree (5). The alpha and standardized item alpha reliability coefficients of the 11 items of the scale that were performed on the sample of 662 respondents were 0.5673 and 0.5762, respectively. Guttman split-half and unequal-length Spearman-Brown reliability coefficients were 0.3844 and 0.3868, respectively. Inter-item total score correlations ranged from -0.3434 to 0.7368. The complete results of the reliability coefficients are contained in Table 6.31.

Table 6.31 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 11	
Statistics	**Reliability coefficient**
Correlation between forms	0.2388
Guttman split-half	0.3844
Equal-length Spearman-Brown	0.3856
Unequal-length Spearman-Brown	0.3868
Alpha for part 1	0.4187
Alpha for part 2	0.5773
Number of items for part 1 = 6	
Number of items for part 2 = 5	
Cronbach alpha reliability coefficient Total number of items = 11	
Statistics	**Reliability coefficient**
Alpha	0.5673
Standardized item alpha	0.5762

Though these reliability scores are not high enough to validate the scale (meaning that the scale does not measure the same construct), the investigator is of the opinion that the results of this investigation will yield results to support the concurrent or predictive validity of the scale.

A rotated (varimax) factor analysis was performed on the scale that resulted in the following two factors:

Table 6.32 Rotated factors and their eigenvalues for section 13 of the questionnaire

Factor	Eigenvalue	% Variance	Cummulative %
1	3.59	28.74	28.74
2	2.10	14.04	42.78

6.4.3.1 Factor I: Unification of Population Groups

This 6-item factor that was performed on a sample of 680 respondents appears to emphasise the role of a multicultural radio station as a unifying force among South Africans. The predominant theme expressed in most of the statements relates to a radio station that could help bring the different population groups closer to each other. The factor loadings are provided in Table 6.33.

Table 6.33 Factor loadings for factor I

Loading	Subscale
0.81	There is a great need for a radio station that could unite all South Africans
0.80	There is a definite need for a multicultural radio station that would help nurture or develop a unique South African culture
0.76	A radio station that serves a multicultural audience would definitely promote understanding between blacks and whites
0.60	A radio station that serves a multicultural audience would definitely help to promote tolerance between the population groups in South Africa
0.32	I can listen to any other radio station as long as I understand the language that is used in the broadcast
0.31	South Africa can best be served by radio stations that serve the individual population groups

The reliability coefficients, alpha and standardized item alpha for the six items, were calculated at 0.7445 and 0.7553, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.7702 and 0.7702, respectively. Inter-item total score correlation ranged from 0.0979 to 0.6733. The complete reliability measures can be found in Table 6.34.

Table 6.34 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 6	
Statistics	**Reliability coefficient**
Correlation between forms	0.6263
Guttman split-half	0.7702
Equal-length Spearman-Brown	0.7702
Unequal-length Spearman-Brown	0.7702
Alpha for part 1	0.5456
Alpha for part 2	0.6027
Number of items for part 1 = 3	
Number of items for part 2 = 3	
Cronbach alpha reliability coefficient Total number of items = 6	
Statistics	**Reliability coefficient**
Alpha	0.7445
Standardized item alpha	0.7553

This factor accounted for 23.7% of the variance.

6.4.3.2 Factor II: Viability and/or Sustainability of a Multicultural Radio Station

This 5-item factor that was performed on a sample of 691 respondents seems to tap the likelihood of whether a multicultural radio station is viable or sustainable in South Africa. The factor loadings are contained in Table 6.35.

Table 6.35 Factor loadings for factor II

Loading	Subscale
0.80	A radio station that is designed to broadcast to a multicultural audience would definitely not succeed in South Africa
0.78	A radio station that is designed to broadcast to a multicultural audience would definitely not be suitable for South Africa
0.57	A radio station that serves a multicultural audience would definitely be a threat to the different cultures in South Africa
0.54	I might have great difficulty listening to a radio announcer who did not come from the same population group as mine
0.29	There is nothing that would change my loyalty to my favourite radio station

The reliability coefficients, alpha and standardized item alpha, were 0.7247 and 0.7264,

respectively. The reliability measures for Guttman split-half and unequal-length Spearman-Brown were 0.5418 and 0.5925, respectively. Inter-item total score correlation ranged from 0.1211 to 0.7364. These and other reliability measures are presented in Table 6.36.

Table 6.36 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 5	
Statistics	**Reliability coefficient**
Correlation between forms	0.4139
Guttman split-half	0.5418
Equal-length Spearman-Brown	0.5855
Unequal-length Spearman-Brown	0.5925
Alpha for part 1	0.7804
Alpha for part 2	0.3492
Number of items for part 1 = 3	
Number of items for part 2 = 2	
Cronbach alpha reliability coefficient Total number of items = 5	
Statistics	**Reliability coefficient**
Alpha	0.7247
Standardized item alpha	0.7264

This factor accounted for 19% of the variance.

6.4.4 Influence of English and European Culture Scale

This scale was designed to measure the extent to which respondents are influenced by English and European culture. The development of this 19-item scale was largely influenced by Tajfel's (1981) social identity theory. The scale employs a Likert-type format. Response options for each item range from strongly disagree (1) to strongly agree (5). The reliability measures for alpha and standardized item alpha were 0.9125 and 0.9139 respectively. Guttman split-half and unequal-length Spearman-Brown reliability coefficients were 0.8714 and 0.8722, respectively. The high reliability scores of this scale may be interpreted as some measure of validity, meaning that the scale is measuring the same construct. Inter-item total score correlation ranged from –0.0371 to 0.7000. The

complete reliability measures of the scale are contained in Table 6.37.

Table 6.37 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 19	
Statistics	**Reliability coefficient**
Correlation between forms	0.7729
Guttman split-half	0.8714
Equal-length Spearman-Brown	0.8719
Unequal-length Spearman-Brown	0.8722
Alpha for part 1	0.8331
Alpha for part 2	0.8672
Number of items for part 1 = 10	
Number of items for part 2 = 9	
Cronbach alpha reliability coefficient Total number of items = 19	
Statistics	**Reliability coefficient**
Alpha	0.9125
Standardized item alpha	0.9139

The rotated factor analysis (varimax) that was performed on the scale resulted in the following four factors:

Table 6.38 Rotated factors and their eigenvalues for section 14 of the questionnaire

Factor	Eigenvalue	% Variance	Cummulative %
1	7.57	37.39	37.39
2	2.29	9.87	47.26
3	1.12	3.71	50.97
4	1.00	3.10	54.07

6.4.4.1 Factor I: Quality of English Language Usage

This 7-item factor was performed on a sample of 678 respondents. Most of the items comprising this factor seem to suggest a strong need or concern for good quality use of English, hence the need to listen to an English radio station. The factor loadings are provided in the table below.

Table 6.39 Factor loadings for factor I

Loading	Subscale
0.69	The high status I enjoy in South Africa strengthens my need to listen to an English radio station continually
0.67	I always find listening to an English radio station a 'cool' thing to do
0.63	Listening to an English radio station will help me speak English like an English citizen
0.62	The high status of English internationally makes me feel good about listening to a good English radio station
0.60	The pride I take in speaking good English makes me to listen to an English radio station to maintain the high standard of English
0.51	I listen to an English radio station like most educated people in South Africa
0.47	I find it appropriate to listen to an English radio station because my home language is English

The reliability coefficients, alpha and standardized item alpha, were 0.8697 and 0.8705, respectively. The reliability measures for Guttman split-half and unequal-length Spearman-Brown reliability were 0.8627 and 0.8828, respectively. Inter-item total score correlation ranged from 0.3380 to 0.6187. This factor accounted for 37.4% of the variance. The complete information on reliability measures can be found in Table 6.40.

Table 6.40 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 7	
Statistics	**Reliability coefficient**
Correlation between forms	0.7872
Guttman split-half	0.8627
Equal-length Spearman-Brown	0.8809
Unequal-length Spearman-Brown	0.8828
Alpha for part 1	0.7883
Alpha for part 2	0.7279
Number of items for part 1 = 4	
Number of items for part 2 = 3	
Cronbach alpha reliability coefficient Total number of items = 7	
Statistics	**Reliability coefficient**
Alpha	0.8697
Standardized item alpha	0.8705

6.4.4.2 Factor II: Identification with English Culture

This 8-item factor was performed on a sample of 685 respondents. Most of the statements making up this factor suggest that listening to an English radio station is associated with being English. People readily identify with, or feel a sense of belonging to, an English radio station, especially on a cultural level. The factor loadings are presented in the table below.

Table 6.41 Factor loadings for factor II

Loading	Subscale
0.73	I listen to an English radio station because I identify with it
0.66	I readily feel a sense of belonging when I listen to an English radio station
0.57	English enjoys a high status internationally, so it makes sense for me to listen to a good English radio station
0.55	I will continue to listen to an English radio station as long as it caters for the needs and tastes of English-speaking South Africans
0.55	As an English-speaking person, I find that listening to an English radio station fits my lifestyle
0.53	I listen to an English radio station regardless of where I am in South Africa
0.52	I listen to an English radio station because I consider myself English
0.49	I feel comfortable listening to an English radio station because I will always be in the company of people who speak English

The reliability coefficients, alpha and standardized item alpha, were 0.8514 and 0.8533, respectively. The reliability measures for Guttman split-half and equal-length Spearman-Brown were 0.8372 and 0.8375, respectively. Inter-item total score correlation ranged from 0.3002 to 0.6049. This factor accounted for 9.9% of the variance. Additional information on other reliability measures is contained in the table below.

Table 6.42 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 8	
Statistics	**Reliability coefficient**
Correlation between forms	0.7205
Guttman split-half	0.8372
Equal-length Spearman-Brown	0.8375
Unequal-length Spearman-Brown	0.8375
Alpha for part 1	0.7774
Alpha for part 2	0.7217
Number of items for part 1 = 4	
Number of items for part 2 = 4	
Cronbach alpha reliability coefficient Total number of items = 8	
Statistics	**Reliability coefficient**
Alpha	0.8514
Standardized item alpha	0.8533

6.4.4.3 Factor III: Improving One's Use of English

This 2-item factor was performed on a sample of 719 respondents. The items that comprise this factor appear to suggest that listening to an English radio station is important for improving one's use of English. This factor accounted for 3.7% of the variance. The factor loadings are presented in the next table.

Table 6.43 Factor loadings for factor III

Loading	Subscale
0.76	I listen to an English station to improve my English language
0.76	I listen to an English radio station because it helps refine my English language

The reliability measures, alpha and standardized item alpha, were 0.8178 and 0.8188, respectively. Guttman split-half and equal-length Spearman-Brown reliability coefficients were 0.8178 and 0.8188, respectively. Inter-item total score correlation was 0.6932. Further information on other reliability measures can be found in Table 6.44.

Table 6.44 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.6932
Guttman split-half	0.8178
Equal-length Spearman-Brown	0.8188
Unequal-length Spearman-Brown	0.8188
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.8178
Standardized item alpha	0.8188

6.4.4.4 Factor IV: Use of European Presenters

This 2-item factor was performed on a sample of 717 respondents. The statements that are contained in this factor suggest that the use of white presenters is the main reason for listening to an English radio station. The factor loadings are presented in the following table below.

Table 6.45 Factor loadings for factor IV

Loading	Subscale
0.75	I listen to an English radio station because the programmes are typically European
0.62	I listen to an English radio station because I identify with the white radio presenters

The reliability coefficients, alpha and standardized item alpha for the two items, were 0.7464 and 0.7465, respectively. The reliability measures for Guttman split-half and equal-length Spearman-Brown were 0.7464 and 0.7465, respectively. Inter-item total score correlation was 0.5955. The complete results of the reliability coefficients are reported in Table 6.46.

Table 6.46 Split-half reliability and Cronbach alpha reliability coefficients

Split-half reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Correlation between forms	0.5955
Guttman split-half	0.7464
Equal-length Spearman-Brown	0.7465
Unequal-length Spearman-Brown	0.7465
Number of items for part 1 = 1	
Number of items for part 2 = 1	
Cronbach alpha reliability coefficient Total number of items = 2	
Statistics	**Reliability coefficient**
Alpha	0.7464
Standardized item alpha	0.7465

This factor accounted for 3.1% of the variance.

6.5 Conclusion

The high reliability measures that were obtained in at least three of the four scales are important because one can say with confidence that they are valid measures of what they were supposed to assess. In other words, the questionnaire was designed in such a way that the items of each of the three scales matched the constructs they were supposed to measure, as defined by the researcher.

The moderate to low reliability coefficients of section 13 of the questionnaire – the scale for embracing other radio stations – do not necessarily mean the scale is not valid, as there are a number of items of the scale that are highly correlated with each other. This is perhaps one of the instances where validity does not guarantee reliability, and vice versa. According to Hair, Jr. et al (1992), a measure may be accurate (valid) but not consistent (reliable). It may also be consistent but not accurate. This is why validity and reliability are two separate but interrelated conditions.

Nevertheless, it is possible to increase the reliability measures of all four scales by removing those items that have low correlation scores.

6.6 Statistical Considerations for Data Analysis

6.6.1 Introduction

This section of the chapter is dedicated to a discussion of the statistical procedures that were considered or used in the presentation of the research results. This section is particularly important because the research question required the selection of an advanced method of analysis of J x K frequency tables.

6.6.2 Search for Statistical Method

Two alternatives were considered: (i) the log-likelihood approach, and (ii) the hierarchical loglinear analysis. The log-likelihood approach is a general method for detecting critical subsections of the cross-tabulation and is based on the familiar Pearson chi-square statistics (χ^2). The loglinear likelihood statistic $-2\ell n\lambda$ is used to approximate the χ^2 value for any contingency table. This approach has the desirable property that $-2\ell n\lambda$ is additive, in the same sense that sums-of-squares in simple ANOVA are additive: the sum of the $-2\ell n\lambda$ values for the individual effects in the various submodels equals the χ^2 for the total model. In the case of the hierarchical loglinear analysis, a person is trying to predict the number of cases in a cell of a cross-tabulation that is based on the values of individual variables and on their combinations. This approach is analogous to factorial ANOVA in the sense that it allows a person to partition variance in the cell frequencies into subsets attributable to main effects and interaction effects of the variable of interest. The base and particular application, however, are very similar to standardised z scores. The natural logarithm of cell frequencies is used to simplify both computation and interpretation of parameter estimates.

6.6.3 Cross-Tabulation Analysis in General

Since the basis of both the log-likelihood ratio and the hierarchical loglinear analysis depends on the availability of contingency tables, a useful starting point is to discuss in abstract terms the contingency table and what it entails. According to Steyn et al (1994), a contingency table is a summary of a univariate or multivariate data set in the form of either a one-dimensional (one-way) or multidimensional (multi-way) frequency

distribution. In a frequency distribution that is regarded as a one-way contingency table, each observation is categorised, according to realisation or contingency, into one of a number of mutually exclusive 'classes of events'.

It also happens every so often that information is obtained on two or more characteristics of individuals or entities. The measurement of such characteristics produces multivariate data sets, which can be represented simply and meaningfully in a multi-way contingency table (Steyn et al, 1994). A well-known example of a two-way contingency table that is commonly used in statistics, and which is the basis for both the hierarchical loglinear analysis and the log-likelihood ratio, is a multidimensional cross-classification table. A cross-classification table, or simply a cross-tabulation, is known as such because the two main effects – main effect A and main effect B – are 'crossed' with each other. The cells in the cross-tabulation describe the interaction between main effects A and B and are designated as AB.

Table 6.47 Representation of J x K contingency table for both the loglinear likelihood and hierarchical loglinear approaches

		Main effect B						
		B (column factor)						
	A (row factor)	B_1	B_2	B_3	B_4	.	B_K	**Row Totals**
Main Effect A	A_1	O_{11} E_{11}	O_{12} E_{12}	O_{13} E_{13}	O_{1k} E_{1k}	.	O_{1k}	r_1
	.	.	.	.	.	.	.	.
	A_j	O_{21}	O_{22}	O_{23}	O_{24}	.	O_{2k}	r_2
	.	.	.	.	.	.	.	.
	A_J	O_{J1}	O_{J2}	O_{J3}	O_{J4}	.	O_{JK}	r_J
	Column Totals	c_1	c_2	c_3	C_4	.	c_K	N

O_{jk} = Observed frequency of row j and column k

E_{jk} = Expected frequency of row j and column k = r_j x c_k / n

A cross-classification table shows a cell for every combination of categories of the two variables. The cells are the little boxes that make up a cross-classification table, and they

are arranged in rows and columns. Inside the cell is a number showing how many people gave that combination of responses. The labels at the left and top of the table describe what is in each of the rows and columns. To the right and the bottom end of the tables are totals – often called marginal totals – because they are in the margins of the table (Norušis, 1990). A row, column, or total percentages and expected values, can also be calculated for each bivariate table or subtable. The following key words are fundamental to understanding some of these items (Norušis, 1990):

Row percentages are the number of cases in each cell in a row expressed as a percentage of all the cases in that row.

Column percentages are the number of cases in each cell in a column expressed as a percentage of all the cases in that column.

Two-way table total percentages is a number of cases in each cell of a sub-table expressed as a percentage of all the cases in that subtable.

Expected frequencies are the number of cases expected in each cell, if the two variables in the subtable were statistically independent.

There are two key concepts that are critical in any discussion that involves both the hierarchical loglinear analysis and the loglinear likelihood approach, i.e. main effects and interaction effects. Main effects refer to the effect that each main factor (predictor) has on the dependent variable. Main effects can occur irrespective of whether one is testing the effects of individual variables or their combinations. However, the two main methods differ in their approach to the handling of main and interaction effects.

6.6.4 Options Considered

6.6.4.1 Log-Likelihood Ratio

In normal circumstances the calculation of a significant χ^2 value is applicable to the cross-tabulation in its entirety. The researcher often knows very well that significance is limited to only a few cells in the cross-tabulation and not to the complete table. The log-likelihood

ratio being an approximation of χ^2, enables one to pinpoint cells to which significant differences may be linked, and to determine $-2\ell n\lambda$ values of those cells that mainly contribute to the overall χ^2 value of the table. In so doing, one is able to ascertain which cells, or subgroup of cells, play a significant part. Likewise, cells making irrelevant or insignificant contributions are also determined. Tracing of significant and insignificant cell contribution requires decomposition of the $-2\ell n\lambda$ approximation of χ^2 value. The calculation procedures will be described by using the abstract example presented in Table 6.48.

Table 6.48 The Teenager Values Amulets

	Dependent Variable					
Independent Variable	**Strongly Agree**	**Agree**	**Doubt**	**Disagree**	**Strongly Disagree**	**Marginal Row Totals**
Girls	f_{11} e_{11}	f_{12} e_{12}	f_{13} e_{13}	f_{14} e_{14}	f_{jk} e_{1k}	f_{r1}
Boys	f_{21} e_1	f_{22} e_{22}	f_{23} e_{23}	f_{24} e_{24}	f_{jk} e_{jk}	f_{r2}
Marginal Column Totals	fc_1	fc_2	fc_3	fc_4	fc_{jk}	N

The procedure is as follows:

(i) Calculate the χ^2 for the complete table according to the normal calculation procedure. The calculation of the usual χ^2 statistic uses the product of row and column marginal totals, which is then divided by N to estimate the expected frequencies.

(ii) The following formula is used to calculate χ^2:

$$\chi^2 = \sum_{j=1}^{J}\sum_{k=1}^{K}\frac{(O_{jk} - E_{jk})^2}{E_{jk}}$$

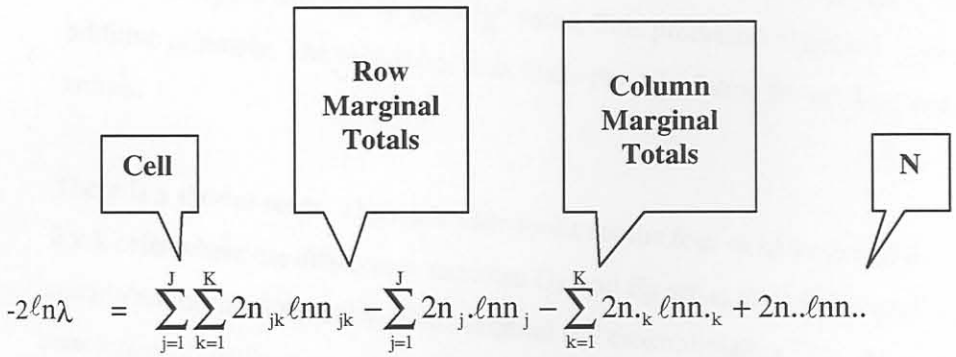
with (J - 1) (K - 1) degrees of freedom, where O_{jk} = Observed frequency and E_{jk} = Expected frequency, wherein the expected frequency is subtracted from the observed frequency, then squared and divided by the expected frequency. The resulting values are summed across all categories and groups to provide the χ^2

value.

(iii) Simulate χ^2 by means of the loglinear likelihood ratio $-2\ell n\lambda$.

(iv) The ratio of χ^2 and $-2\ell n\lambda$ approximates 1, but always falls short of it. The χ^2 value is accurately simulated by $-2\ell n\lambda$.

(v) The loglinear likelihood ratio approach $-2\ell n\lambda$ is used to convert the frequencies using the formula below:



$$-2\ell n\lambda = \sum_{j=1}^{J}\sum_{k=1}^{K} 2n_{jk}\ell nn_{jk} - \sum_{j=1}^{J} 2n_{j}.\ell nn_{j} - \sum_{k=1}^{K} 2n._{k}\ell nn._{k} + 2n..\ell nn..$$

The four terms to the right of the equals sign refers to the sum of 2 n ℓn n values for the individual cells in the table, row and column marginal totals, and for N, respectively. The obtained values are added and subtracted as shown in the formulae to provide $-2\ell n\lambda$. This value is also calculated for the complete table. The end result is a $-2\ell n\lambda$ value that will approximate the χ^2 value of the complete table.

How does the researcher go about decomposing the table? There are two approaches. The researcher makes a selection of a 2 x 2 or bigger cross-tabulation from the original table. This is demonstrated in Table 6.49

Table 6.49 First decomposition: $-2\ell n\lambda$
Categories 'Strongly Agree' compared with 'Agree'

Independent Variable	Strongly Agree	Agree	Marginal Row Totals
Girls	f_{11}	f_{12}	f_{r1}
Boys	f_{21}	f_{22}	f_{r2}
Marginal Column Totals	fc_1	fc_2	N

If the first decomposition proves statistically insignificant, the researcher may collapse the first decomposition table by joining the frequencies of the categories Strongly Agree and Agree, and by adding the frequencies for the category Doubt from the original complete cross-tabulation to form a new 2 x 2 cross-tabulation for the second attempt at decomposition. The process of testing for significance, collapsing the decomposition table to form a new table for a following decomposition may be repeated until the original cross-tabulation is exhausted. Adding up the particular $-2\ell n\lambda$ values for all the attempts at decomposing, the researcher obtains the same $-2\ell n\lambda$ value that was calculated for the original full cross-tabulation. If all the subsections of the base table are decomposed, the $-2\ell n\lambda$ values will add-up to the χ^2 value. This procedure is known as the summation or additive principle. The researcher then scans the calculation for all the significant $-2\ell n\lambda$ values.

There is a shorter route. The researcher looks for the four or more 2 x 2 or 2 x 3 or 2 x j or 2 x k cells where the differences between O_{jk} and E_{jk} are at their maximum. Next, $-2\ell n\lambda$ is calculated for this subsection of the original full crosstabulation. For any given significant subsection of the frequency table under consideration, all the remaining subsections can add up only to the difference between the original $-2\ell n\lambda$ value (approximate χ^2 value) and $-2\ell n\lambda$ for the significant subsections. In practice, further decomposition after the first attempt becomes unnecessary. Testing for significance is done against the normal χ^2 distribution with (J - 1) (K - 1) degrees of freedom. The formulae for calculating $-2\ell n\lambda$ is

partially derived as follows:

$$\ell n\, \lambda = \ell n\, n^{n} \times \left(\prod_{j=1}^{J} \prod_{k=1}^{k} \left(\frac{O_{jk}}{rj \times ck} \right) O_{jk} \right)$$

$$= \ell n\, n^{n} + \sum_{j=1}^{J} \sum_{k=1}^{K} + O_{jk}\, \ell n \left(\frac{Ojk}{rj \times ck} \right)$$

$$= n\, \ell n\, (n) + \sum_{j=1}^{J} \sum_{k=1}^{K} O_{jk}\, \ell n(O_{jk}) - \sum_{j=1}^{J} \sum_{k=1}^{K} O_{jk}\, (\ell n\, r_j \times c_k)$$

$$\ell n\, \lambda = n\, \ell n\, (n) + \sum_{j=1}^{J} \sum_{k=1}^{K} O_{jk}\, \ell n\, O_{jk} - \sum_{j=1}^{J} r_j\, \ell n\, r_j - \sum_{k=1}^{K} c_k\, \ell n\, c_k$$

And by multiplying both sides of the equation by -2

$$-2\, \ell n\, \lambda = -2 \left[n\, \ell n\, (n) + \sum_{j=1}^{J} \sum_{k=1}^{K} O_{jk}\, \ell n\, O_{jk} - \sum_{j=1}^{J} r_j\, \ell n\, r_j - \sum_{k=1}^{K} c_k\, \ell n\, c_k \right]$$

This formula, that is $-2\ell n\lambda$, indicates which combination of cells and row and column totals contribute to the total calculated value. By adding and subtracting, $-2\ell n\lambda$ is calculated. This important step can best be described as the simulation of the χ^2 value.

6.6.4.2 Hierarchical Loglinear Analysis

The basic starting point for hierarchical loglinear analysis is once again the basic cross-tabulation, with its two main effects A and B and interaction effects AB. The combinations of variables sometimes have a different effect from what one would expect of each of the variables alone. In statistical terms, we say there was an interaction effect between variables. Interaction effects refer to the extent to which variance in one independent variable relates to variance on the levels of the other independent variable.

Other terms that are associated with the hierarchical loglinear model, namely the

independence and saturated model, are also worth mentioning. A model in which the variables A and B are statistically independent is called the independence model. This model is formulated as:

$$F_{jk} = \mu + \lambda A_j + \lambda B_k$$

Note that the formula does not provide for assessment of interaction, hence the independence of the two main effects A and B. F_{jk} is the expected frequency in the (j,k) cell.

If the variables are dependent, as in the case of a saturated model, the appropriate log-linear model has interaction terms that can represent them. A saturated model contains all the possible effects. For example, a saturated model for a two-way table contains terms for the row main effects, the column main effects, and their interaction. The term saturated model derives its name from the interaction effects that occur in instances where variables A and B are statistically depended. This model may be written as:

$$\hat{F}_{jk} = \mu + \lambda A_j + \lambda B_k + \lambda AB_{jk}$$

Note that $\hat{F}_{jk}$ is no longer the expected frequency in the (j,k) cell, but is now the observed frequency based on the model.

The log-linear model converts the multiplicative model into linear model by taking the natural logarithms of the expected frequencies. The cell frequencies as well as the row and column marginal totals as well as N are converted to natural logarithmns. An abstract example is used to demonstrate the second method.

Table 6.50 Natural logarithms of expected frequencies of an (J x K) contingency table

	1985-1986	1987-1988	1989-1990	1991-1992	1993-1994	**Marginal Row Values**
Asians A_1	M_{11}	M_{12}	M_{13}	M_{14}	M_{15}	M_{r1}
Coloureds A_2	M_{21}	M_{22}	M_{23}	M_{24}	M_{25}	M_{r2}
Whites A_3	M_{31}	M_{32}	M_{33}	M_{34}	M_{35}	M_{r3}
Blacks A_4	M_{41}	M_{42}	M_{43}	M_{44}	M_{45}	M_{r4}
Marginal Column Values	M_{c1}	M_{c2}	M_{c3}	M_{c4}	M_{c5}	M

Within the converted table M_{11} to M_{45} are the natural logarithms of the original cell frequencies in the starting cross-tabulation. M_r is obtained by adding M_{11} to M_{15} and dividing by 5 (five categories of variable B). The procedure is repeated for all the remaining marginal row totals. Adding up M_{11} to M_{41} and dividing by 4 (for the four categories of variable A), will provide M_{c1}. This again is repeated for M_{c2} to M_{c5}. M is the average of M_{r1} to M_{r4} added and divided by 4 or M_{c1} to M_{c5} added and divided by 5. The calculation procedure reverts from table 6.50 to the contents of table 6.51.

Next, a test for the presence of dependence or independence is done. In other words, accept or reject the hypothesis:

$H_o: \lambda^{AB} = 0$ (independence model)

$H_1: \lambda^{AB} \neq 0$ (saturated model)

The formula that is used for testing this model is

$$\chi^2_L = 2 \sum_{J=1}^{J} \sum_{k=1}^{K} O_{jk} \ \ell n \left(\frac{O^{jk}}{E^{jk}} \right) = \ell^*$$

The statistic ℓ^* follows the χ^2 distribution with (J - 1) (K - 1) degrees of freedom. If the saturated model or model for interdependency holds, further calculations are

made for the contents of Table 6.51.

Table 6.51 Loglinear analysis for the saturated model

Effect	ℓ	S_ℓ	ℓ/s	Conclusion
λA_1				
λA_2				
λA_3				
λA_4				
λB_1				
λB_2				
λB_3				
λB_4				
λB_5				
λA_1B_1				
λA_1B_2				
λA_1B_3				
λA_1B_4				
λA_1B_5				
λA_2B_1				
λA_2B_2				
λA_2B_3				
λA_2B_4				
λA_2B_5				

If the saturated model does not apply, significant interactions are lacking and further calculations proceed according to Table 6.52.

Table 6.52 Loglinear analysis for the independent model

Effect	ℓ	S_ℓ	ℓ/s	Conclusion
λA_1				
λA_2				
λA_3				
λA_4				
λB_1				
λB_2				
λB_3				
λB_4				
λB_5				

Irrespective of which of the two models holds, four further calculations are made: ℓ, an estimate s_ℓ, ℓ/s and the final conclusion. Calculations of these four steps are as follows:

(i) Calculation of ℓ

Estimates for lambda parameters (ℓ values) can be estimated as follows:

$\lambda A_j = \mu_j - \mu_{jk}$ main effect A

$\lambda B_k = \mu_k - \mu_{jk}$ main effect B

$\lambda AB_{jk} = \ell n \hat{F}_{jk} - (\mu_{jk} + \lambda A_j + \lambda B_k)$

for calculation of any interaction effect,

where $\hat{F}_{jk}$ is the observed frequency in the cell.

Calculation of λA_j and λB_k holds for both tables 6.51 and 6.52, whereas λAB_{jk} holds only for table 6.51, as table 6.52 contains no reference to interactions. λA_j and λB_k are calculated by subtracting M_{jk} (grand mean) from the mean of (M_{rj} or M_{ck}) of the particular marginal row total or marginal column total as the case may be. λAB_{jk} is the natural logarithm of the cell frequency F_{jk} minus the sum of the grand mean M_{jk} plus λA_j plus λB_k.

(ii) Calculation of s_ℓ

The next objective is to calculate estimates of the standard deviation of the main and interaction effects (where applicable) by using existing information. The following two formulae are used to estimate the variance:

$$s_\ell^2 = \frac{1}{j^2 k^2} \sum_{j=1}^{J} \sum_{k=1}^{K} \left(\frac{a_{jk}^2}{O_{jk}} \right) \text{for the saturated model}$$

$$s_\ell^2 = \frac{1}{j^2 k^2} \sum_{j=1}^{J} \sum_{k=1}^{K} \left(\frac{a_{jk}^2}{E_{jk}} \right) \text{for the independent model}$$

where a is the values in the unit matrix.

The two calculations differ only in terms of division by O_{jk} in the first instance, and division by E_{jk} in the second. Suitable lists of sets of weights (a_{jk}) in the above two

formulae for cross-tabulations of different sizes, for the estimation of s_ℓ were calculated and published for further reference and usage (Steyn et al, 1994). An example is provided in Table 6.53 pertaining to 2 x 3 cross-tabulation.

Table 6.53 Weights for 2 x 3 table

	a_{11}	A_{12}	a_{13}	a_{21}	a_{22}	a_{23}
λA1	1	1	1	–1	–1	–1
λA2	–1	–1	–1	1	1	1
λB1	2	–1	–1	2	–1	–1
λB2	–1	2	–1	–1	2	–1
λB3	–1	–1	2	–1	–1	2
λ AB11	2	–1	–1	–2	1	1
λ AB12	–1	2	–1	1	–2	1
λ AB13	–1	–1	2	1	1	–2
λ AB21	–2	1	1	2	–1	–1
λ AB22	1	–2	1	–1	2	–1
λ AB23	1	1	–2	–1	–1	2

In the case of the saturated model, each of the relevant sets of weights pertaining to the main effects λA_1 to λA_j, λB_1 to λB_k and the interaction effects λAB_{11} to λAB_{jk} are taken in turn. Each weight from the appropriate table suited to the data, is squared and divided by the observed frequency in the original cross-tabulation. All the a^2_{jk}/O_{jk} values are summed across all the categories (B_1 to B_k) for all the groups (A_1 to A_j) and multiplied by the inverse of J^2 x k^2 (number of columns squared, multiplied by number of rows squared).

The standard deviation is obtained by calculating the square root of s^2_ℓ of the two formulas that are used to estimate the variance, i.e. $s_\ell = \sqrt{s^2}$. To make accurate estimates, s^2 is usually calculated to eight decimal places.

The value s_ℓ is merely an estimate of the standard deviation of the estimator of λ so that

$\frac{\ell - \lambda}{s}$ is actually the standardised value of the estimate ℓ, which is equivalent to a z value.

To determine whether an effect is significant, the following rule is used:

$$\ell \text{ is not significant } (\lambda = 0) \text{ if } \left|\frac{\ell}{s_\ell}\right| < 2.58$$

$$\ell \text{ is significant } (\lambda \neq 0) \text{ if } \left|\frac{\ell}{s_\ell}\right| \geq 2.58$$

This procedure implies that for each main effect and interaction effect (for the saturated model) the null hypothesis

$H_o: \lambda = 0$ is tested against

$H_1: \lambda \neq 0$ (saturated model)

Testing at the 1% level of significance is preferred to testing at the 5% level, owing to the many assumptions on which the model is based. All ℓ / s_ℓ values that exceed 2.58 are significant. The resultant conclusions are the drawn in terms of significant or insignificant main and interaction effects. Since all ℓ / s_ℓ values are standardised, the plus or minus sign they carry will be indicated as exceeding the group norm (plus sign), or falling short of the group norm (minus sign).

The interpretation of the statistics could be written as follows, depending on whether the independent or saturated model applied:

'In instances where the independence model is proven to hold, the search of interaction effects in the cross-tabulation is not required. However, borderline interactions that occur may also be mentioned, if necessary. Only the findings of the main effect of the loglinear analysis can be reported in the table. In the case where the saturated model applies, further analysis of the cross-tabulation is necessary in order to trace for the presence of interaction effects in the cross–classification table.'

6.7 Option Decided Upon

Clearly, there are certain similarities and differences between the two approaches that have just been presented. As has been pointed out, the log-likelihood ratio allows one to pinpoint which groups of cells play a part, whereas the hierarchical loglinear analysis enables one to uncover the potentially complex relationships between variables. The models of the hierarchical loglinear analysis could result in any one of the following representations, that:

1. There is no difference between the B categories in the population
2. There is no difference in the incidence of the A categories in the population
3. There is an equal probability that an entity could be placed in any one of the (J x K) cells of the contingency table

The above considerations have convinced the researcher that the hierarchical loglinear analysis would be the preferred statistical procedure to be used to analyse the data in this research.