An evaluation of an intervention programme on Automotive Service Technicians using Kirkpatrick's framework

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Abstract

This dissertation reports an evaluation study which was done with an educational programme for Automotive Service Technicians which was adapted for South African conditions and derived from a programme used internationally, and originally developed in Schweinfurt, Germany in 2005. The programme was designed to answer to particular problems experienced during automotive driveline-component installations. Since the inception of this programme, ZF Germany had been training representatives from their different subsidiaries over the world on the essential elements of automotive driveline installation protocol. The representatives were trained to adapt the core programme in accordance with the particulars of the vehicle populations in each respective country, and the researcher has performed this task

The aim of this research was to evaluate the effectiveness of one particular module known as “Guidelines to clutch replacement” with regard to bringing about the desired changes in knowledge, attitude and behaviour within the trainees. Previous anecdotal feedback from the industry had suggested that the programme had been helpful in the reduction of installation errors, but the extent of the successes and failures of the programme had been unknown until this study. The training department at ZF South Africa was tasked to design further training modules based on the findings of the module under study in order to establish the successes and failures of the core concept for improvement of successive programmes.

The approach for this programme evaluation was utilization-focused which allowed the researcher to choose from and combine a variety of data collection strategies over the complete range of summative and formative evaluation approaches. However, in keeping with the stated aim of this study, this study had been limited to a summative inquiry by employing a quantitative data collection strategy at the hand of a quasi-experimental research design.

This research report presents the findings of a one-day intervention programme that was offered to Automotive Service Technicians in the Gauteng area. The conceptual framework that was adopted for the research was based on the four level evaluation framework of Kirkpatrick (1998) with the first three levels having been empirically tested and the fourth level discussed on the basis of empirical information.

Findings suggest that although the levels of knowledge-acquisition could not to be considered as high, behaviour modification had indeed been observed to be in alignment with the clutch-installation-protocol and almost all the respondents had adopted the protocol as their preferred way of executing clutch installations.

In addition, most respondents found the programme to be pleasant and of a high utility value. Certain problems with the programme became evident, such as the pace having been too fast; printed hand-outs were not considered to have high utility value, and sensitivity to personal and cultural differences were found to be lacking.

The low levels recorded for knowledge acquisition may be language related which possibly relates to the fast pace of the course. The research findings suggest that the course should be spread over two days instead of one day and be augmented with practical demonstrations and re-designed printed hand-outs.

In order to effectively measure level four of the Kirkpatrick framework, criteria of concern should be negotiated with participating organisations in order to provide relative data for answering research questions on this level. Procedures for collecting data over the course of several years need to be established and agreed upon by all stakeholders for such data to be reliable and valid in the inclusion of a time-series study.

Regarding a relatively simple programme such as the programme under study with programme objectives that have a predominant procedural-knowledge focus, the Kirkpatrick framework has been found to be effective and its procedures may be applied in other industry-based training programmes. An added academic contribution to the previous one is that the Kirkpatrick framework as utilised in this study has shown that the framework offers a high utility value for fast-paced short courses where contact time with trainees are limited and evaluation designs need to fit in with the practical limitations. The high utility value of the Kirkpatrick framework became evident in the findings of this study where transfer of learning had evidently taken place regardless of possible learning problems such as language barriers.

Key words: Evaluation; Programme-evaluation; Automotive-training; Evaluation-models; Kirkpatrick four-level-evaluation-framework; Training-programmes; Quantitative survey; Quasi-experiment; Pre-test and post-test; Learning; Behaviour; Transfer-of-learning; Reactions; Programmes for adults; Technical; Vocational; training; TVET.

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INVESTIGATOR(S)	Vernon John Candlotes
DEPARTMENT	Science, Mathematics and Technology Education
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Dedication

This research has been an unusual experience for me. It did not start off as I thought it would, the journey had been extremely eventful and at times unbearable, and the conclusion was as unusual as the beginning. I sat in my car at the University early in January 2010 and asked my Creator to make this study possible for me. I am eternally grateful to my Creator for seeing me through and therefore my dedication of this project goes to Him first and foremost.

My dear wife and two boys sacrificed as much as I did yet throughout this journey. My wife, Katherine encouraged me, stood by me, made me thousands of cups of tea, typed my unreadable handwritten notes over and over and never once complained. My boys (Kimon and Alex) kept on calling me dad even though my wife had to be a mom and a dad most of the time for more than four years. My second dedication goes to you my beloved family; it is for you that I decided to this in the first place. I love you and thank you!

My last dedication goes to my mom and dad who had shown their five children by example that hard work is the only way to success, there are no short-cuts. I dedicate this study to them for believing in me and encouraging me when I thought I could no longer continue.

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Professor Braun, you joined the team late but I am grateful that you did. Your kindness and wisdom came at a time when it was most needed and you labour to improve the quality of this study astounded me and left a mark of excellence. I am grateful and can honestly say that I was blessed with the most constructive and professional team of supervisors.

I also want to acknowledge the impact that Andries Masenge had in advising with statistical procedures; Melissa Labuschagne for her professional proofreading; the wonderfully helpful librarians; the equally helpful administration staff and the highly competent lecturers who provided much appreciated insights in the research support courses. My sister, Madeleine and her husband Corrie also deserve my gratitude as they played a major role in making my study possible and stood steadfastly behind me during this journey. To the both of you, I am eternally grateful!

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1.1 Overview of the chapter

The purpose of this study is to inform the training department of ZF Services South Africa on the effectiveness of one of the programmes in the technical training curriculum with the title "Guidelines to clutch replacement". A verdict is required on the programme's effectiveness in facilitating the acquisition of new knowledge and corresponding transfer of knowledge. The development of new programmes and the future improvement of the intervention programme under study will be based on the findings of this study.

In this chapter, the competitive and evolutionary nature of the worldwide automotive industry is introduced. This includes a discussion on the industry-drivers responsible for mounting pressures on component manufacturers and suppliers. This is followed by a description of how Automotive Service Technicians are required to keep abreast of the changes in knowledge and procedures instigated by advances in automotive technology. The focus then moves to training and training programmes as the instrument that equips the Automotive Service Technician with the necessary knowledge, skills and behaviour. Training and training programmes also highlight the international and local problems responsible for curtailing the process of corrective action through training. The specific area of technology of concern in this study is isolated with an introduction of those areas and why the focus of this research is concentrated on those components of the modern vehicle. The problem statement, rationale for the study and the research questions are then addressed. This is followed by an overview of the programme that forms the core of this programme evaluation, the research approach and the limitations of this study. This chapter ends with a definition of the key concepts of this study and the outline and organisation of the study is also described.

1.2 Introduction and background

Automotive design is an evolutionary process where compromises are continuously negotiated with regard to design variables such as safety, function, mass, cost, longevity, and the trend to incorporate intelligent systems within all categories of vehicle technology (Uduma, 2000; Causemann, 2000). In today's competitive automotive global market, which is driven by constant and rapid changes in vehicle design, Original Equipment Manufacturers are being pressurised to adapt and reform service processes (repairs and maintenance) with regard to customer satisfaction (Chougule, Rajpathak & Bandyopadhyay, 2011).

Karaali, Gumussoy & Calisir (2011) state that the automotive service training programmes, which are meant to be the mechanism whereby these service processes are kept in tune with international requirements, are not always well planned. These programmes also often fall short of equipping Automotive Service Technicians to affect automotive repairs in a fault-free manner. The lack of up to date automotive training, is a legitimate cause for concern and is a world-wide phenomenon that leads to unnecessary losses for the vehicle owner, as well as the Automotive Service Centres due to faulty maintenance procedures (Ersoy & Kucuk, 2010). Pressure is mounting on Original Equipment Manufacturers to improve service processes, this tension is exacerbated by the constant and rapid changes in vehicle design.

This continuously evolving nature of vehicle design imposes an equal burden on manufacturing processes as well as the implied changes in the maintenance and service requirements of modern vehicles. This is evidenced by the rapid rate of automotive advancement over the last decade (Anastassova, Burkhardt, Megard & Ehanno, 2005; Anastassova & Burkhardt, 2009). The rapidly evolving nature of the automotive industry has been driven to new levels of intensity (Kinsey, 2013). The main drivers responsible for this evolutionary trend in the global automotive industry are: cost pressures, diverging markets, digital demands, and a shifting industry landscape (Kinsey, 2013).

Original Equipment Manufacturers are driven by fierce competition to introduce new and frequent technological changes to vehicles (Sunaoshi, Kotabe & Murray, 2005). Manufacturers are expected to stay abreast of the changes imposed by vehicle designers in terms of processes as well as subsequent changes in the maintenance requirements of modern vehicles (Sunaoshi *et al*., 2005).

Staying abreast of continuous technological advances implies ever evolving training requirements in keeping up with rapid technologically advanced automotive components. Training programmes that are up to date are vital for the Automotive Service Technicians working with these complex and evolving components in order to efficiently and effectively execute service maintenance and repairs on vehicles (Sunaoshi *et al*., 2005). Training requirements and programmes span a wide range of categories covering the function, operation, installation, failure diagnosis, and programming of electronic control units (O'Hara, 2003). Sunaoshi *et al*. (2005) further stresses the necessity for Multi-National Corporations to play a leading role in addressing existing and growing deficiencies in the transfer of knowledge regarding new concepts and procedures across national boundaries by means of appropriate training programmes.

Michalos, Makris, Papakostas, Mourtzis & Chryssolouris (2010) state that this apparent deficiency in the transfer of this knowledge is situated in the human interface between the developer of new automotive technologies and those operators who inevitably have hands-on involvement with the new technology. Michalos et al. (2010) also state that the technicians who work with this ever evolving technology are presented with a significant cognitive workload as they have to keep pace with the ever-increasing changes in automotive technology. Anastassova & Burkhardt (2009) claim that these ever-increasing changes in the automotive industry are not effectively reflected in Automotive Service Technician's training programmes. For the purpose of this study, the ever-increasing changes in automotive technology are limited to the automotive driveline sub-categories of transmissions, tribology, clutches, hydraulics, and vehicle harmonics.

Extensive research has been conducted recently regarding the problems encountered by Automotive Service Technicians. Apart from discovering that it is a much neglected area of research, researchers also identified the following training problems as commonalties in Automotive Service Technician's experiences worldwide (Anastassova *et al.,* 2005; Peti, Obermaisser, & Paulitsch, 2005; Mulholland, Zdrahal, Domingue, Hatala, & Bernardi, 2001; Barkai, 2001):

- Automotive Service Technicians generally agree that training programmes are constantly made shorter and the time provided for completing such courses generally falls short of being adequate.
- The sophistication of diagnostic knowledge to be learnt and transferred to others has sharply increased. This is due to the introduction of advanced electronic systems and on-board computerised-control-systems. Previous stand-alone functions within vehicles are now not only codified in central ECUs (electronic control systems), but several previously unrelated functions are now inter-linked and proportionately controlled by the ECU. A competent transmission diagnostician also has to be competent in areas such as electronic steering systems, electronic fuel-injection systems, and electronic braking systems. An error in one system could present itself as an anomalous symptom in another unrelated system.
- The processes of investigative diagnostics and the consequences of the confluence of multi-level technological changes on training have not been studied thoroughly. Consequentially, the development and planning of training programmes are not properly informed due to the absence of formalised intervention-policies and action plans.

- Training programmes have to be frequently evaluated and adapted to keep abreast of changing technology. Automotive Service Technicians thus experience constant instabilities in what they know and in what they are taught due to the evolutionary nature of the vehicles they work on. This phenomenon is heightened during the introductory period (first year) after a new model is released to the market.
- If training programmes do get offered to the Automotive Service Technicians, it often happens only years after the new technology have already been introduced into vehicles.
- Organisational resources in support of formal programmes that enhance “on the job” learning are seldom effectively utilised at best, and at worst are never brought to mobilisation.
- Training programmes are interwoven strands in a socio-technical system, relying on effective collaboration between stakeholders such as component-suppliers, training-planners, managers, trainers, and learners. Automotive Service Technicians, as end-receivers of the flow of knowledge contained in programmes, are dependent on programme planners and designers upstream. These technicians often experience knowledge arriving late or containing errors, or having even already become obsolete.

South Africa is not unaffected with regard to the problematic experiences as mentioned. Automotive vehicles are assemblies of thousands of sub-components which collectively operate in unison to deliver effectively on their various tasks of transportation. For the purpose of this study, the focus remained on the automotive driveline, and in particular on the dry-friction clutch assembly. Section 1.3 explores the problems as experienced in South Africa and narrows this enquiry down to a problem statement that remained the focus of the study as it developed.

1.3 Rationale for this study

The South African experience relating to the installations of vehicle components in an incorrect manner is much the same as experienced across the world (Heyes, 1998). According to Heyes (1998), and from his research conducted in the South African context, a very high proportion of component failures can be attributed to errors made during installations/repairs. He recommends role players in the automotive industry to focus on training as an intervention that should yield significant dividends. In support of this recommendation, Anastassova (2005; 2009) suggests that the apparent deficit in the knowledge of Automotive Service Technicians could be successfully addressed by planning

adequate and effective training programmes around identified needs. These training programmes would then also need to remain up to date by means of continual evaluation.

Prior to the commencement of this research, this researcher arranged meetings with two automotive training academies, as well as with one of the most renowned trade testing centres in South Africa. The programme, and its contents on clutch replacement, was briefly presented to these three institutions in the Gauteng area. It was anecdotally determined that these three leading institutions were indeed training their apprentices around the principles of old and often obsolete technology. The existing training of these three institutions were determined to be outdated to the extent that clutch fitments performed according to the principles taught there were found to be extremely harmful to vehicles.

The Zeppelin Foundation (ZF) is a charitable foundation and leading shareholder in the Multi-National Zeppelin group of companies which supply the automotive component manufacturing and supply sector. Its head office is situated in Friedrichshafen, Germany. It has made a socially responsible commitment to implement a world-wide policy of end-user training. ZF has developed a unique approach to redress knowledge voids in automotive service technicians' knowledge bases and skill-sets.

The specialised training specifically relates to ZF's range of automotive products, in order to continuously update Automotive Service Technicians who specifically work with these products. ZF invites representatives from twenty-seven countries on an annual basis to undergo training in Germany on the latest product developments and to share product information in the form of feed-back on failures from the global market. These representatives are then tasked with developing training programmes suitable to the particular vehicle fleets in their respective countries and according to the respective training needs of the end-users within their countries.

As the South African representative, the author of this study is partly responsible for the design and implementation of training programmes suitable for the South African context in the clutch systems, suspension systems, transmissions, axles and steering systems component categories.

By scrutinising the existing failure reports from ZF records, it has been established that the area in which the most installation/repair errors have been reported is the domain of clutches for the after-sales-market. In order to establish whether the existing intervention programme in clutch replacement is effective in countering unnecessary installation errors, an evaluation of this intervention programme should be effected based on sound programme planning and evaluation principles (Caffarella, 2002).

1.4 The Problem Statement

Automotive Service Technicians in South Africa have demonstrated a lack of conceptual and procedural knowledge regarding clutch installations. This results in the premature failure of these components and unnecessary resource expenditures by both service centres and customers. A pilot intervention programme spanning the course of one day was designed to redress the lack of conceptual and procedural knowledge, specifically for the installation of clutches.

The programme was designed by ZF Warranty engineers in Germany as an answer to the European problem, and then adapted to the South African vehicle population by this researcher. The German programme was adapted by replacing pictures and graphics not pertaining to vehicles common to South Africa. The German programme was further adapted by structuring the content under the six chapters of verification, pre-inspection, extrication, failure-analysis, preparation, and installation. The content is approximately eighty percent true to the German original and the balance of twenty percent is particular to prominent problems experienced in the South African context. This study sought to evaluate the effectiveness of the South African version of the intervention programme for clutch fitment.

1.5 Aims and objectives

This study aimed to establish the effectiveness of an automotive training programme known as “Guidelines to clutch replacement” utilising Kirkpatrick’s (1998) four level framework for programme evaluation. This research aimed to provide information as to the extent that the programme was perceived as effective in the reduction of errors made by trained Automotive Service Technicians at their place of work. In achieving this aim, this research focused the investigation on the reactions of the trainees, their learning, and behaviour at the workplace. Trainee reactions relate to the affective domain, as is evidenced by the opinions and attitudes of the trainees regarding their satisfaction with the programme (Kirkpatrick, 1998).

Learning relates to the trainees' knowledge acquisition from the programme as compared to their prior knowledge (Kirkpatrick, 1998). Behaviour relates to the degree to which knowledge transfer has taken place as is evidenced by the trainee's behaviour at the workplace (Kirkpatrick, 1998).

It is important to note that this study did not seek to prove or imply that positive reactions would yield high levels of learning and that high levels of learning would in turn yield high levels of behaviour modification. In fact, very few studies have been conducted to prove or disprove causality between levels and those that have been conducted have not yielded substantial empirical evidence for negative or positive correlations between levels (Alliger & Janak, 1989; Alliger, Tannenbaum, Bennett, & Traver, 1997; Yardley & Dornan, 2012; Steinert, Mann, Centeno, Dolmans, Spencer, Gelula & Prideaux, 2006). Alliger *et al*. (1997) state that although one should not assume causality between reactions and further outcomes it remains important to measure reactions because negative reactions could have a detrimental effect on the programme.

Kirkpatrick's four level framework also proposed a fourth level of measurement which related to the results of the programme as measured in monetary terms (Kirkpatrick, 1998). Only the first three levels of Kirkpatrick's four level evaluation framework were statistically measured for this study as the financial benefits to the Automotive Service Centre for participating in this study were extremely complex. This researcher was not privy to the financial status of the different service centres taking part in this study, but the possibility did exist for an appropriate longitudinal study spanning several years to be conducted in order to measure the results as a consequence of the programme's effect (Kirkpatrick, 1998). However, it could have been possible to gauge the intermediate impact of this programme under study by requesting the service centres that participated in this study to keep an accurate record of clutch failures after the completion of the programme so as to compare the rate of premature failures before the programme to the rate of premature failures after the programme. The absence of reliable statistical measures rendered this strategy as a non-reliable measure of the actual increased monetary results as a consequence of the programme's influence on limiting premature failures that may historically have been acceptable. As mentioned before, only a disciplined longitudinal study running parallel with accurate previous failure records could produce results of a statistically significant nature.

1.6 Research questions

Sprouting from the common problems in the automotive industry nationally and internationally, and guided by the problem statement and the stated aims and objectives of this study, this study's research questions were formulated.

1.6.1 Main Research Question

How effective is the intervention programme known as "Guidelines to clutch replacement" in equipping an Automotive Service Technician with the required knowledge and behavioural changes to ensure a fault-free clutch replacement?

This main research question is inherently quite broad in terms of possible research approaches and it is therefore essential to narrow the focus for the sake of applying an effective research design. This was done by posing specific sub-questions (Mertens & Wilson, 2008:280).

1.6.2 Sub questions

The main question was informed by focusing on three narrow programme outcomes in which the following three specific sub-questions were posed:

1.6.2.1 Affective domain (satisfaction with the programme)

What are the participants' reactions regarding to the training programme?

This question informed the main question by measuring the respondents' reaction to the programme's content, the presentation skills of the trainer and the overall programme impact by way of surveying the respondent's effective judgements of stated survey items.

1.6.2.2 Cognitive domain (learning that took place)

How effective is the training programme in facilitating the acquisition of new knowledge?

This question aimed to inform the main question with regard to the effectiveness of the intervention programme in facilitating the respondent(s) to discard prior incorrect or obsolete

knowledge about clutches and replace such knowledge with the new, up to date knowledge on clutches and the correct procedures during installation. Written pre-tests and post-tests were used as the instruments of measurement.

1.6.2.3 Outcome domain (behaviour modification)

How effective is the training programme in changing the participants' observable work behaviour?

The main question was further informed by means of practical checklist instruments. This was done by way of pre-installation observational checks and post-installation observational checks. These measurements were intended to reveal whether the intervention programme facilitated a change in behaviour in the respondents of this study in terms of executing clutch installations in the correct procedural fashion.

1.7 Significance of this study

During research activities prior to the inception of this study, this researcher discovered that very little research had been conducted in the automotive industry related to programme evaluation, and especially so in the South African context. This study could perhaps begin to address the lack of information in the South African automotive field with regard to programmes intended to improve outcomes in the repair and maintenance of vehicles. Table 1.1 offers a summary of areas where this study could provide useful information.

Table 1.1: Summary of areas of significance

Area of significance	Description
Holding the training department accountable	The Zeppelin Foundation who commissioned this intervention programme and ultimately footed the training bill, required evidence that the intervention programme was yielding the differential outcomes that they are were seeking and also if these outcomes were of a short or long term duration (Weiss, 1998:20).
Informs on the degree of efficacy	The summative outcome of this intervention programme's evaluation yielded valuable information on the effectiveness of the programme's design and delivery (Kirkpatrick 1998:16).
Forms a baseline for future programmes	Information gleaned from this exercise was aimed to assist the training manager in the design and development of further training programmes by generalising the findings to other components that require similar interventions (Kirkpatrick 1998:17).
Informs the automotive sector	A great shortage existed in programme evaluation in the automotive industry) as well as intervention programmes that were designed to narrow the growing deficiency in Automotive Service Technician's product knowledge due to technological advances in vehicles (Anastassova *et al*., 2005:68; Anastassova & Burkhardt, 2009:713; Sunaoshi *et al*., 2005:58).

Informs the literature	Training programmes are meant to address certain needs as per context and cannot be planned, designed and executed outside of the context parameters and therefore need to be responsive to the sensitivities of a given context (Owen & Rogers, 1999:29). It was hoped that the outcome of this study, in its South African context, would provide valuable direction for the development of similar programmes by other companies and would also contribute to narrowing the gap in the literature on automotive programme evaluation.
Informs on the use of the Kirkpatrick method	The literature review did not yield any evaluations that were previously executed by utilising the Kirkpatrick (1998) four level framework with regard to intervention programmes in the domain of automotive drive trains (clutches) in South Africa or anywhere else in the world. It may thus be of academic interest to undertake a programme evaluation study in the context of the South African automotive sector.
Informs users of evaluation methods	This study's findings were of importance to the international research community of programme evaluation and may contribute to the body of knowledge and theory on evaluation in general. A further practical contribution was made to the automotive trainers and developers of training programmes as well as to human resource professionals.

1.8 Context of the study

1.8.1 Course structure

The ZF intervention programme for driveline componentry consists of the modules as listed in Table 1.2 with module eight as the intervention programme under study:

Table 1.2: ZF Driveline programme

Module	Description	Duration
1	Clutch function and operation	1 day
2	Drivetrain harmonics and dual-mass-flywheels	1 day
3	Transmission function and operation (Manual)	5 days
4	Transmission function and operation (Automatic)	5 days
5	Transmission function and operation (Automated)	5 days
6	Release systems	1 day
7	Failure diagnostics: Clutch	1 day
8	Clutch fitment (Passenger cars and commercial vehicles)	1 day
9	Mechatronics, diagnostics and programming	2 days

1.8.2 The module: Clutch fitment (Passenger and commercial vehicles)

The aim and objective of this programme module was to equip the Automotive Service Technician with up to date product knowledge and procedural knowledge. This would assist the Technician to approach the task of clutch fitment in a systematic manner. The module was organised to cover the five categories given in Table 1.3:

Table 1.3: Clutch fitment module: Passenger and commercial vehicles

Category	Description
Pre-inspection and verification	Firstly, in this category, the importance of investigating the manufacturing specifications of the vehicle under repair is explained with special emphasis on component-identification, model-identification, engine and transmission identification, as well as articulating the nature of the component failure. Secondly, the various possible origins of component failures are explained at the hand of a checklist. Oftentimes driveline components are unnecessarily removed and replaced with new ones. By following a systematic pre-inspection, the Automotive Service Technician is equipped with the necessary diagnostic knowledge to differentiate between a true component failure and one where a peripheral component to the driveline is in reality the misleading factor.
Extrication	In this category, the danger of causing additional damage to the vehicle through incorrect behaviour is explained. The correct extrication protocol is clarified; and the consequences of incorrect behaviour are explained by discussing the common errors of popular practice.
Diagnostics	In this category, the Automotive Service Technician is taught how to interpret the various signs of driver influence on the driveline and identify the signs of a previous installation that was executed incorrectly. This segment also equips the Automotive Service Technician to inform and educate the vehicle's owner/operator on the dangers of undesirable driving techniques and identify peripheral elements that may affect the new installation negatively.
Preparation	The Automotive Service Technician is taught the various consequences of not following the desired preparation protocol for the new components and a series of case studies are discussed to reinforce the importance of this segment.
Installation	Procedures and sequences are explained in this category and the importance of adhering to the correct protocol is explained in terms of the possibility of further case studies.

1.8.3 The respondents

Eighty-seven male respondents participated in this study and they were randomly chosen from seventeen Automotive Service Centres operating in the Gauteng area. Only data from eighty of the original sample of eighty-seven respondents could be used for statistical analysis as seven data sets were incomplete to the point that they were unreliable. The sample of respondents proved to be quite diverse in terms of their ages, secondary and tertiary qualifications, previous experience, prior-knowledge of clutches, socio-economic, race, ethnicity and cultural classes. This sample cross-section of experimentally available respondents from Gauteng is representative in their characteristics of the larger population of workers in South Africa. The South African developing economy is known to be hampered by factors such as essential skill shortages, poor educational levels and quality of education especially in the area of Mathematics, Science and Literacy Rasool & Botha, 2011; Kleynhans, 2006; Howie, 2003 ; Bloch, 2009). The nature of the diversification of the national workforce further compounds strategies of human capital development in the organised labour market (Kleynhans, 2006).

Ten training sessions were conducted by the same trainer, who presented the same content by means of PowerPoint presentations and physical models (see appendix for the PowerPoint presentation). None of the participating service centres were related to each other and care was taken to exclude the possibility of respondents who had completed the programme influencing respondents who had yet to attend the programme. Before commencing with each of the ten training sessions, respondents were asked whether they had heard of the programme before or had been exposed to the programme before. No respondents had reported exposure to the programme before or had spoken to someone who had already been exposed to the programme.

1.9 Research approach

This study engaged quantitative research as a strategy of inquiry. A summative programme evaluation was conducted using the four-level-framework of programme evaluation as developed by Kirkpatrick (1998). Three data collection instruments were developed, the data of which were quantified and expressed as a combination of descriptive statistics and a variety of graphs. The data collection instruments were self-developed and the process is described below.

1.9.1 Satisfaction survey instrument: Level one

Examples of survey instruments as promoted by Kirkpatrick (1998) were disseminated and altered to cover a range of affective responses (22 response items). These included respondents' reactions to the programme content, the manner in which it was presented and its perceived overall usefulness. Descriptive statistics and histograms were utilised to analyse the data by means of SPSS statistical software.

1.9.2 Written pre-test and post-test: Level two

Forty questions were derived from the programme content which covered the five categories of the programme structure, namely: pre-inspection, extrication, diagnostics, preparation, and installation, as well as general knowledge with regard to clutch function and operation. The post-test questions were identical to the pre-test questions but with the chronological order of the questions altered so as to limit the effect of respondents answering the post-test similarly to the pre-test due to recognition and recollection of how they had answered the pre-test.

Data yielded from the two tests were statistically analysed by means of the SPSS statistical package, and parametric and non-parametric tests were performed to test the significance of the recorded increase in written test performance.

1.9.3 Observational pre-test and post-test: Level three

Forty checklist items were derived from the programme content and covered the same five categories as mentioned in Section 1.9.2. Each checklist item was scored on an interval level scale of 0 to 5 and ascended with the degree of correctness as respondents were observed in the physical execution of clutch fitments. Twenty of the eighty respondents took part in this part of the research and the data was analysed by using the SPSS statistical software package. In a similar manner as with the written tests, parametric and non-parametric test measures were performed to test the significance of the improved observational score.

1.9.4 Results: Level four

The results of this research could not be formally determined through statistical analysis as not enough time had lapsed for useful data to be collected. Anecdotal insights had however been collected, which pointed to a possible trend in the early stages of benefits accrued by participating workshops. These anecdotal insights are discussed in greater detail in Chapter five.

1.10 Definition of key concepts

Certain concepts were particular to this study and required clarification, whereas other concepts would be familiar to educationists but are also clarified below in order to remove possible ambiguities in meaning:

1.10.1 Automotive Service Centre:

This is a small, medium, or large automotive workshop where passenger and commercial vehicles can be repaired and regularly serviced. For the purposes of this study, all participating service centres were active members of the RMI (Retail Motor Industry).

1.10.2 Automotive Service Technician (AST):

For the purposes of this study the respondents were referred to as Automotive Service Technicians regardless of their level of qualification or their qualification status in terms of

being qualified as an Automotive Service Technician or not. Automotive Service Technicians are what is traditionally referred to as motor mechanics.

1.10.3 Behaviour:

Behaviour refers to the physical manner in which work activities are executed with an added focus on modified behaviour as a result of the intervention programme (Kirkpatrick, 2008:20).

1.10.4 Conceptual-knowledge:

This kind of knowledge refers to the “know why” of a knowledge domain and the inter-relationships of the elements associated with that area knowledge. Metacognitive processes underpin expertise in this area of knowledge and can be measured in terms of shallow or deep knowledge capabilities that aren’t merely reduced to factual knowledge (McCormick, 1997:143).

1.10.5 Intervention-programme:

This is a training module or a series of training modules ranging from workshops lasting a few hours, to formal institutional programmes. The purpose of these is to present information that will facilitate changes in conceptual and procedural knowledge in areas where knowledge, attitudes, skills and behaviour have been identified as inadequate or incorrect for effective job-execution (Caffarella, 2002).

1.10.6 Learning:

Refers to the measureable extent to which attitudes change, knowledge improves and skills increase as a result of attending a training programme (Kirkpatrick, 2008:20).

1.10.7 Original Equipment Manufacturer (OEM):

This is a manufacturing concern responsible by contract for the design, manufacture and supply of original equipment to be fitted to new automotive vehicles.

1.10.8 Prior-knowledge:

This is the amount of domain-specific knowledge acquired through experience or training, which may include elements of all kinds of knowledge with the inclusion of conceptual and procedural knowledge (Wood & Lynch, 2002:416).

1.10.9 Procedural-knowledge:

This kind of knowledge refers to the "know how" of practical knowledge application and may be explained as operating on three ordered levels (McCormick, 1997:145):

> First order: For the execution of known goals and is regarded as automatic and fluid and includes skills such as hammering in a nail.
>
> Second order: For the execution of unfamiliar goals, this operates on specific procedures such as strategic skills for problem solving.
>
> Third order: Cognition switches between the former two levels and, by implication, this has a controlling function (metacognition) where knowledge is no longer automatic, but requires differing degrees of self-regulation as the lines between conceptual knowledge and procedural knowledge are no longer rigid.

1.10.10 Reactions:

A measure of the response of respondents to the programme attended with a focus on their level of satisfaction with the programme (Kirkpatrick, 1998:19).

1.10.11 Results:

This refers to the impact a programme has on an organisation with regard to production-efficiency, improved workmanship (quality), cost-reductions, premature-failure-reduction, increased sales-benefits and higher profits (Kirkpatrick, 1998:23).

1.11 Outline and organisation of this study

Table 1.4 shows the outline and organisation of this study.

Table 1.4: Outline and organisation of the study

Chapter	Chapter heading	Chapter outcome
1	Orientation of the study	Provided insight into the advances in the automotive field and the problems associated with these advances. The focus fell on training in particular and explored the need for continuous programme evaluation. This chapter also set the stage for the rest of the study.
2	Literature review	Provides an overview of the relevant literature on evaluation in general, and programme evaluation in particular and explores the different evaluation approaches, evaluation models and evaluation frameworks.
3	Research design and methodology	A description of the research design, methodology and instruments that were used in this study, as well as a description the conceptual framework.
4	Data collection and analysis	Presentation, analysis and discussion of quantitative data for the 3 research instruments: Satisfaction survey questionnaire, written pre-test and post-test, and observational pre-test and post-test.
5	Summary of findings, limitations, recommendations and conclusion	A discussion of the quantitative findings, answers research questions and includes conclusions and recommendations.

1.12 Conclusion

Chapter one presented a background of the problems experienced on an international level with regard to training programmes that are not always up to date, do not arrive in time for end-users to benefit from it, and often don't exist at all. South Africa is not unaffected by this phenomenon and one of the objectives of this study is to intervene in the domain of clutch fitments by means of a programme-offering designed to redress this problem.

The researcher proposed a rationale for a research project focused on the effectiveness of the clutch installation programme with significant benefits to programme planners and evaluators of programmes in the South African automotive industry. Several research questions were stated which positioned this research firmly as a quantitative inquiry with a specific purpose to determine programme outcomes. Programme outcomes referred to the satisfaction of the respondents with the programme, improved knowledge regarding clutch concepts and procedures and behaviour modification as is evidenced at the workplace. This chapter touched lightly on the statistical research instruments designed for measuring programme outcomes on three levels by utilising Kirkpatrick's (1998) framework for programme evaluation.

2.1 Overview of this chapter

This chapter presents a review of the literature on evaluation in general, and in particular programme evaluation. It commences with an overview of the history of evaluation and how historical events have brought about differing foundational paradigms and definitional parameters for the field of evaluation. The chapter then proceeds with an introduction of the most popular modern approaches to evaluation as supported by various current philosophical assumptions. The nature of effective intervention programmes for adults is then explored, followed by an overview of how programme successes and failures are evaluated by virtue of the theory underpinning the programme. Thereafter, the chapter progresses through an exploration of four different popular evaluation models together with their strengths and weaknesses, and comes to a conclusion with a description of Kirkpatrick's four level evaluation model upon which the conceptual framework for this study is based.

2.2 Evaluation

2.2.1 History

Stufflebeam and Shinkfield (2007) have identified five major periods in the development of educational evaluation, and in particular educational programme evaluation. The five periods are (1) the Pre-Tylerian Period (development before 1930); (2) the following 15 years (1930 to 1945) are known as the Tylerian Age; (3) an 11 year period follows (1946 to 1957) known as the Age of Innocence; (4) a 14 year period follows (1958 to 1972) known as the Age of Realism; and finally, (5) the period from 1972 to the present is known as the Age of Professionalism. Each of these periods is discussed in more detail in paragraphs 2.2.1.1 to 2.2.1.5.

2.2.1.1 The Pre-Tylerian Period: Developments before 1930

The conventional method of evaluation before 1840 was an annual systematic oral examination conducted by school committees, whereas other modes of evaluation were less systematic. The first systematic evaluation carried out by printed text in America started to replace the oral method in the 1845s. Educationalists championed the need for factual assessment results in order to facilitate policy-making. Teachers felt especially threatened by this new move as this new method required comparative assessment, which would have

a direct bearing on their competence as a teacher and programme deliverer (Stufflebeam & Shinkfield, 2007). These early printed text assessments primarily focused on fact regurgitation and, to a lesser degree, on the application of knowledge. The conditions of objectivity, validity, and reliability were more easily met with the introduction of printed text methods and it also signalled a greater professionalism towards evaluation approaches in general (Stufflebeam & Shinkfield, 2007).

It is generally recognised that Joseph Rice (1887 to 1898) conducted the first formal educational programme evaluation in the United States (Hogan, 2007). His method concentrated on gathering data by means of surveys and gathering test scores for spelling and mathematics. At that time, his methods were recognised as being the most comprehensive evaluation techniques ever employed for the purpose of correcting and improving educational programmes (Stufflebeam & Shinkfield, 2007).

In the early years of the twentieth century, yet another approach to evaluation started to emerge. In the area of manufactured products, Frederick Taylor applied the concepts of efficiency and standardisation to manufacturing. Taylor found a high degree of increase in efficiency and assurance of consistent quality in manufactured products by means of evaluation through observation, measurement, analysis and efficiency (Russell & Taylor, 1998). As a consequence to Taylor's successes in evaluation practice, and largely led by Edward Thorndike and others, educators shifted their evaluation practices to be in line with the now normal practice of standardised testing (Hogan, 2007; Stufflebeam & Shinkfield, 2007).

A huge criticism has plagued this new evaluation movement since the early twentieth century, the argument being that such abilities as deep comprehension, real-life application and critical thinking skills were often side-lined in favour of establishing quick and easily measured outcomes. Thus, the possibility of simplifying measuring standards and techniques became a real threat by virtue of the types of tests that were designed for evaluation (Stufflebeam & Shinkfield, 2007).

2.2.1.2 The Tylerian Age: 1930 to 1945

Ralph Tyler is generally acknowledged as the patriarch of educational evaluation and has made huge contributions to the science and execution of educational evaluation (Hogan, 2007). Early in the 1930's, Ralph Tyler developed a clear-cut alternative to the conventional views of that time by concentrating his evaluation focus on clearly stated educational

objectives. Educators used the resulting behavioural objectives to develop curricula and accompanying tests. Tyler's influence prompted educators to reverse the traditional order of curriculum development by allowing the expected learning outcomes to dictate the appropriate content and thereby achieve the desired learning behaviours. This period was also known as "progressive education" with the philosophy of pragmatism as the underpinning philosophy. The elements of behaviouristic psychology were also portrayed during this period (Madaus, 2004).

Experimental and control group evaluation can be very costly and disruptive, but with the Tylerian approach to evaluation, outcomes are internally compared to objectives by focusing on direct achievement measures. This is in contrast to assessing inputs such as textbooks, involvement by the community, teaching quality as indirect elements of the programme and its objectives (Stufflebeam & Shinkfield, 2007).

2.2.1.3 The age of Innocence: 1946 to 1957

In the period following the Second World War and Great Depression, educational evaluation reflected the depressed mind-set of society in general, and the educational fraternity specifically (Hogan, 2007; Stufflebeam & Shinkfield, 2007). This era is known for huge expansions in education, but problems in the educational field were not viewed with the same importance as prior to the war and society did not hold the educational fraternity accountable for resolving glaring issues (Stufflebeam & Shinkfield, 2007; Hogan, 2007). During this period, it was up to local school districts to carry out evaluations or not, depending on the level of interest and available expertise. Even though federal and state agencies were not much involved in educational evaluation, and funding for evaluations were largely by private organisations, Tyler's views were rapidly becoming the foundational mind-set (Hogan, 2007).

With the publication of the book "Taxonomy of Educational Objectives" by Bloom, Furst, Hill, Engelhart and Kratwohl in 1956, educational evaluation became more focused in the sense that outcome objectives on a hierarchical scale of measurement categories became the order of the day (Hogan, 2007). Educators and evaluators became more aware of the different elements within the cognitive domain that were important as indicators for learning and behaviour change (Hogan, 2007:5; Reiser 2001:60).

2.2.1.4 The Age of Realism: 1958 to 1972

This era marked the end of complacency due to federal pressure for the further development of evaluation methodologies that reflected accountability, pragmatism, and relevance. This period is known for the incorporation of four main approaches regarding evaluation activities in the educational realm. Firstlly, the Tylerian approach was employed to help define the aims and objectives of the curricula, and secondly, in order to reflect the objectives better, national standardised tests were developed. Thirdly, a professional judgement approach made it possible to judge proposals and make frequent assessments on the inputs of contracted organisations and lastly, field experiments became a popular way for evaluators to scrutinising the value and efforts of curriculum development (Stufflebeam & Shinkfield, 2007; Hogan, 2007). However, due to the nature of legislation decided upon by congress regarding educational evaluation, officials in the evaluation community soon realised that evaluators were using inappropriate strategies based on then existing concepts and accepted methods.

Educators and evaluators realised that their evaluation methods and strategies as applied to a particular programme really only measured general abilities and individual learning outcomes. They realised that instead these methods and strategies should be accurate assessments of outcomes directly attributable to a particular programme (Stufflebeam & Shinkfield, 2007; Hogan, 2007). Educational officials finally realised that the feasibility of experimental and control type evaluations were not easily reconciled with generalised assistance programmes that were dynamic and based in the field, especially in the course of programme development.

Many new conceptualisations of evaluation began to emerge with individuals such as Scriven (1967, 1974), Stufflebeam (1967, 1971), and Stake (1967) driving the evaluation community to become more focused on the evaluation of goals, the nature and type of inputs, to scrutinise implementation and delivery of services, and not only assess the intended outcomes but also the unintended outcomes of the programmes under evaluation. These evaluators also emphasised the need to make judgments about the merit of the programme being evaluated and collect evidence as to the worth of the programme.

2.2.1.5 The Age of Professionalism: 1973 to the present

Early on in this age, evaluators suffered a lack of identity; they struggled in identifying themselves as teachers, consultants, philosophers, researchers, administrators, and

reformers. No journals, textbooks or platforms existed whereby evaluators could share ideas as a community; the field of evaluation was amorphous and fragmented. Some universities started offering dedicated courses in evaluation, dedicated evaluation journals started appearing, and government ordered a review of evaluation practices, which led to the useful publication Programme Evaluation Standards in 1994. Hordes of new techniques and methodological approaches have since been researched for evaluating programmes (Stufflebeam & Shinkfield, 2007; Hogan, 2007).

2.2.2 Evaluation defined

In its current operational status, evaluation cannot wholly be described as an autonomous field, but rather as a trans-discipline: evaluation activities are not only employed by the more mature sciences such as physics and biology, but are also prevalent in the social sciences, computer science, accounting, history, geography, education, and business and management (Scriven, 2001; Mertens & Wilson, 2012).

People evaluate all the time for different reasons. One yardstick might be aesthetic: Is the entity beautiful and pleasing? Another yardstick is effectiveness: Does it do what it is supposed to be doing? Another is efficiency: Does it provide benefits that are commensurate with its costs? (Weiss, 1998). Scheirer (2012) and Astbury & Leeuw (2010) are in agreement with Weiss (1998) and stress the importance of efficacy and efficiency as critical areas of inquiry for all disciplines in terms of their rate of success and the influences that can be attributed to the success or failure of the phenomenon that is being weighed.

Weiss (1998:4) puts some perspective on the broad trans-disciplinary nature of evaluation through the following insight:

> Evaluation is an elastic word that stretches to cover judgements of many kinds. What all the uses of the word have in common, is the notion of judging merit. Someone is weighing a phenomenon (a person, a thing, an idea) against some explicit or implicit yardstick (Weiss, 1998:4).

Although the above definition captures the broad trans-disciplinary nature of evaluation, it doesn't adhere to the notion of being a singular process or a standard approach. It is rather a family of different activities for judging the merits of programmes and policies and should be approached in different ways according to the differing set of contextual circumstances true for each programmatic application (Frechtling, 2007; Weiss, 1998).

2.2.3 Evaluation approaches

Evaluation approaches are conceived in expansive conceptual assortments, often signifying clusters of paradigms sharing similar constructs and practical elements (Smith, 2010:384). Evaluation approaches are also fundamentally related to each individual's world view and philosophy of education, training, and evaluation (Wiesenberg, 2000). What evaluators do differently from each other is based on their philosophical and ideological stance (worldview) and directly gives form and function to their paradigmatic and theoretical approach to evaluation (Mertens & Wilson, 2012). The evaluation model that is adopted by any individual is broadly informed by the individuals' paradigmatic stance, which in turn underpins the individuals' preference for a particular programme theory, evaluation theory and social science theory (Mertens & Wilson, 2012).

The inter-relationships of the dynamic ideological mechanisms of paradigms, theories, models and approaches are schematically presented in Figure 2.1 and discussed in greater detail further on.

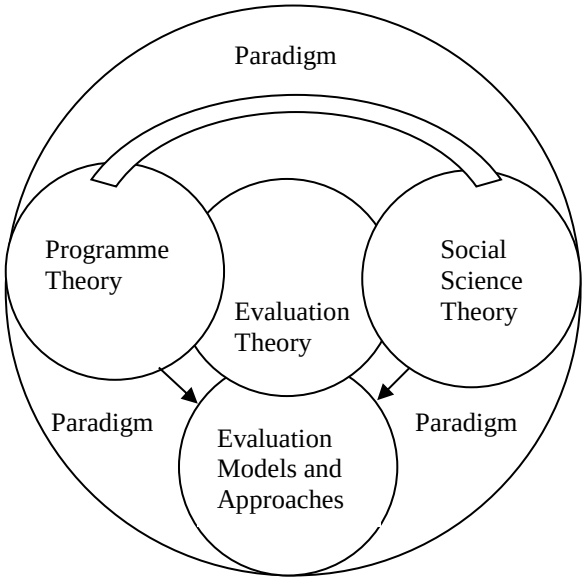


Figure 2.1: Paradigms, theories, models and approaches (Mertens & Wilson, 2012:34)

2.2.3.1 Paradigms and theories

The description of Figure 2.1 that follows is a portrayal of modern approaches to evaluation, but is structured as an extended view of Guba and Lincoln's (1994, 2005) suggested framework for explicating major worldviews (Mertens & Wilson, 2012).

2.2.3.1.1 Paradigms

Paradigms are wide-ranging philosophical constructs or models that include sets of rationally related assumptions of one's world view (Mertens & Wilson, 2012). Such paradigmatic stances guide and shape the theory of change upon which programmes are founded and just as importantly, guide and shape the approach to the evaluation of such programmes (Stufflebeam & Shinkfield, 2007).

2.2.3.1.2 Theories

Theories, being more limited in scope than paradigms, provide structured thinking and argumentation about the interrelationships of differing and interrelated constructs. (Mertens & Wilson, 2012). Theories are often the experience-driven prescriptions and ideas supporting the nature of inputs and activities of programme implementation and go hand in hand with subsequent evaluation objectives (Stufflebeam & Shinkfield, 2007).

2.2.3.1.3 Programme theory

Programme theory plays multiple roles in evaluation in the way that it informs our programmatic decisions and in the way that it explains the mechanisms believed to influence the achievement of the desired programme outcomes (Mertens & Wilson 2012). Programme theories are natural outflows from paradigmatic and theoretical stances and help to scaffold the constructs of change into a coherent framework of programme delivery for the purpose of achieving desired objectives (Stufflebeam & Shinkfield, 2007).

2.2.3.1.4 Social science theories

Social science theories are inclusive of such areas as motivation, change, gender, and critical race theories. These are used both to inform decisions about evaluation practice and to inform programmatic decisions (Mertens & Wilson, 2012). The selection of evaluation criteria and the methodology for instrumentation falls within the domain of social science theories and is also reliant on the evaluation purpose and expectations from relevant stakeholders associated with the programme and its intentions (Arthur, Tubre, Paul, & Edens, 2003).

2.2.3.1.5 Evaluation models

Evaluation models and approaches can be portrayed as sets of rules, instructions, exclusions and guiding frameworks that assist the evaluator in structuring the evaluation in a logical and sensible manner. This is done in order to answer the research questions for the inquiry in the most focused possible way (Mertens & Wilson, 2012; Wang, 2009).

According to Mertens and Wilson (2012), there are four sets of philosophical assumptions that forms and informs each person's unique paradigmatic stance, namely Axiology, Ontology, Epistemology, and Methodology. Refer to section 3.3 in Chapter three for an explanation of how these four sets of philosophical assumptions guided this research. These concepts are expounded on in Table 2.1.

Table 2.1: Philosophical assumptions in paradigms (Mertens & Wilson, 2012:35)

Philosophical assumption	Guiding question	As experienced in life
Axiology	What is the nature of ethics?	We all have moral standards and values that characterise what we believe to be right or wrong, as well as norms that allow us to judge whether our actions are right or wrong. Ethics then, is an area of philosophy that we use to judge our moral standards and values and how they apply to our lives. If I believe that all people are equal, would it be ethical for me to design a programme evaluation that would exclude some members in the sample study from experiencing the benefits of the actual programme?
Ontology	What is the nature of reality?	Is there one reality that I can discover? Or are there multiple realities that differ, depending on the experiences and conditions of the people in a specific context? Do I, a white, hearing South African middle-class male, understand the life of a Ugandan, deaf, low-income immigrant? Whose reality is real?
Epistemology	What is the nature of knowledge? What is the relationship between the one who knows and that which could be known?	How should the evaluator relate to the stakeholders? Do you as the evaluator objectively stand apart from the stakeholders, or do you engage with them in deep conversation and in their activities?
Methodology	What are the systematic approaches to gathering information about what would be known?	Do you need to compare two groups, or can you document progress by intensively studying one group? Should you use quantitative, qualitative, or mixed methods approaches?

Table 2.1 explains the four major assumptions that provide paradigms with their unique form and function. Table 2.2 presents, in turn, the four major paradigms that are prevalent in today's evaluation community, which are the post-positivist, pragmatic, constructivist, and

transformative paradigms (Mertens & Wilson, 2012). The boundaries between these paradigms and the evaluation approaches associated with them are not clear-cut. Rather, each paradigm can be considered as placing dissimilar emphases on diverse theoretical assumptions. However, overlapping among the paradigms through the permeable boundaries that define them is still possible (Mertens & Wilson, 2012). These four paradigms are explained in Table 2.2.

Table 2.2: Major paradigms in evaluation (Mertens & Wilson, 2012:41)

Paradigm	Branch	Description
Post-positivist	Methods	Focuses primarily on quantitative designs and data.
Pragmatic	Use	The focus is primarily on data that are found to be useful by interested parties and stakeholders; and proposes the use of mixed methods (combining quantitative data gathering techniques with qualitative data gathering techniques).
Constructivist	Values	The focus is primarily on the identification of multiple values and perspectives by utilisation of qualitative methods.
Transformative	Social Justice	The focus is primarily on viewpoints of disenfranchised communities and differential power structures. Mixed methods are advocated to further social justice and to protect human rights.

Apart from the broad ideological drivers of evaluation, the implementation of evaluation focuses on the effectiveness of the short, medium and long-term aspects that could cause a programme to either be effective or ineffective. Regardless of one's paradigmatic stance, the evaluation of the programme should be based on a formative, summative, process, or product approach, or even a combination of these approaches (Mertens & Wilson, 2012).

2.2.3.2 Formative and Summative Evaluation

The process of formative evaluation produces data that is iteratively fed back during the development of a programme or curriculum. This occurs in order to help improve it and is of very high importance to the developers of programmes and curricula (Weiss, 1998). Summative evaluation is exercised at the conclusion of the programme and offers information about the efficacy of the curriculum to programme planners and decision makers within the organisation (Weiss, 1998). The nature of the outcome of a summative evaluation will determine if the programme can be adopted as an effective training programme or intervention measure (Mertens & Wilson, 2012). However, certain limitations to the conceptual framework of this study precluded the researcher from having made inferences where the effect of the programme alone could be seen as responsible for any modified behaviour. See section 3.4.5 in Chapter three regarding the stated limitations of this research.

Should a programme yield disappointing summative information, it need not be summarily discarded, but can be re-implemented with a greater emphasis on formative evaluation during the programme's course in order to learn more about the possible failures of the programme (Daponte, 2008). Formative evaluation should be considered as a necessary ongoing practice during the life of a programme or intervention as programme's adapt and transmute in response to conditions inside and outside of the programme agency (Weiss, 1998). Scriven (1967) coined the phrase formative and summative evaluation' and in a later writing he offered the following simplistic defining example:

> When the cook tastes the soup, that's formative evaluation; when the guest tastes it, that's summative evaluation" (Scriven, 1991:19).

Formative and summative evaluation are formulated to yield different sets of data and are driven by the objectives of the evaluator/researcher in undertaking the inquiry – should the resultant data help develop the programme's ongoing delivery or should the data render judgement on its effectiveness. In contrast, process and outcome evaluation is concerned with the stage of the programme under study, which could either be at its completion (outcome) or during the course of the programme (process) and does not refer to evaluator's role (Weiss 1998). This research is situated as a summative evaluation with a focus on the outcome stage, but this does not mean that formative evaluation is not important to this researcher. It is simply a stage within the overall evaluation parameters that provides answers to the programme originators and provides a baseline on which to perform further formative studies (Weiss, 1998).

2.2.3.3 Outcome evaluation and process evaluation

Outcomes relate to the resulting products at the conclusion of the programme for the target group it was designed for, and includes both intended and unintended outcomes (Weiss, 1998). Outcomes could also refer to results, effects, or impact. In some circles, outcomes refer to the immediate results or effect of a programme and impact on the longer term effect once the programme's change is evident in the participants' attitudes and behaviours in the workplace (Weiss, 1998). In a more practical sense, impact could also refer to the financial gains or losses in an organisation as a result of the intervention programme (Kirkpatrick, 1998).

According to Weiss (1998:9), confirming that a programme is doing what it is supposed to do requires an evaluation approach that is concerned with the process of the programme's implementation where the following five core questions drive this process:

1) What kind of service are the participants being given?
2) Is the service following the prescriptions of the programme developer?
3) Participant attendance?
4) What are the problems encountered?
5) Are clients satisfied with the programme?

In other words, a process-evaluation approach focuses on what goes on inside the programme whilst it is still being offered (Weiss, 1998). According to Mertens & Wilson (2012), and building on Weiss's (1998) stance, evaluators need to ask the following questions in order to further focus the lens of inquiry regarding outcomes and processes:

a) To what extent are the objectives of the programme still valid?
b) To what extent are the activities and outputs of the current programme consistent with the overall aims of the programme and the intended outcomes?
c) How do these activities contribute to the attainment of the objectives?

Formative evaluation and process evaluation may appear as alternative descriptions for the same thing, but there is a difference in emphasis. Both formative evaluation and process evaluation should come into effect in the early stages of the programme's implementation. Process evaluation explores and delivers data on what goes on inside the programme while it is in progress with an emphasis on things such as participant enrolment, activities offered, actions taken, staff practices and client actions (Weiss 1998).

Outcome evaluations put the emphasis on what happens to clients after their participation in the programme as a result of the intervention. Outcome data offers direction and could be used for structuring formative objectives, whereas process-data sheds light on the nature of outcomes and thereby informs policy-makers. This process aids in establishing the extent of summative guidance needed for future programme development (Weiss, 1998). The purpose of this summative-outcome evaluation is to provide answers to the HR department of ZF Services SA and to form the foundation for a future formative study.

2.2.3.4 Common approaches to evaluation

Worthen, Sanders & Fitzpatrick (1997:77) state that despite the diversity in approaches to programme evaluation, commonalities do exist. According to Brainard (1996:9), there is general consensus amongst evaluation practitioners that the evaluation process should be led through the following basic chronological steps: See Table 1 in Appendix E and Table 3.8 in Chapter three for procedures followed with this research.

2.2.3.4.1 Select the focus: Formative or Summative

In educational terms, formative evaluation yields information which is circulated back during the development of curricula/programmes, which assists in its improvement and to ensure that it serves the requirements of the developers. Summative evaluation is conducted at the completion of the curriculum. It provides information relating to the effectiveness of the programme to organisations which are considering adopting it or discarding it for the development of their staff (Weiss, 1998).

2.2.3.4.2 Select the information sources needed for the data gathering

This includes all the important players involved in the programme such as: the participants, supervisors, managers, and trainers (Caffarella, 2002).

2.2.3.4.3 Establish a timeline for measuring outcomes and impact

The duration of the time lapse between the delivery of the intervention programme and the collection of data allows for extraneous factors to skew the validity and reliability of the collected data (Cohen & Manion, 1994).

2.2.3.4.4 Select the approach: Quantitative, Qualitative or Mixed methods

Which approach is most effective in answering the research questions? Will the scientific method be more effective than the naturalistic method or will a combination of the two be the best approach? (Creswell, 2008; Tashakkori, & Teddlie, C. 2003).

2.2.3.4.5 Develop or select the instruments to collect the data

A decision has to be made whether standardised instruments will be utilised, or whether new instruments will have to be developed to suit the situation at hand (Creswell, 2008).

2.2.3.4.6 Collect the data

The method of data collection is vital for the inquiry to be deemed valid and reliable. Surveys, true experiments, quasi experiments, interviews, and observations are valid methods of data collection (Cohen, Manion & Morrison, 2000).

2.2.3.4.7 Analyse the data

Will the analysis be inductive, deductive, interpretive or perhaps statistical? (Creswell, 2008).

2.2.3.4.8 Conclusion

This involves drawing conclusions and writing a report.

Daponte, (2008) makes a strong proposal for the inclusion of at least one extra step in the eight step process above. A rigorous description of the programme's theory of change should be included in the form of a logic model. This approach forces the evaluator to become intimately acquainted with the programme, both theoretically and operationally. The principles of a logic model are described in greater detail in point 2.3.5. Building on Daponte's (2008:4) stance, evaluation activities can be further focused by incorporating an evaluation model or framework in order to give structure to the inquiry (Worthen *et al*., 1997). Evaluation models are described in greater detail in point 2.3.6.

Sections 2.1 and 2.2 focused more on general evaluation nomenclature, where the terms assessment and tests are allied to the tasks and the outcomes for learners (Forsyth, Jolliffe, & Stevens, 1999). In addition to being concerned with tests and assessing learner performance, programme evaluation also focuses on the effectiveness of course support materials, presentation of content to the learners, as well as the personal (trainee) and organisational impact as a result of the training programme (Forsyth *et al*., 1999).

2.3 Programme Evaluation

A programme's life cycle is dynamic and by implication, evaluation methods need to be tailor-made for the different programme stages during its life cycle. Such an approach provides programme designers with structured assistance regarding the types of evaluation which are most appropriate over the protracted life cycle of social and educational programmes and change-interventions (Scheirer, 2012). By employing an appropriate repertoire of methods to inform on the different stages of an evaluation, programme evaluation could be seen as a managerial action and function whereby programme data are

collected on a planned and ongoing basis. This methodological collection of programme dynamics could be employed for programme improvement and decision making (Scheirer: 2012).

Apart from the stages of evaluation which could be during the process or product (outcome) stage of the programme offering, Scheirer (2012:264) lists four additional elements that describe a programme's life cycle as it progresses through the process and product stages. These four elements describing a programme's life cycle are depicted in Figure 2.2.

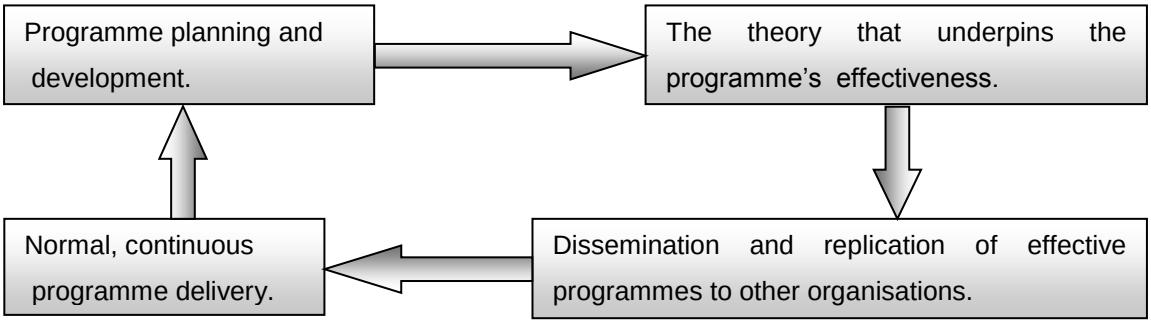


Figure 2.2: The four elements of a programme's life cycle (Scheirer, 2012:264)

2.3.1 Rationale for programme evaluation

Scheirer, (2012:266) explains by way of a three-fold rationale the main reasons for organisations to implement some form of programme evaluation.

1) Evaluation for accountability: Funders and stakeholders are always interested in determining the appropriate use of funds. Figures, statistics and performance-measurement are essential for this purpose. Assessing efficiency requires determining the costs per unit of service and/or per capita, which relates directly to accountability.
2) Evaluation for causal knowledge: Evidence is required that the intervention/programme is indeed responsible and to what degree it is responsible for causing the intended outcomes and unintended outcomes. This is also called impact evaluation or evaluation of effectiveness.
3) Evaluation for programme improvement: Continuous collection of data for programme management often involves keeping track of data on different levels and using this data for short-term outcomes and impacts. A utilisation-focused approach is essential for measuring outcomes on different levels especially since immediate, intermediate and long-term impacts/outcomes need to be correlated.

This research contains elements of all three these areas mentioned above as ZF Services SA requires evidence of efficacy for justifying the ongoing offering of the programme under study with the added future improvement of the programme as a natural extension of the current programme stage.

According to Caffarella (2002), the practical outcomes of learning, transfer, and impact are paramount to organisations as they are designed to meet the intervention objectives in an area of concern such as the clutch-intervention-programme in this research. Learning is defined as a combination of changes in learner's knowledge, attitudes and skill-sets that result directly from the programme or intervention. Transfer relates to the application of newly learnt content at the work place after completion of training. Impact relates to the improvement in the observable performance of the organisations' employees with evidence of altered behaviour and improved work output (Wiesenberg, 2000).

The purpose of empirical measurement on the three-fold rationale as mentioned above is to provide concerned stakeholders with a data-based document regarding the failures and successes of the programme for confirmation if it remains appropriate for its target population. This document should also provide analysis and recommendations for clear actions to be taken for areas where the programme works but still requires alteration. Empirical measurement also informs on the programme's current effectiveness and also relates to students' perceptions about the programme (Wiesenberg, 2000).

2.3.2 Programme evaluation defined

In order to establish the scope and intensity of a programme or intervention in bringing about the desired outcomes, programme planners and developers have to extract sensible data from the programme activities on which the level of success or failure of the programme can be based (Scheirer, 2012; Daponte, 2008). Therefore, programme evaluation in its most simplistic form can be described as a weighing of one thing against another (Weiss, 1998).

Thorpe (1988:32) offers a more specific definition for programme evaluation in educational terms, by suggesting that:

> "Evaluation is the collection of, analysis and interpretation of information, about any aspect of a programme of education or training, as part of a recognised process of judging its effectiveness, its efficiency and any other outcomes it may have".

Weiss (1998:4) provides this defining statement for programme evaluation:

> Evaluation is the systematic assessment of the operation and/or outcomes of a programme or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the programme or policy.

Fournier (2005:139) defines programme evaluation as:

> Evaluation is an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, value, merit, worth, significance, or quality of a programme, product, person, policy, proposal, or plan.

The way in which a programme operates, together with the eventual outcomes, cannot be separated from the initial planning of the programme as there is an inherent logic in the programme outcomes that is irretrievably part and parcel of the initial planning of the programme and the way in which it should be evaluated in terms of its effectiveness (Caffarella, 2002; McLaughlin, 2004; Wiesenberg, 2000; Frechtling, 2007). For the purpose of this research, Weiss's (1998) definition as mentioned above is chosen as this research focuses on the outcome of the programme as compared to the explicitly stated standards contained in the clutch-fitment-protocol.

2.3.3 Programmes

2.3.3.1 What are programmes?

Education and training programmes, or interventions for adults, are varied in terms of their formats, expansiveness, and instructional design. They could be simple information sessions or skill workshops spanning only an hour or two. They could also be day-long workshops or conferences to intense main-stream programmes at colleges, technikons and universities. In these institutions the focus is on wholesome development or adding to some aspect of the lives of the target student community with the overall aim of enhancing opportunities for productive lives (Caffarella, 2002; Scheirer, 2012). Programmes are, by their sheer diversification, complicated phenomena which are established on solid historical knowledge and experience as well as professional lore. The ultimate aim of programmes is to nurture lasting change (Caffarella, 2002; Weiss, 1998; Daponte, 2008).

Caffarella (2002) describes three broad categories for anticipated change that effective programmes should strive for:

1) Change in the individual related to transfer of new knowledge, developing of skill-sets, and examination and adjustment of personal values, attitudes and beliefs.
2) Organisational change by virtue of new or revised policies, methods of job execution and general procedures.
3) Societal change by nurturing differing segments and sub-cultures of general society to embrace alternate world views and in so doing respond appropriately to their environment and world in alternative ways.

According to Knowles, Holton, & Swanson (2012), effective programmes for adults need to take into consideration the particular approach that adults in the work place have towards learning. It is counterproductive to blindly configure the programme around what is traditionally understood under the principles of pedagogy and conventional classroom teaching and learning. The major differentiating factors between pedagogy and andragogy are centred in five areas: adults are self-directing; more diverse in experience; their readiness to learn can be initiated by efficacious role-models; adults are life-centred, task-centred, or problem-centred; adults are driven by internal motivators such as better quality of life or self-actualisation (Marquardt & Waddill, 2004). The unique learning principles (Andragogy) of adults are further expounded upon in section 2.3.3.2.

2.3.3.2 Intervention programmes for adults

Learning implies a change-process and relates to the acquisition of new habits, knowledge, and altered attitudes (Knowles *et al*., 2012). It empowers the individual to realise both social and personal adjustments. Since the concept of change is embedded within the domain of learning, any change in behaviour offers, by implication, the possibility that learning is taking place or has already taken place (Knowles *et al*., 2012).

Adults are motivated differently in the learning process than younger learners and therefore planners of intervention programmes for adults should take cognisance of the adult's peculiar orientation to learning, as well as the greater diversity in entry characteristics than those of younger learners (Knowles *et al*., 2012). According to Caffarella (2002), and Knowles *et al*. (2012), approaching adult learning from a pedagogical perspective will certainly result in a programme that is not as efficient as it ought to be as the andragogical principles that support effective adult learning differ significantly and dynamically.

Adults typically have a relatively diverse repertoire of knowledge and experience and learn best when their prior learning and experience is taken into account and new information is allowed to build on their past knowledge and experience (Caffarella, 2002). Adult motivation is largely driven by unique sets of external and internal forces as adults have acquired preferred and different ways of processing information. Adult learners are pragmatic in their learning and will engage more willingly in learning due to their desire to meaningfully apply newly learnt content to their present situations. Adults have strongly formed personal goals and objectives and as they don't respond well to being passive in the process of knowledge exchange, active involvement in the learning process could enhance the achievement of the stated goals and objectives of the programme.

By virtue of the degree of physical and psychological comfort within the learning milieu, adults embrace independent modes of learning or collaborative and interdependent modes of learning and can easily switch between modes (Caffarella, 2002). How adults learn, and what and why they learn are easily impaired or enhanced by the role they fulfil such as worker, parent, boss, and spouse. Other personal contexts such as gender, race, social class, culture, and ethnicity also impact on the way they immerse themselves in a learning task (Caffarella, 2002).

A programme cannot be expected to deliver on the objectives that it is built upon if the programme is not designed and configured on certain essential foundations that are critical for the desired changes in learning, attitudes and behaviour to take place (Kirkpatrick, 1998).

2.3.3.3 Foundational principles of effective programs

According to Weiss (1998), the evaluation community is often so preoccupied with the models and methodologies of programme evaluation that they lose focus of the actual programme itself, the theory of change that underpins the very core of the programme, and the actual foundations that the programme was initially built on. Weiss (1998) encourages evaluators to pay close attention to the programme, familiarise themselves with the general field of study early on in the study, and learn as much as possible about the peculiar trends and phenomena of the programme under study as the evaluation progresses. Evaluators should also have a clear understanding of how the programme is expected to bring about the required change and what the theories are that support this expectation of change (Weiss, 1998; Daponte, 2008).

Caffarella (2002) promotes seven elements to be regarded as foundational for any programme to be considered as effective and which should be considered during a programme evaluation. Caffarella's (2002) seven elements are discussed under section 2.3.3.3.1 through to 2.3.3.3.7.

2.3.3.3.1 Context of the programme/intervention

Organisational diversity in terms of culture, gender, ethnicity, background, qualifications, experience, and organisational structure (mission, goals, and objectives) has to be afforded careful consideration when designing a programme/intervention that is meant to bring about the desired changes.

2.3.3.3.2 Support base for the programme/intervention

A programme will not achieve its full effect if all the critical role-players are not committed to the short, medium, and long-term changes and impact that the programme is meant to achieve through its stated objectives (Kirkpatrick, 1998). This required commitment is especially true for the target population of the programme, but it is equally important for immediate managers and supervisors to completely embrace the programme.

2.3.3.3.3 Organisational needs analysis

In some cases, organisational problems are quite glaring and it may initially appear to be easily solved by putting together an intervention programme (Kirkpatrick, 1998). However, programmes often only address a symptom and fail to cut to the root-cause of the observed problem. Conducting a highly structured needs analysis through a structured process of inquiry is very time consuming and expensive, but will in all likelihood shift the lens of inquiry to previously ignored areas of influence. Programmes need to address all the possible variables of significant value in order to be truly deemed effective. One significant advantage of conducting a structured needs-analysis is that the outcome of such an inquiry establishes a sound theory of change for the intended programme and the evaluation plan can be shaped from the inception of the programme idea (Daponte, 2008).

2.3.3.3.4 Programme/intervention objectives

Without any clear objectives, there cannot be any clear, measurable outcomes whether they are intended or unintended (Kirkpatrick, 1998). Programme objectives provide clear statements of the expected results to be achieved through training and intervention

programmes. Additionally, programme objectives serve as the keystone of instructional plans, tangible guidelines for developing transfer-of-learning plans, and realistic benchmarks against which programmes are evaluated. In contrast, programme goals usually refer to training programme's broad proclamations of purpose or intent. They provide answers to such questions as: (a) Why do we have to do this? (b) Why is the programme valuable? Programme planning, design, and evaluation revolve around the eight elements, as depicted in Figure 2.3:

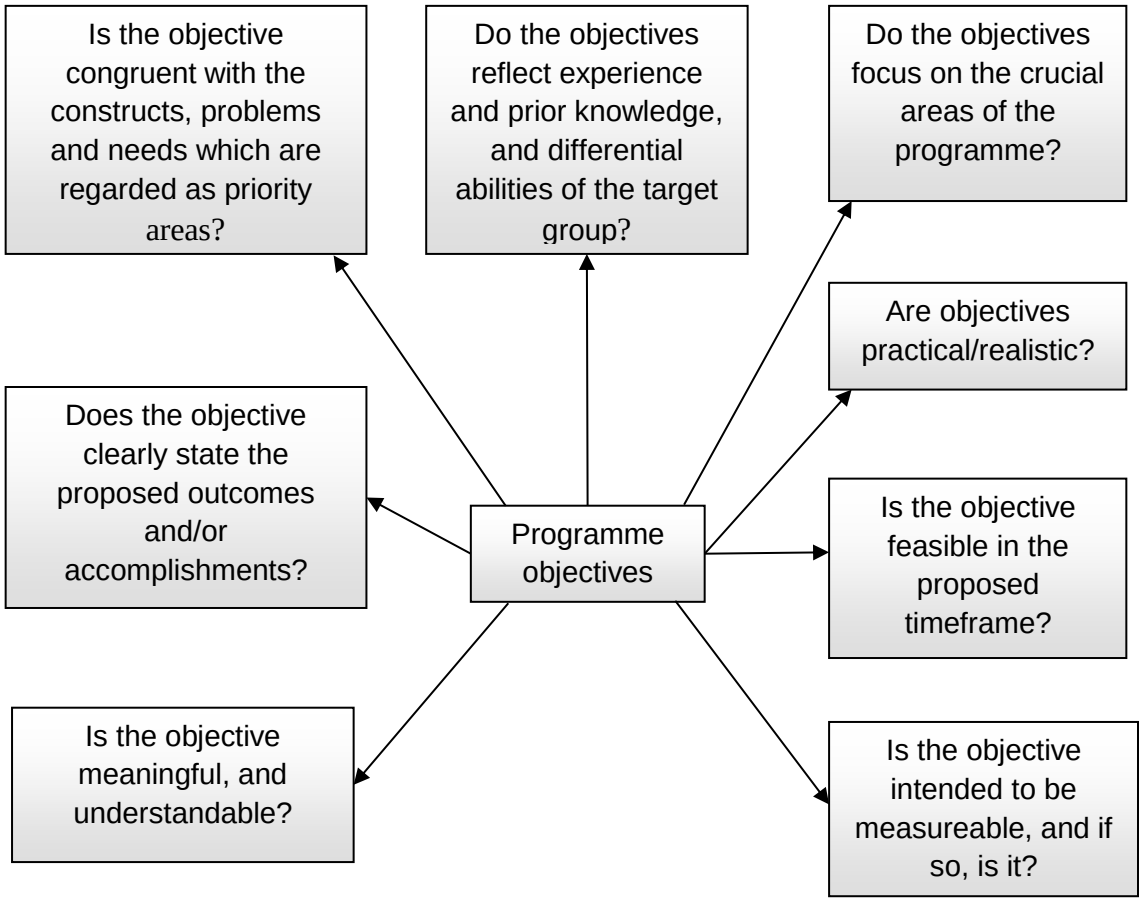


Figure 2.3: Programme objectives (Caffarella, 2002:23)

2.3.3.3.5 Instructional plans

Learning objectives, performance objectives, or learning targets, set the descriptive parameters of what participants should learn as a result of attending a training programme. These learning objectives are set within the context of the overall programme objectives and goals with the focus on participant learning, so there is continuity between the two sets of objectives (Caffarella, 2002).

The practical difference between programme and learning objectives is that the focal point of learning objectives is he expectations for individual participants and modules within a larger programme, while programme objectives relates to the expectations of the education or intervention programme as a whole.

Table 2.3, as adapted from Caffarella (2002) illustrates how programme objectives for an automotive programme such as the intervention programme under study could be formulated and how they are translated into learning objectives:

Table 2.3: Programme objectives and learning objectives (adapted from Caffarella, 2002)

Programme objectives	Learning objectives
To provide an intervention programme for Automotive Service Technicians on the correct installation of a clutch assembly. Three outcomes are expected as a result of this programme: 1. Automotive Service Technician's will demonstrate a change in knowledge by correctly answering a series of questions on clutch installation. 2. Automotive Service Technician's will demonstrate a change in behaviour by installing a clutch in the correct manner. 3. The premature failure rate of newly installed clutches will drop significantly.	The participants will: 1. Carry out a verification process on the vehicle specifications in order to determine if the failed components were perhaps incorrect for the vehicle and identify the correct components for the vehicle. 2. Conduct a thorough preliminary inspection on all related components. 3. Remove the failed components according to the correct protocol. 4. Conduct a failure analysis on the failed components in order to isolate the cause/s for premature failure. 5. Prepare the vehicle and new components for installation. 6. Carry out the new installation according to correct protocol.

The major categories of learning outcomes for most intervention programmes are: acquisition of knowledge, strengthening of problem-finding skills, and changes in attitudes, values, beliefs and behaviours. Learning objectives are further useful to provide a focal point and consistent model for the design of instruction and serves as a guideline for collecting course content and instructional methods. Learning objectives form the benchmark for assessing what participants have learned and offers learners assistance in organising their own learning.

2.3.3.3.6 Transfer-of-learning plans

The construct of transferring learning points to effective application by trainees and participants of programmes relates to what they learned as a result of attending a training or intervention programme (Kirkpatrick, 1998). Transfer of learning is strongly thought of in behavioural terms. In other words, that which is to be transferred can be unambiguously specified in terms of observable changes in knowledge, skill-sets, attitudes and behaviour on

the job. For organisations to remain consistently competitive in the global and local marketplace they have to sustain the preparation of highly skilled workers, therefore, improving the transfer of learning should be highly prioritised (Ersoy & Kucuk, 2010).

Many variables are dynamically at play in allowing for behaviour modification to take place at the workplace or conversely, to prohibit desired behaviour modification from occurring (Kirkpatrick, 1998). Besides variables within the programme and its delivery which are still relatively within the training provider's control, many powerful variables exist within the organisational context as well as the trainee himself/herself (Caffarella, 2002). Table 2.4 explains seven categories of potential barriers to transfer of learning which could affect the results of a summative evaluation negatively:

Table 2.4: Potential barriers to the transfer of learning (adapted from Caffarella, 2002:212)

Potential barriers	Description
Programme participants	Required prior knowledge and experience are lacking (Kraus, 2001; Wood & Lynch, 2002; Seifert, 2004). Group exclusion (Probyn, 2001). Lack of motivation or confidence (Probyn, 2001). Possesses no authority to implement changes (Kirkpatrick, 1998). Cultural background is ignored (Probyn, 2001). Qualifications: (Spitz-Oener, 2006). Expert and novice learners: (Kalyuga, Ayres, Chandler & Sweller, 2003).
Programme design	Instructional methods invokes passive learning (Caffarella, 2002). Applications context is far removed from training context (Kirkpatrick, 1998). No transfer of learning strategies are included (Caffarella, 2002).
Programme content	A disparity exists between the strategic goals of the organisation and/or life roles of individual participants (Probyn, 2001). Too little content (Caffarella, 2002). Knowledge is the focus when skill and attitude changes are required (Krathwohl, 2002) Not relevant or usable (Kirkpatrick, 1998).
Programme delivery	Pace is too fast and concepts are not repeated enough (Probyn, 2001; Boaler *& Brown*, 2000; Ebner & Holzinger, 2007:876). Language: Second or third language learners are disadvantaged (Block, 2009; Howie, 2003; Foley, 2004; Probyn, 2001). Trainer effectiveness: (Kirkpatrick, 1998; Praslova, 2010; Arthur *et al*., 2003; Koon & Murray, 1995).
Changes required to apply learning	Unrealistic and too disruptive to present practice, actions, and/or beliefs Time requirements for change are not considered or unrealistic (Seifert, 2004:145). Perception is that no real opportunity exists to apply what is learned (Kirkpatrick, 1998).
Organisational context	Climate of resistance to innovation and change (Kirkpatrick, 1998). Support from peers, supervisors, and managers is weak or non-existent (Kirkpatrick, 1998). Financial and other resources are inadequate (Kirkpatrick, 1998; Caffarella, 2002). Reward systems work against applying what has been learned (Kirkpatrick, 1998).

Community or societal forces	Little recognition that cultural differences affect the transfer process (Probyn, 2001). Key leader is hostile to this change (Kirkpatrick, 1998). Political climate is not right (Kirkpatrick, 1998; Caffarella, 2002). Economic conditions are adversely affected (Kirkpatrick, 1998; Caffarella, 2002). Community and/or societal norms are not supportive (Kirkpatrick, 1998; Caffarella, 2002).

Successful programmes/interventions that help ameliorate a recurring problem ought to be based on a well-defined theory, framework or model of how the programme is meant to bring about the desired or modified outcomes. If the programme is based on an incorrect theory, the desired changes, irrespective of the quality of implementation will not be realised (Bamberger, Rugh, Church & Fort, 2004; Astbury & Leeuw, 2010). All the different principles that make up the domain of andragogy as discussed in section 2.3.3 together with personal experience and paradigmatic stances are the tools that programme designers, planners and evaluators rely on to position a programme within a theoretical frame that explains the programme's rationale for bringing about change (Weiss, 1998; Knowles et al., 2012).

2.3.4 Programme Theories

2.3.4.1 Definition

In the very early efforts to build programme evaluation as a discipline, scientific research methods were greatly emphasised in many pioneering works in their attempts to define and conceptualise programme evaluation (Chen, 1990). Yet with such a great emphasis on research methods in conceptualising and defining programme evaluation, the implications of the theory that underpins the programme's intention to change tended to be ignored (Chen, 1990).

According to Weiss (1998), a programme's theory of change is simply a set of convictions or beliefs that underpins action, and needn't necessarily be highbrow or multi-syllabic as its purpose is to postulate a series of related hypotheses upon which professionals build their programme plans. Daponte (2008) agrees and states that a programme's theory is a set of causal links that tie programme inputs to expected programme outputs and is representative of a credible and sensible archetype of how a programme is meant to function. More specifically, programme theory refers to the mechanisms that play a mediatory role between the delivery of the programme and the way in which it is received.

This also comprises the outcomes derived, which include such elements as programme resources, programme activities, and programme outcomes in the short, medium and long-term (Weiss, 1998; Donaldson & Lipsey, 2006).

Callow-Heusser, Chapman & Torres (2005) define programme theory as the collection of underlying expectations regarding the unique programmatic operations. These operations produce the desired social benefits, and the strategic, tactical identity that describes the programme in the achievement of its goals and objectives. It is important to recognise that in programme theory, "theory driven" as the presumed strategy does not necessarily have to be derived from a research base. Research-driven theory is entirely possible, but it is also acceptable to have programme theories that are based on practitioner experience (Frechtling, 2007).

In section 2.3.4.2 the difference between programme theory and evaluation theory is explained.

2.3.4.2 Theory-driven Evaluation

Theory-driven evaluation has its origins with Tyler in the 1930's but it was not until 1990 with the publication of Chen's seminal book, Theory-driven evaluations, that theory driven evaluation came into sharp focus (Coryn, Hattie, Scriven & Hartmann, 2010). A theory-driven programme evaluation requires the programme to be based on an explicit and/or implicit theory with regard to the most effective and efficient way to achieve the intended programme outputs and impact. The adopted theory has to also logically describe the factors constraining or facilitating the achievement of programme outputs and impact (Bamberger *et al*., Rugh, Church & Fort, 2004).

Theory-driven evaluation is also known as theory-based evaluation, theory-guided evaluation, and programme-theory evaluation, theory-of-action, theory-of-change, programme logic, and logical frameworks (Coryn *et al*., 2010). Rogers (2000) offers a more precise definition by stating that theory-driven evaluation is in concept and operation conceived on a precisely defined theory or pattern of how the programme is designed. Theory-driven evaluation is also designed to cause the intended or observed outcomes and an accompanying evaluation that is fully or partially steered by this pattern. Smith (2010:384) conversely proposes that evaluation theories are unlike the theories of science that provide empirically testable predictions but instead, evaluation theories are stated as conceptual loci or arguments suggesting a specific solution to some core question about evaluation practice

(Smith, 2010). Smith (2010) centres his description of evaluation theory on the purposes of evaluation. Evaluation theory is that aspect that reflects our understanding of the way and why we engage in evaluation by focusing the purpose of evaluation on the aspects of validation, accountability, monitoring, improvement and development.

Scriven (1998:65) proposes that a good theory of evaluation should include the following four elements:

1. The programme under evaluation ought to be supported by a theory of evaluation that allows for the entity to be evaluated so as to systematically and objectively measure it against the constructs of merit (quality), worth (value), and significance (importance).
2. Evaluation conclusions ought to be expressed in terms of ranking, grading, scoring, or apportioning. A different design is needed for each of these to determine the relative importance of outcomes (ranking), how performance compares to a standard (grading), how outcomes compare (scoring), and how resources should be distributed (apportioning).
3. In order to move forward from recommendations or explanations, additional knowledge beyond the evaluative data is needed (e.g. contextual variables, organisational culture; political considerations)
4. The general course of an evaluation inquiry will normally involve determining some and often all of the following: the nature of the questions, context, stakeholders, underlying assumptions and context, nature of the evaluation, needs assessments, objectives, evaluation criteria and weight per criterion, identification of quantitative and qualitative standards, performance achievements, observation, experimentation, data analysis, and conclusion statements.

Stufflebeam and Shinkfield (2007:63) state that a programme theory should have six components:

> "overall coherence, core concepts, tested hypotheses on how evaluation procedures produce desired outcomes, workable procedures, ethical requirements, and a general operational framework for guiding programme evaluation practice and conducting research on programme evaluation".

2.3.4.3 Programme Logic

The core of theory-driven evaluation resides in the explicit programme theory and is usually conceived as flow-charts that specify the logical inter-relationships among programme activities, outcomes, and other instrumental variables, but they are also often expressed in table format, or as narratives (Coryn *et al*., 2010).

Two vital components are responsible for making up the core of theory-driven evaluation. The first component is conceptual, and the second component is empirical (Rogers, 2000; Astbury & Leeuw, 2010). Coryn *et al*. (2010:203) explain that conceptually, theory-driven evaluations should explicate a programme theory or model, and empirically seek to investigate how programmes cause intended or observed outcomes (Coryn *et al*., 2010).

The core elements that describe a programme theory normally include an input category, an activity category and an output category, which collectively describe the theory supporting a programme's process. This type of flowchart usually also comprises a product category where a description of the programme's initial outcomes, intermediate outcomes, and long-term outcomes (impacts) are made available and is often described as a programme impact theory (Coryn *et al*., 2010; Bamberger *et al*., 2004). See the flow diagram (logic model) in Figure 3.1 in section 3.4 that depicts this study's proposed theory of change.

The planning, design and implementation of a programme normally follows a logical linear path (from left to right), residing within the two fields of process and product. But each operational element within these two fields could be iteratively visited and adapted and the evaluation design could follow a linear or non-linear path according to the evaluation purpose of the study at hand (Caffarella, 2002). A simple linear type of this model of programme theory is shown in Figure 2.4.

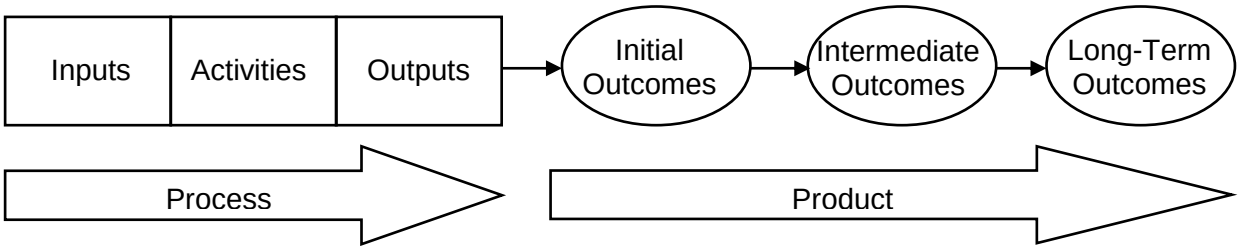


Figure 2.4: Linear programme theory model. Adapted from Donaldson (2007)

The input category for this linear representation of a programme theory model includes diverse types of resources for the implementation of a programme (such as human resources, physical resources and financial resources). Programme theory models of this nature relate to the category of activities as being the physical actions (such as training delivery and service delivery) that are undertaken as the operational part of the programme process (Coryn *et al*., 2010). The output category describes the immediate results of an action (such as the number of training sessions and number of trainees, or number of services provided and to whom). The outcome describes the anticipated/or planned changes that should occur as a direct or indirect consequence of the combined efforts of inputs, activities, and outputs. Initial outcomes are usually immediately measureable and can be described as knowledge acquisition, skill-set enhancement, newly acquired abilities, attitudinal changes and other characteristics (Coryn *et al*., 2010; Mayne, 2001).

Intermediate outcomes are often classified as behavioural changes founded on the principles of knowledge transfer. Programme theories usually depart from the assumption, as based on past experience, that intermediate outcomes will gradually influence long-term outcomes. Such changes could lead to the mitigation, decline, or eradication of specific problematic phenomena or, more specifically, meet the needs of a programme's target group as determined in a needs-assessment study (Coryn *et al*., 2010; Dyehouse, Bennett, Harbor, Childress & Dark, 2009; McLaughlin, 2004; Mayne, 2001).

Bamberger et al. (2004) add two extra elements to the basic linear type of programme theory model, as discussed in Figure 2.2. The first element is concerned with how the project was designed, for example: was the programme designed with a set of interventions in mind, with the expectation of producing certain outcomes, or alternatively by pre-determining a desired impact and then establishing how best to design appropriate interventions? The second addition to the standard programme theory model, as proposed by Bamberger *et al*. (2004) identifies contextual factors. Contextual factors should include the organisational context, economic and political factors, as well as the socio-economic characteristics of the target population (Bamberger *et al*., 2004).

Another key element that theory-driven evaluation is known for is to establish the critical assumptions on which the chosen inputs, the choice of implementation processes, and the expected linkages between the different stages of the programme cycle are based and to monitor the effect of these assumptions.

Logical framework analysis (Logic Models) is a popular and widely used programme theory approach where the identification of critical assumptions is required and where the assessment of their validity at each stage of project implementation is also required (Bamberger *et al*., 2004; Astbury & Leeuw, 2010).

2.3.5 Logic models

Too often educational programme development and evaluation is over-simplified by only focusing on the end relationship between interventions and outcomes (Dyehouse *et al*., 2009). She also states that what is needed is a broader evaluation approach based on appropriate models that support the rationale that posits that interventions will result in the desired outcomes.

Regardless of the type of theory underlying a particular intervention or change approach, the key is in defining the elements of a programme or intervention, understanding their function and operation and bearing in mind their interrelationships and explicitly stating the nature and purpose of interconnections. Programme theory places special emphasis on spelling out the steps that should occur and detailing intermediate processes by way of a logic model (Frechtling, 2007).

The core functions of an evaluation model are to un-clutter and clarify the system, and to allow for a clearer structure whereby analysis of the programme can be made more explicit through separate analysis of the sub-components of the system. Furthermore, improvement of theoretical models becomes possible by minute analysis of the inner components and building on the logic of the system (Dyehouse *et al*., 2009). Apart from the application of Logic models in other settings, the concept has been applied with great success to model programme evaluation in educational settings and logic modelling offers a utilisation approach as a possible alternative to other methods in representing programme theory (Dyehouse *et al*., 2009).

The logic model presents the hypothesis of how the programme is expected to work to produce the intended results. Should the logic model not be implemented according to the design for a particular programme, problems may arise and inhibit the realisation of programme goals (McLaughlin, 2004). An iterative approach may be applied whereby the appropriate theory-in-use is first identified, followed by revisions of the espoused theory or adjusting the implementation of the espoused theory (McLaughlin, 2004).

By following such a suggested process, evaluators can be confident that the programme design is constructed in a logical manner, that it is complete, and that it portrays what programme staff and stakeholders believe to be an accurate picture of the proposed programme (McLaughlin, 2004).

Logic modelling within the context of programme evaluation adds enormous value by adding structure to the entire evaluation process and clarifies what is really intended in a project, programme or policy, and enhances communication among project team members (Frechtling, 2007). Once the theory of change is articulated, certain identified key points need to be monitored so as to ensure that all activities are being executed according to schedule and that problems are not allowed to develop unnoticed (Frechtling, 2007).

Once the logic model is developed and understood, the individual parts of the model set out important guideposts for the evaluation and the questions that might be addressed. The activities or strategies identify opportunities for formative evaluation, assessing implementation and whether or not the plan is proceeding as envisioned. The outcomes identify results that must be examined in the summative evaluation (Frechtling, 2007).
The logic model becomes a map that guides others who may want to replicate the project or adapt it to other situations. It is useful to also document theories of change that did not quite work. This documentation is especially useful if reasons for the failure can also be offered and explanations offered for why the theory or theories did not hold (Frechtling, 2007).

A logic model can be used to describe the theory of change underlying the programme and address all the functions as described for the project. It clarifies what it is about, enhances communication, manages the programme, as well as structures the scaffolding of its evaluation. Tried and tested evaluation models can be incorporated into the logic model to enhance the structure and make actions and activities more clear (Mertens & Wilson, 2012).

The intervention programme (guidelines to clutch replacements) under investigation was conceived in Schweinfurt Germany by ZF warranty engineers as previously mentioned and follows a linear programme model. The conceptual framework supporting such programme models is relatively simple and follows a strict “left to right” path (see Figure 2.4) as exposure to such programmes are very restrictive and very distinctive outcomes are objectivised for evaluation (Caffarella, 2002). Kirkpatrick’s (1998) four level framework has been proven to be of substantial utility-value to organisations especially where a verdict is required on the overall impact of technical programmes (Wang, 2009). The linear logic model representing the theory of change for the programme under study is shown in Figure 3.1 in Chapter three.

2.3.6 Programme Evaluation Models

Evaluation models are structured proposals that offer pragmatic and sensible solutions that include deeper ideological constructs. These constructs provide a congruent and adaptable collection of guidelines for the execution of an evaluation (Smith, 2010). According to Mertens and Wilson (2012) models can be thought of as a set of parameters with rules, specifications, and restrictions and guiding frameworks that specify what an acceptable and proper evaluation is and how it should be carried out. However, models fall short of the status of being called theories because they do not strictly meet the test requirements to be a theory as they are merely heuristics that simplify reality to help us understand, predict, make decisions, and plan actions (Mertens & Wilson, 2012; Rogers, 2000).

The evaluation of educational programmes is known to have a long and troubled history, plagued by definitional and ideological disputes (Wiesenberg, 2000; Worthen *et al*., 1997; Stake, 2004). The proliferation of evaluation models as seen over the past fifty years poses a perplexing dilemma for the practitioner who is puzzled about which model is best for his purposes (Worthen *et al*., 1997; Smith, 2010). Worthen *et al*. (1997) explain that the philosophical and ideological differences among evaluation theorists and practitioners is the driving force in the ongoing practice of developing new evaluation models and thereby further fragmenting the field of programme evaluation.

Smith (2010) argues that the tendency amongst researchers in the evaluation community to focus on model-superiority by means of comparative studies leads to further confusion as to which model would be better than others to use in any given evaluation study. Smith (2010) points out that a deeper understanding of how models are embedded in ideology, intertwined with operational strategy and intervention principles will guide the evaluation community in separating the constructs of evaluation approach, evaluation theory and evaluation models as different operations within a prevailing philosophical and ideological position. According to Smith (2010), the term “theory” is often used as a substitute for the term “model” but erroneously so.

2.4 Existing Evaluation Frameworks

Many evaluation models have emerged in the past fifty years ranging from comprehensive prescriptions to checklists of suggestions (Worthen *et al*., 1997:). The proliferation of evaluation approaches and their respective implementation frameworks arose from the diverse backgrounds, mind-sets and personal paradigmatic stances of their authors.

This rich and diversified cauldron of evaluation ideas sprouted an assortment of philosophical proclivities, methodological partialities, and pragmatic predilections (Worthen *et al*., 1997; Stake, 2004).

Evaluation models or frameworks are merely suggested guidelines as to the course an evaluator should take and should never be blindly implemented. Instead, it should be thought through with regard to the specific purpose of the evaluation and adapted accordingly (Stake, 2004). By critical investigation of alternatives to programme evaluation, evaluators will develop and refine their craft by pondering on, assessing, and selectively applying different and appropriate evaluation frameworks (Stufflebeam & Shinkfield, 2007). Such scrutiny of evaluation approaches will assist in isolating the models or frameworks most suitable to "when and how" they are best employed. Adopting such a position as described above will offer the researcher/evaluator better direction for improving his/her approach, better alternatives can be formulated, and one's ability to conceptualise hybrid approaches to programme evaluation can be bolstered (Stufflebeam & Shinkfield, 2007).
A discussion of four time honoured evaluation models/frameworks that could be utilised for the purposes of this study follows.

2.4.1 The CIPP Evaluation Model

Stufflebeam (1971) has been one of the most influential and prolific supporters of a decision-orientated approach to evaluation, which is structured to assist administrators in making appropriate decisions. He developed an evaluation framework to support managers and administrators of programmes by postulating an evaluation framework consisting of four categories (Worthen *et al*., 1997). The first letters of each of the four categories - context, input, process, and product form the acronym CIPP. Each of the capital letters in the acronym represent an area of evaluation that can be included or excluded in an overall programme evaluation (Worthen *et al*., 1997).

2.4.1.1 Context evaluation

This evaluation area serves to plan decisions by determining the needs that are to be addressed by an intervention programme, thereafter, the programme's objectives are properly defined (Kirkpatrick, 1998). The objective of this area of evaluation is to identify the target group or population, define the organisational context, and assess their needs. In this category, opportunities for addressing the identified needs have to be determined, and obscure problems underlying the needs have to be identified. Judgements have to be made regarding whether proposed objectives are adequately responsive to the assessed needs

(Worthen *et al*., 1997). Gathering and analysing data in this area of evaluation is achieved by using such methods as document reviews, interviews, system analysis, diagnostic tests, as well as the Delphi technique (Worthen *et al*., 1997). The relation of this evaluation area to management in the change process pivots on the peculiar milieu (the setting to be served), the goals and objectives for meeting needs, and the plans and goals associated with solving problems in order to provide a basis for judging the outcomes (Worthen *et al*., 1997).

2.4.1.2 Input evaluation

This evaluation area serves to structure decisions. Identifying available resources and alternative programme strategies should be considered in this category, as well as which plans seemingly have the best potential for addressing needs as these are important factors in facilitating the design of programme procedures. The main objective of this area in this evaluation model is to identify and evaluate system possibilities and capabilities, alternative and appropriate programme strategies, careful designs for procedures of strategy implementation, as well as budgets and schedules (Worthen *et al*., 1997). The input category of this model requires a well-kept inventory of all types of data, record keeping of the appropriate material and human resources and keeping a library of old and newly proposed solution strategies. Thorough literature searches, scrutiny of exemplary programmes and procedural designs for feasibility, relevance and economy of possible approaches, advocate teams, and pilot trials are all necessary activities within this category (Worthen *et al*., 1997). The relation of this evaluation area to decision making in the change process pivots around scaffolding various change activities such as: identifying and establishing sources of support, formulation of solution strategies, logical procedural designs, as well as to secure a foundation for judging implementation (Worthen *et al*., 1997).

2.4.1.3 Process evaluation

This evaluation area serves to implement decisions. How well is the programme strategy being implemented? What learners pose a threat to its success? Is there a need for revisions, and what is the nature of the required revisions? Once these questions are adequately answered, procedures can be successfully monitored, evaluated and refined. The main objective of this category of evaluation is to detect early in-process anomalies in the evaluation design with regard to procedures and their enactment. This category also assists the evaluator to supply information for pre-determined decisions, and to monitor, judge and record procedural activities and events (Worthen *et al*., 1997).

Gathering and analysing data in this area of evaluation is achieved by identifying and monitoring this category's potential procedural hurdles, and by remaining alert to unexpected hurdles. This goes hand in hand with describing the actual process, ongoing interaction with and observing the activities of evaluation staff, and ensuring that specified information for programmed decisions are adhered to (Worthen *et al*., 1997). The relation of this evaluation area to management and decision making in the change process revolves around the implementation and refining of the programme design. This includes the ability to control the process as well as to provide a log of how the process actually played out for later use in the interpretation and analysis of outcomes (Worthen *et al*., 1997).

2.4.1.4 Product evaluation

This evaluation area serves to recycle decisions. What are the results and their nature that were obtained? To what extent were needs reduced? What should be done with the programme at its completion and after it has run its course? These questions are important in judging programme attainments. The main objective of this category of evaluation is to gather descriptions and judgments of all outcomes and to compare them to previously stated objectives. This category also compares previous descriptions and judgements to context, input and process information so as to form a reliable platform for interpreting their worth and merit (Worthen *et al*., 1997).

Gathering and analysing data in this area of evaluation is achieved by measuring against outcome criteria through the collection of opinions and judgments of the outcomes from stakeholders. This is done through the application of both quantitative and qualitative analyses (Worthen *et al*., 1997). This evaluation area relates to decision making in the change process by way of decisions whether to continue, cancel, adjust, or refocus a change activity, and to make available a clear record of outcomes (intended and unintended, positive and negative) (Worthen *et al*., 1997).

2.4.1.5 Strengths and Limitations of the CIPP evaluation model

Worthen *et al*. (1997) explains how this model of programme evaluation can be used with an emphasis on different areas, as demanded by the evaluation setting. Cronbach (1963) and Reinhard (1972; 1973) have both made valuable contributions to this model, should the evaluation want to focus on the process of programme delivery or the programme's impact respectively (Worthen *et al*., 1997).

This approach to programme evaluation is non-linear and the evaluator can easily focus his attention on the areas of evaluation applicable to the programme under study (Worthen *et al*., 1997). Thus the CIPP evaluation model's main attraction lies in its inherent adaptability and simplicity. Worthen *et al*. (1997) continues to explain that the model's strength is in a way also its weakness in the sense that it is designed to be driven by management and, in cases where management is not in full control of the programme, the stated objectives cannot be reached.

The CIPP evaluation model is largely driven by top management and the danger exists that an undemocratic situation can develop whereby the programme and its evaluation becomes a manipulating tool in the hands of an individual (Worthen *et al*., 1997). Another danger inherent to the CIPP model is that if priorities are not carefully set and followed, the many questions to be addressed using a management-orientated approach can clamour for attention, leading to an evaluation system as large as the programme itself, which diverts resources from programme activities (Worthen *et al*., 1997). The CIPP approach offers the evaluator an enormous scope of variables by which to evaluate the programme's effectiveness.

The research questions for this study have a purpose of judging the effectiveness of the programme in terms of the extent to which the respondents had adopted and implemented the programme at their place of work. For the purposes of this study, the CIPP evaluation model as a whole is too comprehensive and does not offer this researcher the sharp focus required to answer the research questions, and would be more effective in a formative programme evaluation. The CIPP evaluation model offers a wide range of variables and methodologies should the evaluation purpose be all inclusive of summative and formative objectives. The CIPP model could be selectively applied in order to achieve a very narrow evaluation purpose as is the case with this research; the ZF Services SA training department specifically issued a request for an evaluation that would provide information on the immediate effectiveness of the intervention programme under study which obviates the need for the broad capacity of the CIPP model.

2.4.2 Responsive evaluation

Beginning in 1967, some evaluation theorists began to show a reaction to what they believed to be the overbearance of mechanistic and insensitive approaches to evaluation, specifically in the domain of education (Worthen *et al*., 1997). Consequently, a new orientation to evaluation was born, one that stressed personal, immersive experience with programme

settings and its various activities. Stake (1967) is regarded as one of the initiators of re-orientating programme evaluation towards a portrayal and processing of the judgements of participants as stakeholders in education (Worthen *et al*., 1997).

Worthen et al. (1997) describe how Stake (1972) looked upon this new approach as an attempt to develop a technology that would improve and focus the naturalistic evaluatory tendencies of humans. Stake (1972) advocated the need to be responsive to realities in the programme by becoming sensitised to the reactions and concerns of participants, rather than being preoccupied with evaluation tactics, relying on preconceived ideas and formally stated procedures and objectives of the programme (Worthen *et al*., 1997). Stake (1975) defines responsive evaluation as follows:

> An educational evaluation is responsive evaluation if it orients more directly to programme activities than to programme intents; responds to audience requirements for information; and if the different value-perspectives present are referred to in reporting the success and failure of the programme (Stake, 1975:14).

The purpose, structure and focal point of a responsive evaluation become apparent from interactions with stakeholders on all levels. On the basis of those interactions and observations, a purposeful and progressive focus on issues of concern develops (Worthen et al., 1997). Figure 2.5 below represents the responsive evaluation approach of Stake as portrayed by Worthen et al., 1997:161).

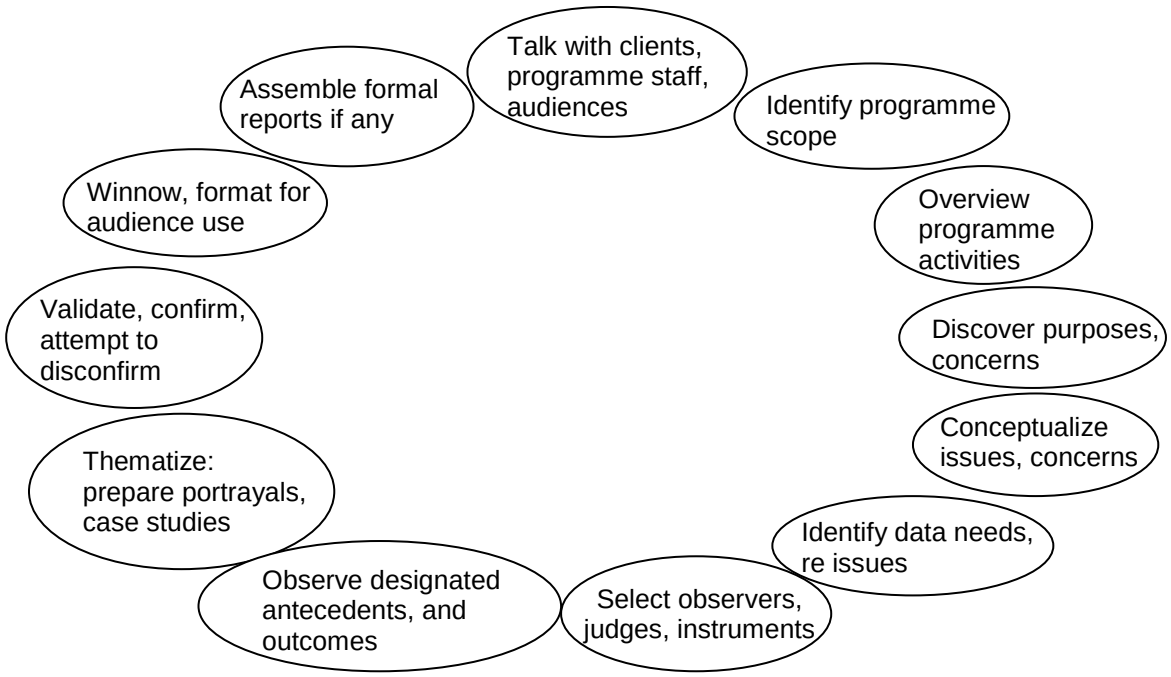


Figure 2.5: Prominent events in a responsive evaluation (Worthen *et al*., 1997:161)

Worthen *et al*. (1997) explain that the responsive evaluation approach can be designed to either address programme outcomes and their impact, or programme processes, or programme effectiveness or be used all together. Stake's (1974) idea behind the twelve-point "clock-styled" evaluation approach was in essence to remove the evaluator from the rigid mechanistic dominance of the formal preordained experimental approach that was so dominant in the early years of programme evaluation. Stake's (1974) discontentment with the way programme evaluation was conducted in a mechanised, rigid fashion is reflected in the following statement he made to the evaluation community in 1974: "I know that some of you would remind me that a clock moves clockwise, so I hurry to say that this clock moves clockwise and counter-clockwise and cross-clockwise" (Stake, 1974).

In other words, this model does not prescribe a chronological order; any event can follow any other event or happen simultaneously and is iterative in nature (Stake, 2004). Stake notes that Responsive evaluation is more of an attitudinal mind-set than a model or framework or recipe, and orients the evaluator to the experience of personal immersion in the programme experience, feeling the activity, the vibration and tension, really knowing the people and their values; and thus relying deeply on personal interpretation and analysis (Stake, 2004).

The most significant work in the area of responsive evaluation and its links to naturalistic inquiry is to be found in the work of Lincoln and Guba (1985). The major role of an evaluator is one of responding to a group, community, or audience's requirements for information in a manner that pivots around the different value-perspectives of its members (Lincoln & Guba, 1985). The evaluator immerses him or herself into the naturalistic setting of the programme activities where it occurs naturally, without constraining, manipulating or controlling it (Lincoln & Guba, 1985). The naturalistic evaluator makes use of interviews, observations, non-verbal cues, documents, records, and subtle, non-intrusive measures together with their field notes and records as the varied sources of information during data collection (Worthen *et al*., 1997).

2.4.2.1 Strengths and Limitations of Responsive Evaluation

Critics of responsive evaluation label it as "soft headed" and argue that most, if not all, of the evaluators of programmes do not possess the virtues or intellectual agility to execute masterfully the seductively simple, subtle methods that this approach requires where the inherent nature of this methodology balances on a slippery slope (Worthen *et al*., 1997).

Proponents of naturalistic, responsive evaluation argue that any sensitive individual could easily master this approach and that such evaluations are more powerful than other approaches and infinitely richer by their nature (Worthen *et al*., 1997).

What makes responsive evaluation as an alternative approach to evaluation very attractive is the fact that both quantitative and qualitative data are recognised as valuable sources of information, thus illuminating the programme in its natural setting in a powerful way (Worthen *et al*., 1997). This approach is loaded with the potential for the emergence of new and usable theories, as well as deep insights about our educational, social, or organisational programmes. (Worthen *et al*., 1997).

As with other approaches to evaluation, the potential excellence of responsive evaluation may also prove to be its limitations. Responsive evaluation may prove more popular with theorists than with practitioners due to the underlying tension that begs for complexity rather than simplicity, regardless of however sound it may be on other grounds (Worthen *et al*., 1997).

Promoters of responsive evaluation have often been criticised for unsubstantiated evaluations because of their strong reliance on individual perspectives of human observation and the general tendency to discount the significance of instrumentation and quantitative data (Worthen *et al*., 1997). Even proponents of approaches such as responsive evaluation concede that dependence on open-ended techniques and progressive focal-point-shift make evaluator subjectivity a potential problem (Worthen *et al*., 1997).

Even though responsive evaluation could be utilised for both formative and summative purposes, this programme under study seeks to affect a transfer of factual and conceptual knowledge towards improved procedural behaviour during clutch installations. The procedural knowledge and behaviour contained in the intervention programme under study are best assessed by closed-ended questions as these procedures cannot be replaced by any alternative procedures and are not open to the Automotive Service Technician's interpretation of the factual knowledge contained in the programme.

Clutch installation is a strict linear activity where actions are chronologically dictated by the very nature of the foundational technologies underpinning the way in which certain components are to be treated. A simple, objective approach to the effectiveness of the programme under study in achieving the transfer of procedural knowledge and behaviour is more suitable for the purposes of establishing whether the quality of future clutch fitments may or may not improve.

2.4.3 Utilisation-focused evaluation

2.4.3.1 Definition

In general, the method of utilisation-focused programme evaluation is defined (Stufflebeam & Shinkfield, 2007:233) as:

> "Active-reactive-adaptive and situationally responsive, emphasising that the methodology evolves in response to ongoing deliberations between evaluator and client group and in consideration of contextual dynamics"

Patton's (1997:383) definition for utilisation-focused evaluation is:

> Evaluators are active in presenting to intended users their own best judgements about appropriate evaluation focus and methods; they are reactive in listening attentively and respectfully to others' concerns; and they are adaptive in finding ways to design evaluations that incorporate diverse interests…while meeting high standards of professional practice.

2.4.3.2 Operational premise of utilisation-focused-evaluation

Pivotal to this approach to evaluation modelling is allowing the evaluator to select from the entire range of evaluation approaches, models, frameworks and methodologies, those that are regarded as best suitable for the particular evaluation. Additionally, the evaluator personifies a wide range of evaluation and intervention roles as and how it is deemed appropriate to satisfy the local needs (Stufflebeam & Shinkfield, 2007).

As a pragmatic approach, utilisation-focused evaluation advocates no particular evaluation model, theory, values, system of criteria and indicators, methods, or procedures (Wiesenberg, 2000). Wiesenberg (2000:84) also states that utilisation-focused evaluation can include or exclude a range of evaluative purposes such as: formative evaluation, summative evaluation, developmental evaluation. It can also include any form or kind of data gathering and analysis approaches (quantitative, qualitative, mixed-methods), any kind of research design (naturalistic, experimental, quasi-experimental). It can also focus on any of the evaluation phases (such as: processes, outcomes, impacts, costs, and cost/benefit), needs, attitudes, learning and behaviour adjustments (Wiesenberg, 2000).

Stufflebeam and Shinkfield (2007:439) differentiate utilisation-focused evaluation from other evaluation approaches by stating that: “Utilisation-focused-evaluation is a process designed to help specific users examine the evaluation methods cornucopia and the local situation, then choose the model, methods, values, criteria, indicators, and intended users that best fit the local situation”.

Patton (2003) offers a succinct summary of the core principles of his version of utilisation-focused evaluation and how a study based on utilisation-focused evaluation should progress. Patton (ibid) states that the driving force of an evaluation should be commitment to the intended users, while bearing in mind that personal factors contribute significantly to use and should be treated as a psychological imperative. Careful and thoughtful analysis of stakeholder profiles and dynamics should inform recognition of primary target users, whilst taking into account the existence of diverse and multiple interests within the programme milieu, and by implication, all evaluations (Patton, 2003).

Strategy formulation about use is an ongoing process and continues from the very commencement of the evaluation. Focusing on an intended use requires making thoughtful yet decisive choices, including judgements regarding merit or worth (summative evaluation), programme improvement (formative evaluation and instrumental use), and generic knowledge (conceptual) (Patton, 2003). Evaluations that are worthwhile must be formulated and altered ‘situationally’ as standardised fixed formula-type approaches poses severe limitations. Evaluators should adopt ownership of an evaluation with their credibility and integrity always positioned at risk, which calls for a natural mandate to be active-reactive-adaptive (Patton, 2003).

2.4.3.3 Strengths and limitations of utilisation-focused-evaluation

Patton (2003), who is the most fervent promoter of utilisation-focused evaluation, sees the main limitations of utilisation-focused evaluation to be a turnover of involved users being frequently replaced. Substitute users often require the specifics of the programme evaluation to be revisited in order to maintain or restore the expectations for evaluation impacts. This can completely derail or at least delay the process (Stufflebeam & Shinkfield, 2007).

Certain threats, such as bias and corruption by the evaluation group, seem to be real weaknesses of this approach. Whatever the group’s representativeness, certain stakeholders may present conflicts of interest which could influence the evaluation process or product or both inappropriately, especially if the evaluator is inexperienced and vulnerable to manipulation (Stufflebeam & Shinkfield, 2007).

Where significant power differentials exist within stakeholder groups, exclusion to the important questions and pertinent bases for interpretation may be effected by such persons who could compromise ethical, reliable and valid methods of data collection, reporting and dissemination (Stufflebeam & Shinkfield, 2007). Nevertheless, systematic involvement of the intended users in the entire evaluation process helps ensure that they will develop ownership of the evaluation process and findings, and also develop the necessary understanding of the information, and consequently act responsibly and intelligently regarding the evaluation findings (Wiesenberg, 2000).

In the most positive sense of the word, the evaluator co-opts the users to participate fully in the evaluation process and its application to programme decision making when evaluation is approached from the utilisation-focused evaluation perspective. The selected group is encouraged throughout the evaluation to accept the study as their own, thereby ensuring that the evaluator will fit the evaluation services appropriately to their needs, priorities, and agendas (Stufflebeam & Shinkfield, 2007).

2.4.4 Kirkpatrick's four level framework for programme evaluation

The foregoing three evaluation approaches are highly respected in the evaluation community and any one of the three could have been used effectively for the programme evaluation under study. The researcher decided on Kirkpatrick's (1998) four level framework as guiding framework for this study, and the rationale supporting this decision is explained in section 2.4.4.7 of this chapter.

2.4.4.1 Definition

A four level framework gauges the effectiveness of a programme by means of the sequential utilisation of four levels together, or individually, in order to gather insight into the trainee's affective reaction to the programme. The four level framework also determines the learning that has taken place, the resultant change in behaviour at the work place and the long and short term results the programme has yielded for the organisation (Kirkpatrick, 1998).

Worthen *et al*. (1997) state that the two most prolific programme evaluation approaches are the CIPP model as discussed earlier and the four level framework of Kirkpatrick (1998). The four level evaluation framework by Kirkpatrick (1998) was first introduced to the evaluation world in 1959. It became very popular, and to this day remains the most utilised approach to programme evaluation in organisations by human resource departments (Bates, 2004; Worthen *et al*., 1997).

The Kirkpatrick (1998) framework for programme evaluation is largely an objectives based approach in the sense that the programme should be evaluated around the impact or results that it sets out to achieve, the behaviour to which trainees should transfer to, and the knowledge, skills and attitudes that trainees should learn. Worthen *et al*. (1997) classifies this approach as an objectives–orientated approach, or a Tylerian approach after the originator of this approach. See section 1.5 in Chapter one and Table 2.3 in Chapter two for clarification of the objectives of the programme under study.

Kirkpatrick (1998) describes four levels of evaluation which become progressively more difficult to measure as one starts at level one and proceeds to level four. More time and resources are required as one progresses through the four levels with level four being the most complex and time consuming level to evaluate on. Using this study as an example, level one was achieved by the respondents spending ten minutes on completing a twenty-two item satisfaction survey; level two required the completion of two tests which took up an hour, and level three required two full days of observation per respondent. Level four in the case of this clutch intervention programme will take several years to complete. Kirkpatrick (1998) further states that the value of the measures and findings per level gradually increase in importance as one starts at level one and proceeds to level four. Figure 2.6 below shows the hierarchical nature of Kirkpatrick's (1998) approach to programme evaluation.

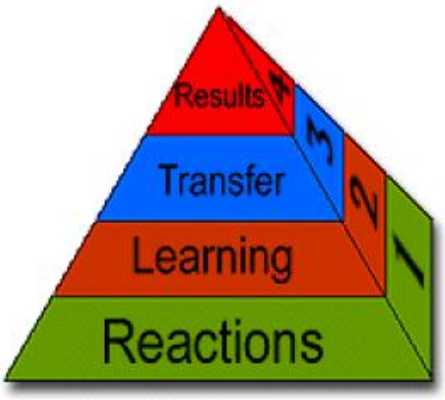


Figure 2.6: The four level Evaluation Framework (Kirkpatrick, 1988)

With this approach, the evaluator measures four different aspects of the training programme that firstly seeks to ascertain the affective outcomes of the programme (Reactions level) by means of a survey questionnaire, secondly the increase in knowledge (Learning level) is measured by means of a pre-test and post-test, followed by a measurement of the changes in behaviour at work (Behaviour level) by, for example, using a behavioural observational checklist (Kirkpatrick,1998).

Finally, the resultant benefits enjoyed by the organisation through the results (Results level) of the training programme are measured in terms of monetary gains, increase in productivity, and reduction in faulty workmanship (Kirkpatrick, 1998).

The four level framework is hierarchical in nature by way of the increasing difficulty/complexity of data collection on each successive level. Kirkpatrick (1998) also suggests that the value of the data collected at each successive level becomes more important in the way that focus is progressively narrowed down to the eventual degree of benefit of the programme to the organisation. Data gathering and analysis by means of the four level Kirkpatrick model is traditionally conducted by means of quantitative methods, but it can be used equally well by means of qualitative techniques or a combination thereof (Forsyth *et al*., 1999; Haupt, 2008).

2.4.4.2 Level one: Reaction

According to Kirkpatrick (1998), evaluating reaction relates to measuring customer satisfaction and, by implication, the degree to which the programme has motivated the trainees to change their attitudes and behaviours in accordance with the prime objective of the programme's intention. Measuring reaction is of substantial importance for several reasons (Kirkpatrick, 1998). Firstly, the feedback is valuable for gauging the immediate effects of the programme. Secondly, trainees are bolstered by the perceived importance attached to their opinions and the possible role they are playing in the improvement of the programme. Thirdly, reaction sheets (opinion survey) can provide quantitative information for informing and supporting managerial activities regarding the future of the programme. Finally, by application of reaction sheets, quantitative information on trainer effectiveness could be registered for the establishment of standards of achievement for future programmes. Kirkpatrick recommends the guidelines as described in Table 2.5 in order to realise the maximum benefit from this level:

Table 2.5: Guidelines for evaluating reaction (Kirkpatrick, 1998:26)

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Determine what you want to find out.</td><td>It is important to find out how the trainees react to the subject, the trainer, the facilities, the schedule (time, length, breaks, and convenience), meals, case studies, audio-visual aids, hand-outs, as well as the perceived value that participants place on different aspects of the programme.</td></tr>
<tr><td>Design a form that will quantify reactions.</td><td>The ideal form should provide the maximum amount of information and should require the minimum amount of time to complete. Trainees are generally tired at the conclusion of a programme and do not want to sit for hours to fill out forms. The best type of reaction form is one where each question is answered by checking a box according to an escalating scale of importance such as: Poor, Fair, Good, Very good, Excellent.</td></tr>
<tr><td>Encourage written comments and suggestions</td><td>The ratings that are tabulated present only a part of the participants' reactions. They do not explicate the reasons for their reactions nor do they offer suggestions as to what can be done to improve the programme.</td></tr>
<tr><td>Get immediate response</td><td>Not issuing reaction sheets at the conclusion of the programme and not collecting them immediately could result in a large percentage of the participants' opinions being lost to the gathering of data and thereby skewing or impoverishing the reaction results. It is important to gather the reactions of the group as a whole so as not to influence the standard deviation statistics of the enquiry.</td></tr>
<tr><td>Get honest responses.</td><td>It could be of great value to be able to identify the participants according to their filled out forms, but the request for identification should be strictly optional. Participants may not want to be as critical as they ought to be and they may fear reprisal should their criticism become known to management. Collection of the forms should also not be done in a way in which the participants could be easily identified afterwards. Complete anonymity is essential for honesty to prevail.</td></tr>
<tr><td>Develop acceptable standards.</td><td>Consider again the example in point 2 and quantify each choice:
<table><tr><td>Poor = 1</td><td>Fair = 2</td><td>Good = 3</td><td>Very good = 4</td><td>Excellent = 5</td></tr></table>
Add the numerical responses in each category for all items. For each item, multiply the number of responses by the corresponding weighting and add the products together. Then divide by the total number of responses received. Over time, this exercise will establish an acceptable baseline (for trainer effectiveness) against which future data can be compared.</td></tr>
<tr><td>Measure reactions against standards and take appropriate action. (Formative stage)</td><td>When results are below what has been established as an acceptable standard, several approaches should be considered:
Make a change – in trainers, facilities, subject, and content.
Delivery method – audio-visual, models, books, and hand-outs.
Conduct an exploratory, qualitative enquiry to determine where the programme is failing in its intention to change.</td></tr>
<tr><td>Communicate reactions as appropriate</td><td>Trainers should be allowed insight into the outcome of the reaction sheets so that they can modify their own behaviour to shift towards the requirements of the objectives and/or mission statement of the programme and its theory of change.</td></tr>
</table>

2.4.4.3 Level two: Learning

According to Kirkpatrick (1998:39), instructors in a training programme can facilitate learning on three possible levels:

1) What knowledge was learned?
2) What skills were developed or improved?
3) What attitudes were changed?

It is important to measure changes in learning because no change in behaviour can be expected unless learning has occurred in one or more of the three possible learning levels. Kirkpatrick (1998:39) recommends the guidelines as described in Table 2.6 in order to realise the maximum benefit from this level:

Table 2.6: Guidelines for evaluating learning (Kirkpatrick, 1998:40)

Item	Description
Use a control group if practical	A control group is a group of people within the same sample that is not exposed to the intervention programme and the group that does receive the intervention programme is called the experimental group. The purpose of the control group is to provide better, more reliable evidence that any change that has taken place could realistically be apportioned to the influence of the intervention programme and not to any other external or internal stimulus. If the two groups are not similar in all characteristics, the data cannot be considered as valid. However, if it is not practically possible to have control group then pre-tests and post-tests for one group will suffice.
Conduct a pre-test and post-test	Design a multiple choice or true/false questionnaire where the pre-test and post-test will cover exactly the same content elements without necessarily having to be identical in appearance. The creation of a valid instrument for this area of data collection will be further discussed in Chapter 3.
Get a 100% response	Statistical analyses become more accurate and valid the greater the numbers of participants that are included in the collection of performance data.
Take appropriate action	One major area of interest for the trainer is to establish as accurately as possible whether the resultant data (positive or negative) are indicators for possible problems with the teaching activities or rather the individual learning activities. The nature of the data will guide programme developers to either make changes to the mode of delivery and transfer of learning, or include additional elements to the existing programme to facilitate learning. It is not reasonable to expect significant changes in behaviour at the workplace if learning and insight into the new content has not been successfully achieved in the minds of the trainees. The cognitive value of the programme is foundational for the programme to have an effect in the behavioural realm.

2.4.4.4 Level three: Behaviour

According to Kirkpatrick, (1998), the ultimate goal of the programme's effect on the trainees should be the successful transfer of knowledge, skills, and attitudes as is evidenced by appropriate changes in behaviour at the workplace.

As previously stated, the four levels become progressively more important in the nature of the data collected per level and the difficulty of such data collection and interpretation becomes equally more complicated for various reasons (Kirkpatrick, 1998).

Firstly, trainees need an opportunity to demonstrate their change in behaviour. If the activities at the workplace do not allow for such opportunities, the programme's intention of change becomes un-implementable through no fault of the programme. Secondly, it is not possible to predict when and if a change in behaviour will become evident (Kirkpatrick, 1998). Trainees may implement their learning immediately at their return to the workplace, or some time later or perhaps never at all. Thirdly, after completion of the programme the trainee may apply the learning at his workplace and settle on one of the following three decisions:

1) "I like what happened, and I plan to continue my new behaviour"
2) "I don't like what happened, and I will go back to my old behaviour"
3) "I like what happened, but managerial, resource, time constraints, or something else outside of my control is preventing me from changing previous behaviours"

From an organisational perspective, it is imperative to provide assistance, encouragement, and realistic rewards or incentives when the trainee returns to the workplace from the training session. Considering the first two levels of reaction and learning, evaluation can and should be effected at the conclusion of the programme. Evaluating behaviour however should be an ongoing exercise as there should be evidence of behaviour change immediately after the training session; follow-up evaluations will gauge the longevity of the effectiveness of the training programme (Kirkpatrick, 1998).

Kirkpatrick (1998) proposes several guidelines by which research into the evaluation of behaviour could be conducted, which are presented in Table 2.7 below.

Table 2.7: Guidelines for evaluating behaviour (Kirkpatrick, 1998:49)

Item	Description
Use a control group if practical	As already mentioned before, the evidence of a control group goes a long way to bolster the conclusions drawn regarding the sole effect of a programme on observable changes in the trainee and helps to isolate other external factors that may or may not have assisted in the changes as observed in the trainee's learning and behaviour.
Allow time for behaviour change to take place.	The nature of the condition at the workplace will determine if behaviour changes could be expected immediately. As mentioned before, opportunities have to be present for the required behaviour to be practised and maintained. For example, in the automotive field, behaviour changes will be expected immediately if the intention of the programme is to correct previous errors during the installation of drive-line components.

Evaluate both before and after the programme if practical.	Time and budget constraints are often serious factors that hamper the implementation of a pre-evaluation stage and in other cases it may be completely impossible. Alternatively, supervisors and managers can be interviewed sometime after the conclusion of the programme to voice their observation of the changes in behaviour within trainees as compared to how they used to behave before the programme.
Survey and/or interview one or more of the following: trainees, supervisors.	People who are knowledgeable with regard to the previous behaviour of trainees and are in a position to effectively scrutinise the behaviour of trainees after the programme are ideal sources of information where such information can be transcribed as quantitative or qualitative data in order to support or reject the notion that the programme has achieved in its intention. Subordinates of the trainee are more likely to be in constant observation of the behaviour of the person who underwent training. It is important though to be sensitised to the possibility of validity distortion or bias by virtue of interviewees saying things that may not be entirely accurate because of an upwards or downwards power balance with the trainee in question. This data can then easily be quantified and statistically processed. The interview mode would be the best method for gathering accurate information on behaviour change as the reasons for and against behaviour change can be better expressed and explored by talking to the trainees. A cheaper and more time-saving mode would be the survey method where similar information as with the interview can be gathered quicker and on a larger scale, but with the absence of the possibility to explore certain interesting remarks by the trainees.
Get 100% response or a sampling.	It's often impractical to measure the change in behaviour in all trainees, but one can include as many as practically possible until a trend becomes noticeable in the behaviour data. The smaller the number of trainees that are measured, the less valid the generalisation of data to the greater group becomes.
Repeat the evaluation at appropriate times.	Some trainees may alter their observable behaviour as soon as they are back at work. Others may wait six months or longer or never change. Those that do change to the required behaviour immediately may change back to their old behaviour after a period. The best approach would be to measure behaviour change immediately, maybe six months later again and wait again another six months and do a final measurement.
Consider cost versus benefits.	Training is an investment and the cost commensurate with the benefits needs to be determined as supporting evidence of the programme's worth. If the programme is a repeat programme by nature, then a costly evaluation on level three could be justified as future presentations of the programme will benefit from previous expenses. It is important to understand that change in behaviour is not an end in itself, but rather, it is a means to an end: the final results that can be achieved if change in behaviour occurs. If no change in behaviour occurs, then no improved results can occur. At the same time, even if change in behaviour does occur, positive results may not be achieved.

2.4.4.5 Level Four: Results

According to Kirkpatrick, (1998), the most important and difficult part of evaluation is measuring the final results of change within an organisation where the change is attributable to the trainees attending the programme. Evaluators of programmes should seek answers to the following questions at the conclusion of a training programme (Kirkpatrick, 1998):

How much has the improvement of quality of work improved the organisations profits because of the programme? What is the increase in productivity? What reduction is there in wasted time, incorrect workmanship, and come-back errors? What is the extent of the personal improvements of the staff that underwent training? By how much has the cost of

production and/or work execution decreased? What are the overall tangible benefits that are measurable as a result of the programme's influence? What is the return on investment for all the money that has been spent on training?

These questions and many others often remain unanswered for two reasons: firstly, trainers are unable to measure the results and compare them with the cost of the programme. Secondly, even if they do know how, the findings probably provide some form of evidence at best and not clear-cut proof that the positive results can be attributed to the training programme (Kirkpatrick, 1998).

Kirkpatrick (1998) proposes several guidelines by which research into the evaluation of results for organisations could be conducted, which are in Table 2.8.

Table 2.8: Guidelines for evaluating results (Kirkpatrick, 1998:59)

Item	Description
Use a control group if practical	The reason for control groups is always the same: to eliminate any possible external factors other than the training-intervention that could have caused the observed changes to take place.
Allow time for results to be achieved	There is no sure answer as to how long it would take before real changes can be measured on this level. In some organisations, changes can be seen immediately after the conclusion of a training programme, but in others it could take years before an accurate measurement can be taken.
Measure both before and after the programme if practical	If it is impractical to measure results before the commencement of a programme, previous records are often invaluable documents that can be used to measure changes against.
Repeat the measurement at appropriate times	Organisation must decide when and how often to evaluate. Results are dynamic and could vary on a continuum of positive and negative in any direction. It is up to the evaluator to determine the influence of training on these results.
Consider cost versus benefits	Change in behaviour is usually the most expensive level to evaluate. What makes level four more tolerable from a cost perspective is the possibility of making use of documents and figures ex post facto in order to gauge the change in results. The difficulty however is to determine which figures are meaningful and in what way they relate to the training programme. The factors affecting operating profits are myriad and sometimes impossible to link to ROI (return on investment).
Be satisfied with evidence if proof is not possible	The top management of some organisations requires "evidence beyond reasonable doubt" whereas others require "preponderance of evidence" which could be anecdotal in nature but yet satisfactory.

2.4.4.6 Strengths and Limitations of the four level framework

From criticism levelled at the four level framework by the evaluation community, it is clear that two issues are of concern. Firstly, it appears as if Kirkpatrick's four level framework holds the assumption that learning can only increase if the reactions of trainees are

measured as positive, and thereby producing greater transfer of learning with subsequent positive results for the organisation (Bates, 2004). The framework relies heavily on implicit assumptions of causality between levels and hierarchical significance of levels which cannot always be scientifically verifiable as the full spectrum of outcome-attributions is not accounted for (Yardley & Dornan, 2012:100).

Holton (1995) also raises the concern of causality between the levels and states that no empirical study has convincingly proven Kirkpatrick's assumptions that trainees need to experience a positive reaction to a programme in order for learning to take place. Alliger and Janak (1989) have carried out extensive research on the four-level model, but have been unable to demonstrate significant relationships between levels as implied by the four level framework. Holton (1996) reports the findings of several other investigators where very varied and inconclusive findings were posted and these findings seem to corroborate the findings of Alliger and Janak (1989). Yardley and Dornan (2012:100) state that the framework traditionally focusses on programme outcomes (summative purpose), and due to the absence of formative operations cannot explain how or why such outcomes are linked to particular elements of the programme. The framework is relatively successful at measuring anticipated outcomes but disregards unanticipated results.

A second limitation of the four level Kirkpatrick framework is the inclusion of trainee reactions as a primary outcome, which some regard as one of the greatest flaws of the four level framework (Holton, 1996). This statement is supported by findings reported by the American Society for Training and Development on the implementation of the four level framework, which yielded the following information: Ninety-two percent of courses are evaluated at level one (Reactions); thirty-four percent evaluated at level two (Learning); eleven percent evaluated at level three (Behaviour); and two percent evaluated at the results level four (Watkins, Leigh, Foshay, & Kaufman, 1998). The assumption of causal linkage has encouraged a depleted focus on reaction measures. Exercising such a narrow focus is inadequate in supporting credible judgements about the merit of training programmes and the course of action required to improve them (Bates, 2004).

Due to the lack of clarification criteria proposed by the four level framework, the t-Test as a test of significance could be problematic if the researcher relies too heavily on the statistical number of significance. A host of different clarification-perspectives (sets of assumptions for different evaluation criteria) are applicable for different evaluation situations and should be factored in, since focusing on only a few criteria-perspectives could lead to the totally wrong interpretation of the decision rule (hypothesis adoption or rejection) (Fay & Proschan,

2010:1). As is the case with the research under discussion, the t-Test simply confirmed that a significant change had indeed occurred between pre-tests and post-tests which allowed for the adoption of the stated null hypotheses or alternative hypotheses (Fay & Proschan, 2010:1). According to Alliger and Janak, (1989) even though cause-effect relationships should exist to some extent between levels, especially between level two, level three, level four, and within levels, one cannot conclude with the utmost of confidence that the intervention programme was solely responsible for positive and negative outcomes.

So does the weakness lie with the evaluation framework or the executor/user of the framework? Michalski and Cousins (2000) perhaps describe exactly what the problem is by stating that it is often easier to develop a training programme that evokes positive reactions from participants, than one that will facilitate true learning and behaviour change at the workplace.

A culture of placing a heavy emphasis on trainee reactions may only yield misleading or inaccurate information by promoting lower level outcomes as the final impact that was measured during the programme's evaluation (Bates, 2004). This kind of practice is dishonest and is not a true reflection of the programme's effectiveness (Bates, 2004). The problems that stem from the use of the four level model are rather telling of the under-utilisation of the full potential of the model, as well as a lack of skills, knowledge or motivation on the part of the evaluator (Watkins et al. 1998).

Giangreco, Carugati & Sebastiano (2008) make a strong argument in favour of the four level model, and states that as a heuristic framework it could easily be augmented by filling in the missing elements of criticism. This argument is aligned with Patton's (1997) utilisation-focused approach whereby a research design could benefit by the four level framework as a heuristic device that simply delineates the parameters of inquiry, but embedded in a mixed methods approach with the inclusion of relevant conceptual criteria of interest that could perform reliably within cause-effect inquiries. One has to bear in mind though that the original un-augmented four level framework is conceptually too simplistic in informing multi-dimensionally on programme improvement but as a heuristic framework it offers a level of utility that could be quite valuable in offering researchers with sufficient programme impact information in the case of relatively short and simple interventions as is the case with this programme under investigation (Yardley & Dornan, 2012:103).

Kirkpatrick states that the quality of the evaluation is situated in the rigour that the evaluator himself or herself puts into the process. His model requires an evaluator to be guided by the following seven questions (Kirkpatrick, 1998):

1) Were the identified training needs objectives achieved by the programme and to what extent?
2) Were the learners objectives achieved and to what extent?
3) What did the learners learn (content specifics)?
4) What parts of the learning have learners adopted for application at work?
5) Did trainees implementing their action plans and to what extent?
6) Did they receive support from their line managers?
7) What benefits have accrued to the organisation based on the actions above?

All of the above questions seem to be focused on the actual learning and application of learning that takes place as a result of the training. Therefore, Kirkpatrick's (1998) four level framework is ideally suited to this study as it will allow this researcher to conduct a summative evaluation on the intervention programme aimed at equipping trainees with specific factual, conceptual and procedural knowledge for the reduction of installation errors during new clutch replacements. The main purpose of this study is to obtain a summative verdict on the effectiveness of an intervention programme and the lens of this enquiry is therefore focused on the transfer of knowledge in the form of correctly altered behaviour during the activity of clutch replacement.

This researcher has chosen to develop data collection instruments for the first three levels of Kirkpatrick's (1998) four level framework because they appear to be adequate for answering the first three sub-research questions. Previous applications of the first three levels of evaluation have been proven to yield a high degree of practical utility (Forsyth *et al*., 1999). The fourth level (Results) is not statistically measureable for this study for two reasons. Firstly, an automotive clutch is a mechanical component which is designed to yield a very long service life. Vehicles that received new clutch installations after the intervention programme will have to be monitored over several years of the clutch's lifespan and a judgement against the quality of the clutch installation can only be made once latent installation errors bring the clutch to a point of premature failure. A long-term longitudinal study performed in collaboration with service centres would be the correct approach for statistically judging the merit of the intervention programme with regard to its effectiveness (Kirkpatrick, 1998).

A longitudinal study within the time constraints of this research is not possible. An attempt will however be made to anecdotally determine the immediate results (if any) that the programme has had that could be considered as a benefit not previously enjoyed by the organisations participating in this study.

2.4.4.7 Rationale for incorporating Kirkpatrick's four level framework

The Kirkpatrick framework has been successfully used in many technical training programme evaluations in the past and, regardless of the criticism mentioned above, it is still regarded as highly useful and perhaps still the most preferred evaluation framework among human resource development professionals (McLean & Moss, 2003). Kirkpatrick's framework for programme evaluation has been utilised by evaluators from many diverse academic fields and has stood the test of time with both quantitative and qualitative evaluators. (Aitken & Tabakov, 2005; Ozturan & Kutlu, 2010; Sinclair, Smith, Colligan, Prince, Nguyen & Stayner, 2003; Strother, 2002; Cafarella, 2002).

According to Patton (1997; 1999), who promotes a utilisation-focused approach to evaluating programmes, the evaluator should put together an adaptable "toolkit" for each and every different programme that is under evaluative study. A high degree of utility and ease of use is attached to the four-level Kirkpatrick framework and it offers this researcher a systematic structure through the maze of variables in the summative measurement of programme impact (Bates, 2004). The four level Kirkpatrick framework provides very clear guidelines for evaluators to follow when designing and implementing survey questionnaires and pre-tests and post-tests.

For the purposes of this study, some of the criticism against the four level framework could be ameliorated by incorporating level one (Reactions), level two (Learning) as well as level three (Behaviour) into the data collection strategy and analysis phase and, in so doing, not weaken the rigour of the evaluation inquiry (Holton, 1996). An attempt will be made to provide as much information as possible for level four (Results), which would place this study among very few other studies that have utilised all four of Kirkpatrick's (1998) levels (Watkins *et al*., 1998).

The criticism levelled against the four level framework regarding the assumption of causality between level one (Reactions) and the remainder of the four levels has no bearing on this study. Causality is not the focus of this research as the satisfaction survey questionnaire that has been developed for answering sub-question one (Reaction level) seeks to measure a summative verdict on the value of the content, the presenter skills, and the trainee's

perception of the overall programme. This study does not seek to measure the level of correlation between trainee reactions and increased learning.

Sub-question two will be informed by a pre-test and post-test (Learning level) where performance differentials will be measured against the intervention of the programme without seeking causality and correlations between any variables.
Sub-question three (Behaviour level) will be measured by means of an observational checklist, which will be completed during the installation of a clutch with this researcher as an observer and again, the focus will not be on causality or correlation factors.

2.5 Summary

A review of the literature indicates that evaluation has a long and troubled past and, as a trans-discipline, functions differently to serve the needs of the various sciences where evaluation practices are performed. Evaluation approaches are highly fragmented due the inter-relationship of varying paradigmatic stances and dynamic ideological mechanisms which form the bases for a proliferation of evaluation models and frameworks (Mertens & Wilson, 2012).
Besides the deep-rooted ideological powers at play in the domain of evaluation, further fragmentation of major approaches become a reality when a programme under evaluation is divided into two sub-areas of focus, namely the process of the programme and the product of the programme. At this point, a number of detailed focus areas become apparent in terms of the formative and summative nature of the evaluation focus, which leaves evaluators often confused and disorganised in the choice of evaluation models or frameworks to follow for achieving the evaluation goals and objectives (Weiss, 1998).

Fortunately, a number of criteria for programme evaluation exist upon which most evaluators agree and on which clear evaluation procedures could be based on should one incorporate a logic model to provide the programme evaluation with a sensible structure (Daponte, 2008). Logic models are dynamic representations of how the programme is expected to bring about change, the process that should be followed and the outcomes that are expected as a direct consequence of the programme's effectiveness. Following an approach that is utilisation-focused, evaluators/researches could provide form and identity to their programme evaluation by choosing from existing evaluation frameworks or models that have been thoroughly and favourably peer-reviewed (Patton, 1997).

The research questions for this study seek to measure the respondents' satisfaction with the programme delivery and the programme as a whole, the improvement in procedural and conceptual knowledge, the transfer of learning with evidence in behaviour modification, and benefits enjoyed by the organisations after completion of the programme where respondents are employed. Kirkpatrick's (1998) four level model for programme evaluation is designed to measure on four hierarchical levels, which include the areas in which these four research questions reside. The conceptual framework for this research is derived from Kirkpatrick's framework and will be discussed in greater detail in chapter three.

3.1 Overview of this chapter

In this chapter, the quantitative strategy of enquiry of this study is introduced, and the scope of this study's research strategy is explained. This is followed by an explanation of how this study is rooted in the post-positivist paradigm alongside the philosophical assumptions that underpin this researcher's approach to evaluation. The focus then shifts to the conceptual framework that governs this programme evaluation and explains how this researcher combined elements of Patton's (1997) utilisation-focused approach with Kirkpatrick's (1998) four-level framework to give structure to this study. The core elements of Kirkpatrick's (1998) four-level framework are concisely described and a rationale for choosing the conceptual framework is offered together with the limitations imposed on this study by this choice of conceptual framework. A description of the target population and choice of respondents for this study follow, as well as the random sampling by which the respondents were chosen. The nature of the intervention programme under study is explicated and followed with a description of the manner in which the research instruments were derived from the content of the intervention programme. In conclusion, the procedures of data collection and analysis are clarified, followed by the limitations of the quantitative method employed as well as the ethical considerations that governed the collection of the data.

3.2 Strategy of inquiry

Quantitative strategies of inquiry can be divided into two broad categories: those that are used to determine the effectiveness of an intervention (such as a quasi-experiment), and those that are more descriptive in nature, such as surveys (Mertens & Wilson, 2012). Since this research sets out to determine the effectiveness of the programme by measurement of learning outcomes, behaviour outcomes and satisfaction with the programme, data collection instruments were developed from both categories.

According to Mertens and Wilson, (2012), three important designs that reside under the quantitative umbrella of approaches are experimental designs, quasi-experimental designs, and surveys. Mertens and Wilson, (2012) state that the primary purpose of using experimental, quasi-experimental and quantifiable survey designs in programme evaluation is to be able to say with confidence that whatever changes occur in the participants' behaviour, knowledge, skills, or attitudes are indeed as a result of the intervention.

This study engages a quantitative approach, which includes the use of valid and reliable survey instruments and performance test instruments (quasi-experimental) to measure the effectiveness of the intervention programme and thereby effectively answer the three research questions through the mathematical processing of quantified data (Creswell, 2008).

The quantitative approach allows for this researcher to be a passive and objective participant in the evaluation process. The data that is gathered are numeric measurements which can be manipulated to describe phenomena or assess magnitude and reliability of relationships among variables through the use of statistics (Burkett, 2011; Creswell, 2008). The sample of Automotive Service Technicians that form part of this inquiry could perhaps serve to generalise findings to the larger population of Automotive Service Technicians residing in Gauteng (Burkett, 2011). However, should the characteristics of the experimentally accessible population not match those of the target population, the findings may not be suitable for generalisation to the greater Gauteng and by implication to the greater South African region (Mertens & Wilson, 2012). Limitations to the quantitative research strategy, and in particular to the conceptual framework, are discussed in greater detail in Section 3.4.6.

3.3 Philosophical assumptions

As was discussed earlier in Table 2, Chapter 2, the methods branch reflects evaluation's roots in applied social research involving the use of rigorous methods of inquiry, largely based in the assumptions of the post-positivist paradigm (Mertens & Wilson, 2012). During the 1950's in the United States, positivism, as a precursor to post-positivism, became associated with quantitative research, measurement, and statistical analysis as a way of testing hypotheses about the way humans behave (Mertens & Wilson, 2012).

Positivists hold the ontological belief that one reality exists and that it is independent of the observer. Their epistemological belief is that distance from the object of study contributes to avoiding bias (Mertens & Wilson, 2012; Ponterotto, 2005). The positivist paradigm's methodological belief is associated with an approach focusing on the use of true experiments, which require random selection of subjects and random exposure to interventions – conditions seldom to be found in the real world of evaluation (Mertens & Wilson, 2012). Campbell (1991) advanced a way for researchers to adapt the principles of positivism by the development of quasi-experimental methods whereby non-randomised human populations can be studied in a similar way to the true experimental method of the positivist paradigm. This method made the post-positivist approach popular amongst modern

researchers where the tendency towards quantitative methods is retained, but with a modification to their ontological view of reality to take into account the complexity of human behaviour (Ponterotto, 2005; Mertens & Wilson, 2012). Post-positivists hold an epistemological view of acknowledging the possibility for the researcher to influence the research in some way, but they strive to remain true to the principles of objectivity and researcher-subject independence (Ponterotto, 2005).

The axiological assumption of this paradigm is intertwined with the methodological assumption in that the conduct of "good research" is a fundamental requirement for ethical conduct (Mertens & Wilson, 2012). The axiological stance is thus one whereby the researcher controls any influence he or she may have on the research process and its participants by barring personal values, expectations, hopes, and feelings from surfacing (Ponterotto, 2005). Methodologically, post-positivist researchers strive to simulate strict scientific methods by carefully manipulating or controlling variables (Ponterotto, 2005).

The philosophical assumptions that guided this study were based on the post-positivist view, which included the use of statistics as a means of describing a social, educational phenomenon through quantitative data collection methods that were empirically supported. Empirical here refers to that which is verifiable by careful observation and experimentation (Cohen, Manion & Morrison, 2000). The post-positivist paradigmatic stance allows the programme researcher to view the intervention programme and its effect on the respondents in an objective manner, as an isolated observer where personal hopes and expectations are not allowed to surface. Data collected from the respondents were mathematically measureable indices of their improved learning and application of their improved learning (transfer of learning) (Garratt & Li, 2005; Crook & Garratt, 2005).

By means of descriptive statistics, data can be explored in a primary way to portray the impact of the programme on the trainee's knowledge, as well as the way he/she applies what has been learnt during the programme without focusing on the myriad of other variables that may influence the final behaviour of the trainee (Lewin, 2005). In summary, this research was guided by the following post-positivistic assumptions:

3.3.1 Axiological assumptions

Guided by the principles of beneficence, respect, and justice, the researcher strived to achieve satisfactory outcomes for science, respondents, humanity and minimise or avoid risk and harm to anybody.

People were treated with respect and courtesy regardless of power differentials and social class. The researcher ensured that procedures were reasonable, non-exploitative and that the respondents as risk-bearers were also the beneficiaries.

3.3.2 Ontological assumptions

The researcher bore in mind that human nature is complex and that reality can be known within a certain level of probability and can only be measured imperfectly. It was by this ontological stance that the researcher was open to the notion and possibility of a follow-up study that is naturalistically driven through interviews in order to refine an approximated reality of collective respondent experiences. The researcher therefore acknowledged the limitations of the quantitative approach and the chosen conceptual framework in being unable to establish all the truth around the programme's effectiveness.

3.3.3 Epistemological assumptions

In striving to remain distant and objective by controlling researcher-respondent independence, it is acknowledged that the individual or the research process may still be influenced in some way. Nevertheless, the researcher strived to remain distant and objective during the collection of survey data and test scores.

3.3.4 Methodological assumptions

The researcher's method was a natural flow from his position on ontology, epistemology, and axiology. The quasi-experimental and quantitative survey design of this research was controlled as best possible to remain true to the principles of scientific inquiry without being influenced by the researcher's emotional or expectant stance.

3.4 Conceptual framework

An evaluator's approach to programme evaluation is ideologically related to each individual's philosophical preference of programme planning (Wiesenberg, 2000). This study's approach to programme evaluation was grounded in a utilisation-focused approach as described by Patton (1987). Patton's (1987) utilisation-focused approach relating to programme evaluation is based in the construct that evaluations should be assessed by their practical utility and actual use. This approach does not insist on any particular evaluation content, framework, model, methodology or theory.

Instead, it rather describes a process for assisting intended users in the selection of the most appropriate content, framework, model, methodology, theory and process of implementation and application for their particular situation (Wiesenberg, 2000).

Thus, an evaluation which is utilisation-focused may include any form of evaluation purpose (formative, summative, developmental), any kind of data collection approach (quantitative, qualitative, or mixed methods) with a varied or combination of focal points (processes, outcomes, long and short-term impacts, resource utilisation and costs as well as cost/benefit analysis) (Wiesenberg 2000).

In line with Patton's (1997) argument for a utilisation-focused approach to programme evaluation, this study was a conceptualisation of an evaluation approach whereby Kirkpatrick's four level framework provided the structure and focus. This conceptualisation aided in the quest to answer the research questions but was also based on a theory of change that conforms to certain assumptions. Figure 3.1 shows a diagrammatical representation of this study's theory of change.

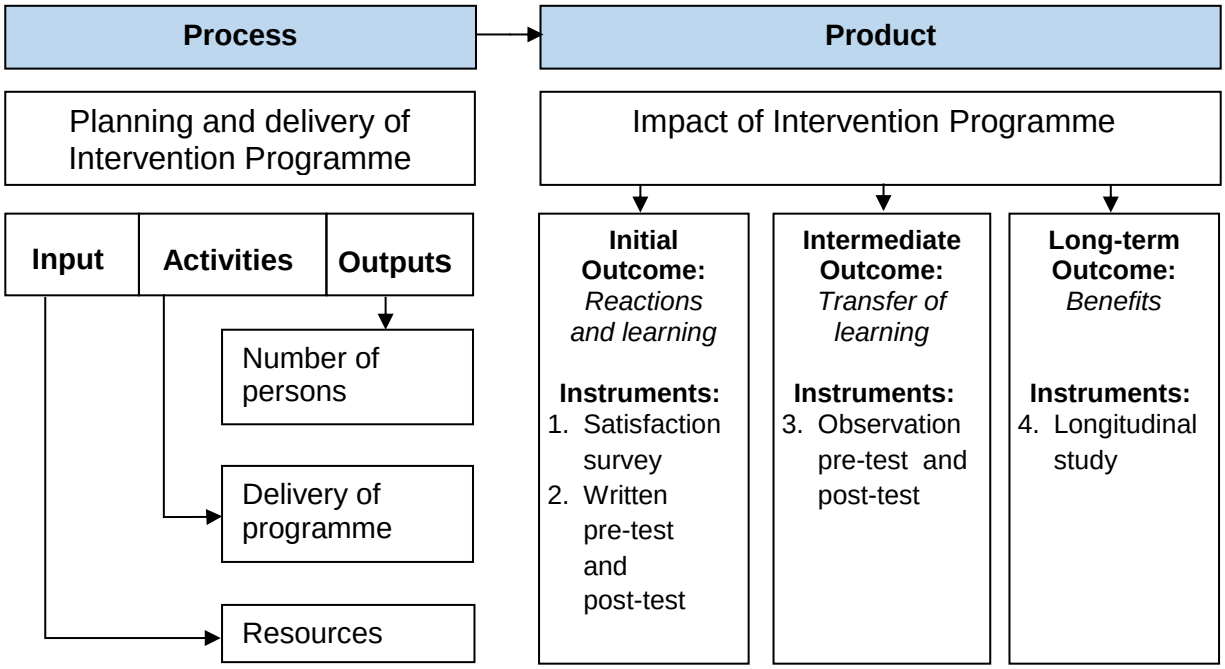


Figure 3.1: Diagrammatical representation of this study's theory of change

Figure 3.1 is a linear flowchart depicting the main elements in the programme's process that were proposed to guide the inputs, activities and outputs that in theory were to bring about the desired product. The desired product was measured in terms of initial outcomes,

intermediate outcomes, and long-term outcomes. The following sections discuss the theory of change as proposed in Figure 3.1 in greater detail.

3.4.1 Assumptions underpinning this study's theory of change

As was previously discussed in paragraph 2.3.4.2, a theory-driven programme evaluation pivots around the construct of the programme's theory of change. The stated explicit and/or implicit theory underpins the most effective way to achieve the desired programme outputs, the long and short term impacts and the foreseeable factors repressing or enhancing their achievement (Bamberger *et al*., 2004).

In order to derive a practical theory of change, ZF Services South Africa acquired all the appropriate technical and educational material from ZF Germany and adapted the content to suit the South African market. ZF Services South Africa also undertook to equip this researcher with the correct information regarding driveline technologies by allowing this researcher to be extensively trained in Germany on the subject of driveline technologies. This researcher was also equipped with the practical presentation tools for training adults through exposure to train-the-trainer concepts.

To summarise this study's theory of change, one could say that it was founded on a triangular relationship of uniquely selected content (based on conceptual and procedural knowledge), needs analysis of the trainee audience and appropriately equipping the trainer with transfer of knowledge skills. The diagram in Figure 3.1 is explained in more detail in Section 3.4.2 and 3.4.3 and the conceptual framework that is embedded within this theory of change is explained in Section 3.4.4. The data collection instruments were self-developed and this process was guided by overlapping the theory of change and the conceptual framework at the point of focus (the-product). The manner in which the data collecting instruments were developed is detailed in Section 3.4.3.

3.4.2 The process

From the diagram in Figure 3.1, the process category of the theory of change embedded in the intervention programme and the accompanying evaluation theory can be summarised by way of the following three elements:

3.4.2.1 Inputs

Before this programme could be implemented, certain inputs were required such as finances, labour to produce learning materials, and knowledgeable people to create a

PowerPoint presentation based on the programme content (Frechtling, 2007). Appropriate teaching aids such as models, product samples and hand-outs had to be acquired and/or created. Most of the PowerPoint slides were created in Germany and slides had to be rearranged and in some cases translated for an English audience. The programme contains approximately eighty percent of the German original programme and twenty percent added content specific to the South African vehicle population. ZF staff residing at the Johannesburg head office assisted this researcher with such inputs. Physical models of clutches and driveline components, as well as the printing of hand-outs were provided by ZF.

3.4.2.2 Activities

The programme had to be effectively marketed within the target audience, properly scheduled and presented in an educationally sound way. Before commencement of the intervention, a pre-test had to be administered on the exact content of the programme and a post-test covering the same content had to be administered at the conclusion of the programme. Additionally, an opinion survey also had to be completed at the conclusion of the programme that was offered. This part of the programme process also included all the training activities related to the intervention programme (Coryn *et al*., 2010).

3.4.2.3 Output

For the programme to achieve its intended result, the correct target audience had to be identified. The number of service centres and respondents with the inclusion of trained and untrained workshop personnel and managerial staff comprised the output of this study. The number of outputs also included certain service centre employees not directly involved in physical clutch installations in order to effectively intervene within the full scope of people in the organisation who were involved in clutch replacement activities (Frechtling, 2007).

3.4.3 The product

With reference to Figure 3.1, the product category of this study's theory of change pivoted around the three outcome periods of: immediate outcomes, intermediate outcomes and long-term outcomes. According to Mayne (2001:9), the differences between these three levels of outcomes can be described as is portrayed in Figure 3.2, where it can be seen that programme activities and programme outputs are still under the training organisation's control, but a proliferation of outside factors prohibit any further control once the respondents are back at work.

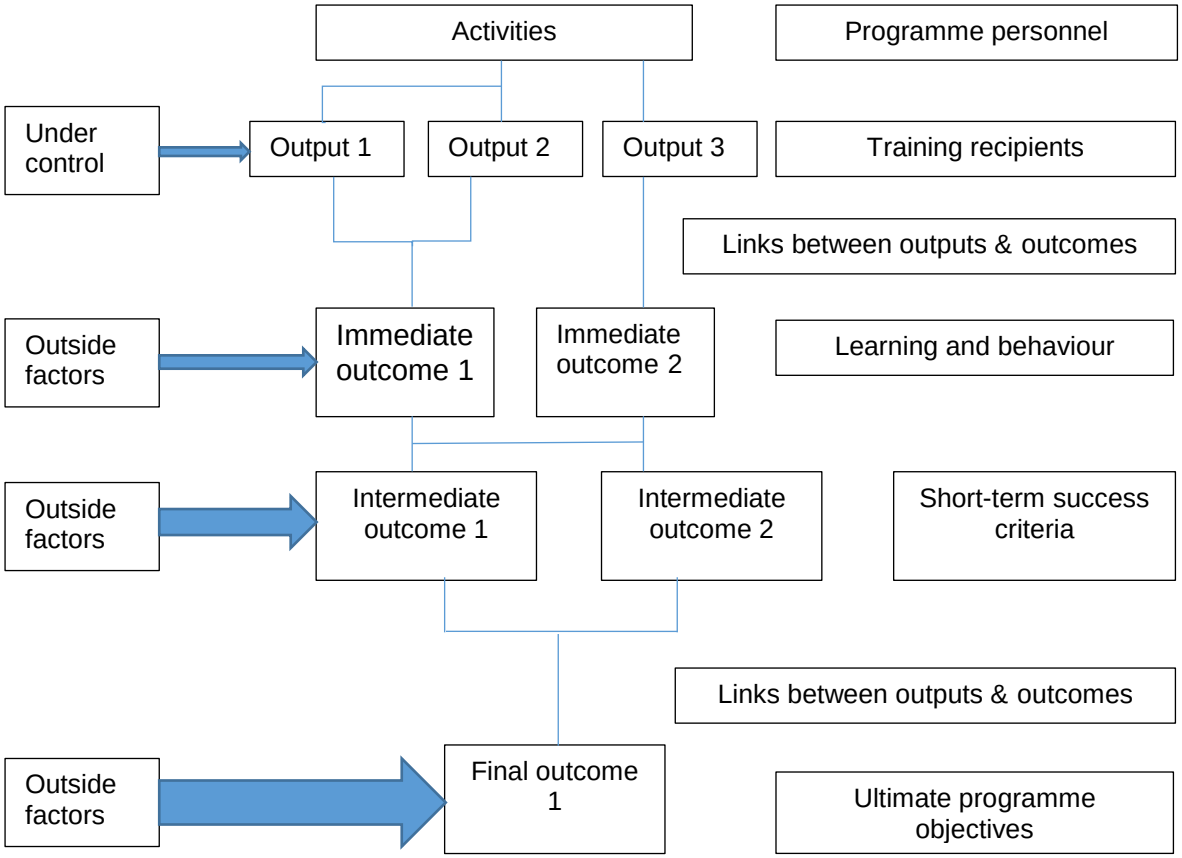


Figure 3.2: Classification of outcome levels over time (adapted from Mayne, 2001:9)

3.4.3.1 Initial Outcome

There ought to be an immediate change in knowledge and attitude that comes with understanding the concepts that were taught during the day-long seminar and the correct behaviour ought to be evident at the next possible occasion where a new clutch is to be installed (modified behaviour could also be an intermediate outcome). The trainees' reaction to the presentation ought to also be experienced as positive and measurable directly at the conclusion of the programme (Kirkpatrick, 1998). Kirkpatrick's (1998) first two levels of reaction and learning ought to be measured immediately after the conclusion of the presentation by means of the written pre-test (before programme commencement), and the written post-test at the conclusion of the programme (Learning: level 2). The satisfaction survey were also completed immediately at the conclusion of the programme in order to measure Kirkpatrick's (1998) level 1 (Reactions).

Respondents of this intervention programme ought to display an immediate improvement in knowledge (level 2: Learning), and behaviour-modification (level 3: Behaviour) ought to be evident as soon as the respondents have had an opportunity to display transfer of learning

(Kirkpatrick, 1998). The extent of the transfer of learning to the workplace can be measured by how closely the Technician follows the clutch installation protocol as taught in the programme. Behavioural changes were measured by checking off items on an observation checklist before the programme (pre-test) while observing a clutch installation, and after the conclusion of the programme (post-test). Due to logistical variables such as opportunities for clutch installations and the researcher's work schedule, behaviour modification could be observed as an immediate outcome or as an intermediate outcome as time lapses.

3.4.3.2 Intermediate outcomes

As the Technician becomes more confident in the prescribed clutch replacement protocol, his skill level should increase and a follow-up observational checklist should score him at 100% as measured against the required clutch installation ptotocol. Should the Technician score less than 100%, a further investigation will have to be carried out to determine the reasons for scoring below the required level.

3.4.3.3 Long-term outcomes

Fourth level measurements (Results) can only be determined after a long time lapse by measuring the reported failure rate of newly installed clutches as compared to the history of prematurely failed clutches. This level may be impossible to measure as vehicles do not always remain in the same ownership and people have a tendency to migrate from workshop to workshop. There are also other external variables outside the control of the workshop that could cause premature clutch failure.

One way of gauging the effectiveness of the programme would be to ascertain if any future failures or come-backs are as a result of poor workmanship or other extraneous variables outside of the influence of the workshop. However, this researcher attempted to gauge the benefits accrued by the participating Service Centres in the short period that had elapsed since the programme was concluded. A long-term longitudinal study is the most appropriate way of measuring benefits accrued over time, as some programme benefits may become evident shortly after the intervention programme, and yet other measureable benefits may take years to manifest (Daponte, 2008; Kirkpatrick,1998).

Mayne's (2001:9) classification of outcome levels supports Kirkpatrick's (1998) suggestion that various programme outcomes are reliant on the workplace conditions for encouraging positive outcomes (see Figure 3.2). Outcome measures may be evident immediately, or surface later, or may never become evident due to powerful personal and workplace

variables (Kirkpatrick, 1998). The weighted effect of the external influences that could harm outcomes is also progressively more removed from the training organisation's control as time lapses between immediate, intermediate and long-term outcomes (Mayne, 2001).

Kirkpatrick (1998) suggests that some of these factors affecting behaviour modification and, by implication, outcomes could be due to factors such as:

1) Management will not allow for the extra time to execute crucial actions.
2) Some crucial equipment may be lacking that is necessary for correct job-execution.
3) Supervisors might enforce their ideas in conflict with the programme protocol.
4) Fear of abandoning familiar ways of job execution.
5) Respondents attending the programme did not understand the new concepts and procedures.
6) Respondents have a negative attitude and are unwilling to change.

3.4.3.4 Sequence of instrumentation application

As the application of data-collection instruments reside within the product category of this study's theory of change, it is important to note that the implementation of each data-collection instrument followed in a particular sequence (Kirkpatrick, 1998; Yardley & Dornan, 2012). As is to be expected from a quasi-experimental research design, and as is suggested by Kirkpatrick (1998) for programme evaluations structured around the Kirkpatrick (1998) four level framework, adherence to a chronological order of data-collection is crucial for such data to be reliable (Kirkpatrick, 1998; Mertens & Wilson, 2012). The application of the instruments as depicted in Figure 3.1 followed a sequence as outlined in Table 3.1.

Table 3.1: Sequence of instrumentation as per Kirkpatrick's (1998) four levels

Instrument	Type of data	When to collect
Observational pre-test (Behaviour: level 3)	Quantitative: practical test by means of observational checklist checked by this researcher	Before the programme event
Written pre-test (Learning: level 2)	Quantitative: Multiple choice written performance test	30 minutes before the programme
Intervention: One day event		
Written post-test (Learning: level 2)	Quantitative: Multiple choice written performance test	On conclusion of the presentation
Satisfaction survey (Reaction: level 1)	Quantitative: 4-point Likert scale satisfaction response items	On conclusion of the presentation
Observational post-test (Behaviour: level 3)	Quantitative: practical, observational checking	During the months after the intervention
Informal, un-recorded Interviews (Results: level 4)	Anecdotal collection of possible benefits accrued by interviews with participating Service Centre management	After the intervention. Results could be: Immediate Intermediate or Long-term

3.4.4 The conceptual framework for this study

The conceptual framework for this study was based on the four level framework as proposed by Kirkpatrick (1998). See section 2.4.4 in Chapter two for a detailed description of Kirkpatrick's (1998) four level framework. It was not the process of this programme's offering that was under study, but rather elements of the final product at the conclusion of this study. A product or outcome evaluation, according to the summative approach to programme evaluation, offered a useful indicator whether this programme under study could be adopted as an effective intervention measure or not (Mertens & Wilson, 2012). The product or outcome of this programme ought to be measureable on three levels of concern which include immediate outcomes, intermediate outcomes, and long-term outcomes (Weiss, 1998).

These three levels of measurement were regarded as sufficient for answering this study's three research questions which were:

(1) What are the participants' reactions with regard to the training programme?
(2) How effective is the training programme in facilitating the acquisition of new knowledge?
(3) How effective is the training programme in changing the participants' observable work behaviour?

Kirkpatrick's (1998) four level framework for programme evaluation offered an ideal structure for answering the research questions adequately and was therefore utilised to measure the impact of this programme on the sample of respondents. The pyramidal shape in Figure 2.6 Chapter two is an indication of Kirkpatrick's (1998) four levels of how a programme evaluation should progress sequentially and how the intensity of the data-collection process increases.

Kirkpatrick (1998) does not imply that the first level (Reactions) is not important, but he states that the most valuable information that could be gathered resides in the fourth level (Results). Kirkpatrick's four level framework for programme evaluation thus suggests that researchers should determine respondent satisfaction with the programme at level one (Reactions), progress to level two by measuring the performance difference by means of pre-tests and post-tests (Learning), measure behaviour modification (transfer of learning) at level three (Behaviour), and finally by applying level four (Results) determine in which areas the recipient organisations of the programme had experienced positive benefits (Kirkpatrick, 1998).

3.4.4.1 Reaction

A programme facilitator could easily enhance or destroy the quality of the affective environment during the programme presentation by not being sensitive to the fickle, emotive nature of human's reactions towards the programme's delivery, the content, the instructional media and the learning climate (Heimlich, 1994; Steinert *et al*., 2006). Establishing a favourable learning setting is a very important determinant in achieving positive cognitive and effective outcomes to a training programme (Dornan, Littlewood, Margolis, Scherpbier, Spencer & Ypinazar, 2006). A favourable reaction (affective outcomes) to a well presented programme, the learning materials, and the effective climate in the classroom, as well as the presenter's interaction with the trainees instils motivation, which is an important pre-condition to effective learning (Kyriakides, 2006; Heimlich, 1994). See section 2.4.4.2 in Chapter two for more detail on the reaction level.

However, literature available on programme evaluations where the Kirkpatrick four level framework (1998) was utilised does not offer any conclusive empirical evidence in support of causality between the levels (Alliger & Janak, 1997). One cannot therefore assume that positive reactions to the programme will automatically lead to learning and the transfer of learning (Yardley & Dornan, 2012). Motivation to learn and to transfer such learning as evidence in behaviour modification is a very complex interplay of variables that could differ from person to person. Participant satisfaction is but one variable amongst many, but is commonly recognised as an important aspect for facilitating motivation to learn, especially where respondents are expecting follow-up programmes and have experienced completed programmes as satisfying (Steinert *et al*., 2006).

A data collection instrument consisting of reaction sheets in a survey format could give trainers quantitative information for establishing standards of performance for future programmes and offer managers tangible proof of programme effectiveness (Kirkpatrick, 1998). Caffarella (2002) points out that it is very important to attend to the reactions of adult learners to training programmes as adults are more diverse in their backgrounds and tend to be more critical than young learners. However, deliberate focus on the reaction level as a primary source of proof for a programme's effectiveness will skew the conclusions drawn as to the programme's overall effectiveness (Alliger & Janak, 1989). It is possible to deliver a very pleasant training session, but with limited or no learning as a result (Michalski & Cousins, 2000; Bates, 2004).

It is therefore vital for an evaluator to not only consider effective variables that affect a programme's success, but to also consider the cognitive impact by giving equal weight to the measurement of changes in learning and behaviour (Fisher & Khine, 2006).

In Chapter two, Table 2.5, Kirkpatrick's (1998) eight guidelines for evaluating reactions are tabled and adapted in Table 3.2 in terms of their application for this research.

Table 3.2: Guidelines for evaluating reactions (Kirkpatrick, 1998)

Process for evaluating reactions		
Kirkpatrick's guidelines		As implemented in this research
1	Determine the categories of reactions to be measured	A four point Likert scale was developed to measure responses on satisfaction with (1) the programme content through ten survey items, (2) the presenter skills through eight survey items, (3) the overall programme through 4 survey items.
2	Design an instrument	The four point Likert scale mentioned above offered a range of responses from strongly agree, agree, disagree, and strongly disagree. The survey items were presented in a statement format. See Section 3.7 and Exhibit 1.
3	Encourage written comments/suggestions	As this programme spanned over one day, there was not sufficient time for respondents to elaborate on responses. Thirty minutes was allowed for the written pre-test and forty minutes was allowed for the written post-test and reaction survey.
4	Get honest responses	Anonymity was guaranteed by not forcing respondents to provide their names. However a respondent number system was used whereby respondents could be identified which was only accessible by this researcher.
5	Get 100% immediate response	The reaction survey was administered immediately at the conclusion of the presentation and 100% of the responses were accounted for.
6	Develop acceptable standards	This suggestion of Kirkpatrick's was not implemented as a Likert scale does not necessarily ascend with equally weighted increments (Blaikie, 2003).
7	Measure reactions against standards and take appropriate action	As this research was strictly summative, a future formative follow-up study will include this step. An SPSS statistical analysis was conducted with descriptive statistics and graphs forming the basis of reaction measurements in Section 4.3.
8	Communicate findings	Findings will be communicated to the relevant parties at the conclusion of this study.

3.4.4.2 Learning

On this second level, the researcher seeks to measure any changes in terms of knowledge that was gained, skills that were developed or improved, and changes in attitudes. It is important to establish whether the content had been fully absorbed and understood, before trainees could be expected to alter their behaviour at work (Kirkpatrick, 1998).

Knowledge in general is the repertoire of cognitive skills an individual possesses that he or she utilises in the execution of their daily activities by way of their ability to process

information and attach meaning to what they know (Fisher & Khine, 2006; Coetzee, Botha, Kiley & Truman, 2007).

For the purposes of this study, learning was defined as the new, explicit knowledge that is added to the trainee's repertoire of existing knowledge and covered the categories of factual knowledge, conceptual knowledge and procedural knowledge (Amer, 2006:218; Coetzee *et al*., 2007). Factual knowledge includes such elements as product terminology, and technical details of the constituent components of a larger mechanical assembly (Amer, 2006:218; Krathwohl, 2002:214). Conceptual knowledge has to do with the interrelationship among the constituent components within a larger structure that enable them to co-function such as knowledge of categories, principles, theories, and structures (Krathwohl, 2002:214). Procedural knowledge has to do with subject-specific skills and techniques such as action-sequences, techniques, methods, and knowledge about criteria to differentiate between methods and sequences (Krathwohl, 2002:214; Amer, 2006:218). It is important to note that transfer of learning is dependent on the inclusiveness of both conceptual knowledge and procedural knowledge and a more complex task, requires a more sturdy conceptual foundation for procedural knowledge to become useful knowledge (McCormick, 1997).

In Chapter two, Table 2.6, Kirkpatrick's (1998) six guidelines for evaluating learning are listed and adapted in Table 3.3 in terms of the manner in which they were implemented in this research.

Table 3.3: Guidelines for evaluating learning (Kirkpatrick, 1998)

Process for evaluating learning		
Kirkpatrick's guidelines		As implemented in this research
1	Use a control group if practical	This research followed a same group, pre-test, post-test design with no control group (Daponte, 2008:111). Finding a suitable control group was not possible in this research as this researcher had limited access to the respondents of this research. See section 3.5 on sample selection.
2	Evaluate before and after the programme	Pre-tests and post-tests were administered.
3	Use a multiple choice test	A forty item multiple choice type test on concepts and procedures was administered before and after the programme.
4	Use a performance test to measure skills	A practical-observational pre-test and post-test was applied to measure skills (behaviour level). See section 3.4.4.3.
5	Get 100% response	Written pre-tests and post-tests were administered immediately before the programme and immediately after the programme. 100% response was achieved.
6	Use the results to take appropriate action	Certain changes to the programme have already been implemented, but a qualitative study will be performed at the conclusion of this summative investigation in order to clarify certain statistical findings (Weiss, 1998:32).

3.4.4.3 Behaviour

On this third level, the researcher determined to find out whether the knowledge, skills, attitudes or behaviour that were acquired as a result of the learning programme were transferred to the workplace (Coetzee *et al*., 2007). Transfer of learning refers to learner's ability to apply the behaviours and competencies learned in training to the job itself (Coetzee *et al*., 2007). Depending on the effectiveness of the programme, transfer could be positive (improve job performance), negative (hinder job performance) or neutral (Coetzee *et al*., 2007). See section 2.4.4.4 in Chapter two for more detail on this level.

The transfer of knowledge to the workplace in observable and measureable behaviour adjustment is the primary objective of most organisational programmes (Caffarella, 2002). Trainees could possibly never transfer their learning until an opportunity presents itself and therefore predicting when and whether learning will be transferred is not possible (Kirkpatrick, 1998). In fact, one may observe behaviour-modification soon after the first opportunity or it may never be witnessed (Kirkpatrick, 1998). Trainees may have found the training programme positive, but still have to decide to implement or not to implement what has been taught (Coetzee *et al*., 2007).

In Chapter two, Table 2.7 lists six guidelines as suggested by Kirkpatrick (1998) for the evaluation of behaviour, and in Table 3.4 these guidelines are adapted for the purpose of this study.

Table 3.4: Guidelines for evaluating behaviour Source: Kirkpatrick (1998)

Process for evaluating behaviour		
Kirkpatrick's guidelines		As implemented in this research
1	Use a control group if practical	See the reasons mentioned in Table 3.3 for the exclusion of a control group.
2	Allow time for behaviour to take place	Observational post-tests were performed during the course of twelve months after the conclusion of the programme.
3	Evaluate before and after the programme	Observational pre-tests and post-tests were administered to only twenty of the eighty respondents due to time constraints.
4	Survey key staff on respondent behaviour	As the programme under evaluation focused strongly on procedures, observational tests consisting of forty performance items were administered as the nature of this research was summative.
5	Get 100% response on sampling	Due to time constraints, only twenty of the eighty respondents could be tested via practical observations.
6	Repeat the evaluation at appropriate times	This was logistically very improbable as it normally takes a full day to perform one observation on one respondent.

Evaluations to reaction and learning should take place as soon as possible at the conclusion of the programme in order to limit the possibility of extraneous factors influencing the effect of the programme and thereby skewing the data (Daponte, 2008). In the same vein, when, how often and how to evaluate behaviour should be done carefully by bearing in mind any extraneous factors outside of the training programme that could have an effect on behaviour adjustments at work (Cohen & Manion, 1994; Daponte, 2008).

3.4.4.4 Results

Kirkpatrick (1998) states that one should evaluate the benefits to the organisation at this fourth level in terms of the return on investment in the training programme. Are the benefits tangible and measurable in monetary terms (Kirkpatrick, 1998)? This level could not be statistically employed in this study within the time constraints set out for this thesis. Clutch failures sometimes happen within hours after installation, but mostly become noticeable much later on, often months or even years after a poorly executed clutch installation. It is, however, possible to perform a proper factual statistical investigation and report on the monetary benefits enjoyed by the organisations that participated in this study (Stufflebeam & Shinkfield, 2007). See section 2.4.4.5 in Chapter two for more detail on the results level.

A historically trusted and possible way to measure the outcome results in terms of all possible benefits enjoyed by all parties involved related to the intervention programme under study is to follow the principles of a longitudinal (irregular variation time-series design) study spanning over a period of several years (Steyn, Smit, duToit & Strasheim, 1994). This approach is essential in allowing enough time for normal or abnormal degeneration of clutches to take place. Such a study would need to include suppliers, distributors, and end-users of clutches and careful documentation regarding part-numbers, installation dates, failure dates, and vehicle specifications. Vehicle applications would have to be coordinated by a central office. Such a study, supported by forensic failure analyses, would enable the researcher to allocate reasons for failure to factors pertaining to the installation or to extraneous factors. By comparing such data with historical data, an accurate analysis of monetary gains could be calculated.

One must also consider other areas of gain such as improved relationships with distributor organisations, workshops, and private vehicle owners. Such subtle benefits could very well create an improved value-proposition for the organisation facilitating the intervention programme with improved sales as a consequence (Reichheld, 2001). There are a multitude of extraneous factors that could influence the longevity of a new clutch installation

which fall outside of the scope of control of the training programme. Some extraneous factors which could adversely affect the function and operation of the newly installed clutch are considered to be the vehicle operator's driving style, the road conditions, and the normal or abnormal load placed on the driveline. Peripheral vehicle component-tolerances, which are not part of but related to the clutch assembly, could degenerate outside of original design specifications due to normal or abnormal wear and tear. Such factors could accelerate the demise of the newly installed clutch, which could impact negatively on the programme's perceived effectiveness. However, an attempt was made to gather anecdotal insights by communicating with the participating workshops as well as the sample of respondents who took part in this study.

3.4.5 Limitations of the conceptual framework

This conceptual framework was designed in the form of a logic model, potentially to allowing the evaluator to perform a wide range of evaluations spanning the full scope of formative and summative evaluations, including the process and product of the intervention programme (Frechtling, 2007). However, the focus of this study intentionally disallowed the full spectrum of possible evaluation activities by shifting the lens of inquiry to a specific product within a certain time lapse after the conclusion of the programme (immediate and intermediate outcomes).

This researcher's reason for limiting the study to the immediate outcome of the product of the programme (summative evaluation) was two-fold: Firstly, the nature of the automotive arena allowed for trainees to attend this programme for only one full day and therefore future access to the same trainees may be compromised. It was therefore imperative to gather the opinion-survey data and pre-test/post-test data immediately on the same day as the trainees' attendance and the behaviour data as soon as possible after that (Kirkpatrick, 1998). Secondly, the gathered summative data together with the opinion data can be used ex post facto to perform a formative evaluation at a later stage (Weiss, 1998).

It was not practically possible to spread the focus of this research to include more research questions, which would have added value to a formative type of programme evaluation, due to the short time exposure with the respondents (Kirkpatrick, 1998). Due to the severe limitation in time exposure that this researcher had with the respondents, a quantitative approach to data collection and analysis lent itself better to the purpose of this type of summative-product study, whereas a qualitative approach would have been more appropriate to a formative-process study (Kirkpatrick, 1998; Weiss, 1998).

Ideally, a future formative study ought to incorporate a qualitative component which would explain the quantitative data better and lead to more meaningful improvements to the programme (Mertens & Wilson, 2012). Even though the conceptual framework had the potential to be inclusive of quantitative and qualitative data gathering techniques, this study excluded the qualitative types of data gathering such as observations, interviews, and focus groups. This limitation did not necessarily point to a flawed conceptual framework, but rather to the exclusionary nature of a summative evaluation where the focus is on the effectiveness of a programme (product/outcomes), rather than the process that leads to its effectiveness or failure (Frechtling, 2007; Daponte, 2008).

The conceptual framework of this study did not provide the focus and guidance that would be required for testing causation between levels and would also be limited in this regard with a follow-up formative study. The logic model depicted in Figure 3.1, however, is dynamic (utilisation focused) and could be expanded upon to offer a wider choice of evaluation frameworks or models to shift the lens of inquiry to other specific areas of interest (Patton, 1997). Weiss explains that evaluations of programmes could be very narrowly fixed should the intention be to strictly determine a judgement on the programme's outcome or open-ended should the process of the programme be under study (Weiss, 1998). Causation could be explored by shifting focus to the programme's process with a formative aim in mind for programme improvement. Moreover, the data collected during this summative study could form a solid foundation for the design of a follow-up formative study. It is important to reiterate that the aim of this study was to determine a judgement on the effectiveness of the programme with regard to the three focus areas of reactions, learning, and behaviour.

3.4.6 Rationale for using the conceptual framework

The overall structure of this evaluation study was made possible by applying the principle of logic modelling to the study (Frechtling, 2007). Frechtling (2007:1) explains that the logic model empowers the evaluator to, by virtue of its scaffolding nature, define and clarify what should be measured and when. The concept of a logic model is fundamentally an evaluation tool that postulates a theory of change underpinning an intervention. This logic model characteristically offers structure to a project through a system of interconnected elements that include components and connections (Mertens & Wilson, 2012; Frechtling, 2007). The logic model offers the evaluator a workable structure of how the programme's theory of change is meant to bring about the desired change, what the required inputs, activities, and outputs should be in order to achieve the desired impact on the organisation (Mertens & Wilson, 2012).

Guided by Patton's (1997) argument for a utilisation-focused approach to evaluation, Kirkpatrick's (1998) four level evaluation framework added more structure and utility to the standard form of a logic model and positioned the conceptual framework perfectly to answer the three research questions pertaining to this study. Referring to Figure 3.1, it can be seen that the initial programme activities, as depicted by the logic model, are focused on the processes at work within the programme. The balance of the logic model refers to the product or impact that the programme has had on the organisation. The way that this conceptual framework is portrayed gives the evaluator the opportunity to focus the lens of inquiry on any area that is of immediate importance to the organisation at that point (Mertens & Wilson, 2012). For the purposes of this study, and to answer the three research questions accurately, a summative evaluation was required in order to gauge the initial impact that the programme had on the trainees and the execution of their jobs. Kirkpatrick's (1998) four level framework added important structure to the logic model and allowed the evaluator freedom to isolate certain immediate areas of concern (such as the programme's product) from the rest of the programme's process (Caffarella, 2002).

3.5 Description of the sample

The target population for this programme evaluation comprised Automotive Service Technicians in the Gauteng area where such Technicians were involved in the installation of ZF driveline components. However, this region is quite vast and it would have been practically impossible to include all Automotive Service Technician's residing in this area in this study (Mertens & Wilson, 2012).

In keeping with acceptable procedures during the selection of participants and the gathering of data, the following seven principles were adhered to (Mertens & Wilson, 2012):

(1) Sample selection of Automotive Service Technicians within the experimentally accessible target population of Gauteng was achieved by inviting Automotive Service Technicians from seventeen ZF distributors and users of ZF products and the programme was offered on ten different occasions to eighty seven male Automotive Service Technicians that were made available by their employers over a period of twelve months. The owners/managers of the seventeen participating organisations made respondents available as their workload and schedules allowed for employees to attend the one-day intervention programme. Twenty of the eighty seven respondents were observed during clutch installations six months before the intervention programme commenced and these twenty respondents were made available only when customers brought vehicles in on a random basis for clutch

fitments. The researcher was contacted on such occasions and managed to observe twenty respondents during the six month period. It was not possible to perform more than twenty observations as time constraints dictated the small sample frame of twenty respondents.

(2) A total of eighty-seven male Automotive Service Technicians attended the programme over the twelve month offering, but seven sets of data were deemed incomplete and/or unusable for reliable research. The remainder of the eighty sets of data were carefully checked for incompleteness and five respondents had to be contacted where biographical data was incomplete.

(3) Respondents were not allowed to write their names on any of the instruments in order to keep to the ethical requirements of anonymity. Respondents were however allocated a one-time student number according to the chronology of attendance registers and these numbers were inserted on the front page of each instrument.

(4) The same programme was presented over the twelve month period and no formative changes were made to the programme during the twelve month period, even when some obvious areas for improvement became evident over this period.

(5) The presentations were conducted by the same trainer using the same PowerPoint presentation and models during the twelve month period.

(6) All the respondents had the same pre-test, post-test and opinion survey administered to them over the twelve month period.

(7) Although participating service centres were randomly chosen, care was taken to not choose service centres that were related to each other in order to avoid respondents that had already undergone the programme discussing the programme with those that had not yet been exposed to the programme.

The experimentally available sample proved to be quite diverse in terms of race, ethnicity, culture, education, socio-economic status, experience, and age. As correlation procedures were not planned for the research, only three categories of biographical information were requested from the respondents in order to describe the cross-section of the sample better. The three categories of interest comprised age, qualifications, and being certified as qualified automotive service technicians.

3.5.1 Age

Table 3.5 and Figure 3.4 introduce the nature of the research sample with relation to the diversification of ages.

Table 3.5: Frequency count for the age groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Under 25	5	6.3	6.3	6.3
	25 - 30	7	8.8	8.8	15.0
	30 - 35	15	18.8	18.8	33.8
	35 - 40	16	20.0	20.0	53.8
	Over 40	37	46.3	46.3	100.0
	Total	80	100.0	100.0	

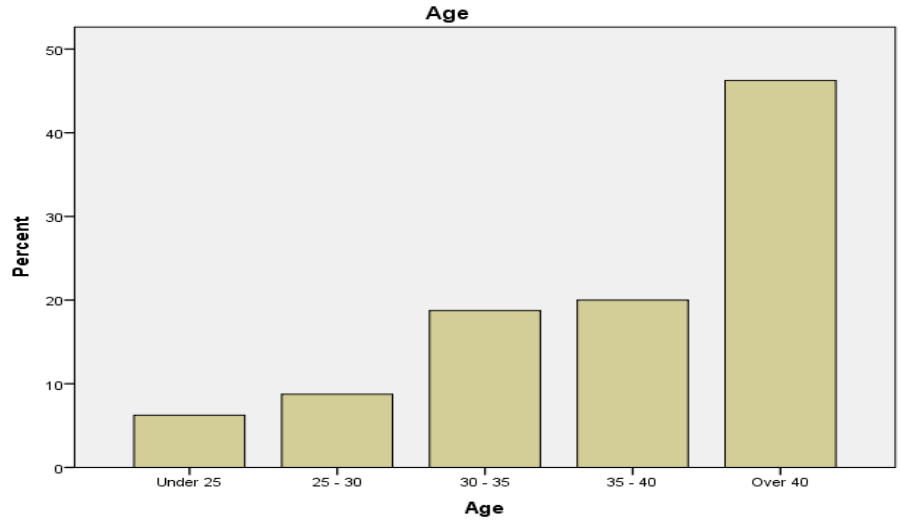


Figure 3.4: Frequency distribution for the age groups (n = 80)

From the data in Table 3.5 and Figure 3.4, it is clear that most of the respondents were over the age of thirty (85.1%). Only twelve respondents out of the eighty were under thirty years of age. This sample group could thus be considered as mature automotive service technicians.

3.5.2 Qualifications

In Table 3.6 and Figure 3.5, the qualifications of this sample group are presented. This researcher was interested in ascertaining how many respondents held tertiary qualifications, how many held grade 10 and matric qualifications (grade 10 is normally the minimum entry qualification acceptable for following a trade), and how many respondents held lower than acceptable qualifications for following a formal trade.

Table 3.6: Frequency count for qualifications

	Frequency	Percent	Valid Percent	Cumulative Percent
Diploma/Degree	10	12.5	12.5	12.5
Matric	37	46.3	46.3	58.8
Grade 10	29	36.3	36.3	95.0
Lower	4	5.0	5.0	100.0
Total	80	100.0	100.0	

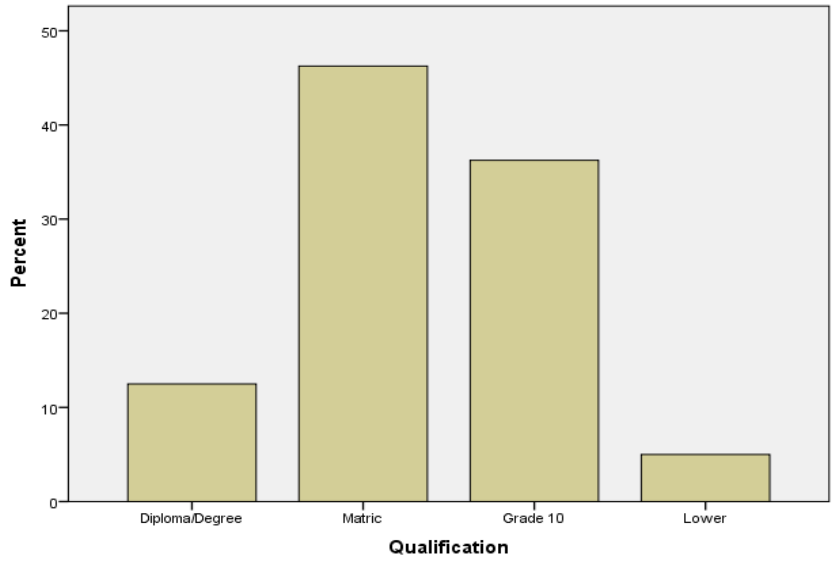


Figure 3.5: Frequency distribution for qualifications

From Table 3.6 and Figure 3.5 it can be seen that only five percent of the respondents had a school qualification lower than Grade 10. 58.8% of the respondents had a matric qualification and within that group, twelve and a half percent had some form of higher education qualification. 36.6% of the respondents had a Grade 10 qualification, which is the minimum qualification for joining an Automotive Service Technician apprenticeship programme in South Africa. One can thus argue that ninety-five percent of the respondents were of an acceptable academic standard. A possible concern is that the lower qualified respondents may not have possessed the language skills to have understood the programme in its fullness. Prior to the test sessions for all the different groups, the questions and survey statements were read out to the respondents and possible difficult words were explained.

This group of four respondents may also have had difficulty in understanding the written pre-test and post-test and the opinion survey. A further concern is that the pilot study that was performed at the beginning of the study did not include respondents with a school qualification lower than Grade 10 as a Grade 10 qualification is the lowest acceptable academic qualification for entering an Automotive Service Technician programme.

However, the reality is that many people holding lower than acceptable qualifications receive minimal on-the-job training and are expected to execute complex tasks on equally complex vehicles. A statistical analysis of these four respondents is offered further on in this study.

3.5.3 Qualified Automotive Service Technician

Table 3.7 and Figure 3.6 inform on how many of the eighty respondents had actually managed to obtain formal certifications for being qualified automotive service technicians.

Table 3.7: Frequency count for certified qualified AST

	Frequency	Percent	Valid Percent	Cumulative Percent
No	50	62.5	62.5	62.5
Yes	30	37.5	37.5	100.0
Total	80	100.0	100.0	

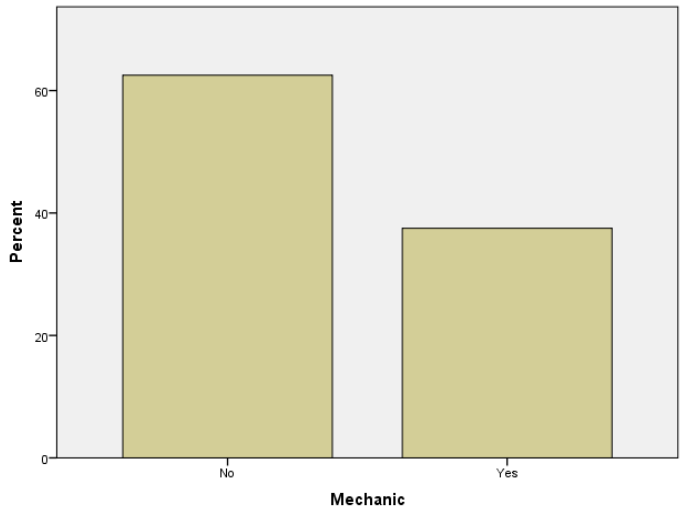


Figure 3.6: Frequency distribution for certified qualified AST (n=80)

From Table 3.7 and Figure 3.6, it can be seen that only 37.5% of the respondents were actually certified as qualified Automotive Service Technicians. The fact that 62.5% of the respondents were working as Automotive Service Technicians with no or very little formal training may be seen as problematic in terms of the validity and reliability of their opinions. One could argue that seeing that they have no or little formal theoretical training, they may not be in an ideal position to make judgements on a programme which they cannot measure against reliable prior knowledge. One could launch a counter argument by offering work experience and informal workplace training from qualified supervisors as a reliable base from which such Automotive Service Technicians could offer judgements on the programme. A more reliable method of bolstering this descriptive statistic is to incorporate a qualitative component in the form of interviews in a future study.

3.6 The programme: Clutch installation

Historically, it has been found that Automotive Service Technicians could cause certain premature clutch failures due to incorrect behavioural practices in the following eight critical areas (Drexl, 1998):

1) Incorrect product application.
2) Incorrect lubrication practice.
3) Incorrect extrication practice.
4) Incorrect preparation practice.
5) Incorrect installation practice.
6) Inability to perform a preliminary general failure investigation.
7) Inability to perform a product failure analysis.
8) Incorrect handling of materials before and during installation.

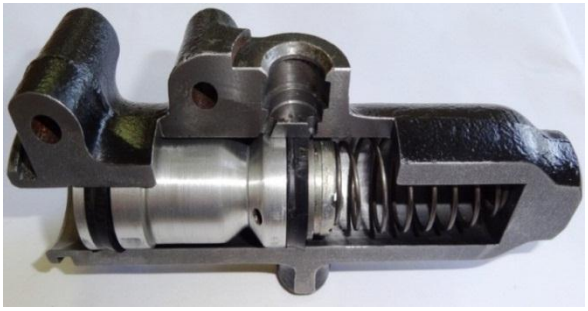
The educational programme forming the core of this study was conceived and developed in Schweinfurt, Germany several years ago as an answer to the above problem. A roll-out programme in Germany was launched to equip representatives of the different ZF subsidiaries around the world with the correct installation protocol regarding different driveline and chassis technologies. Clutch installation forms part of this international drive to improve quality installations of ZF components wherever such technologies exist in that country's vehicle fleets. All the technical concepts contained in the programme were derived from the textbook by Drexl (1998), as well as data obtained from in-house (Germany) research. The programme came to life due to a need within the organised service centre environment in Europe for manufacturers of automotive components to develop programmes of excellence guiding the users of their products regarding the correct protocol for installation, and operation.

The programme was designed around the following six principles which establish a standard clutch installation protocol (Drexl, 1998):

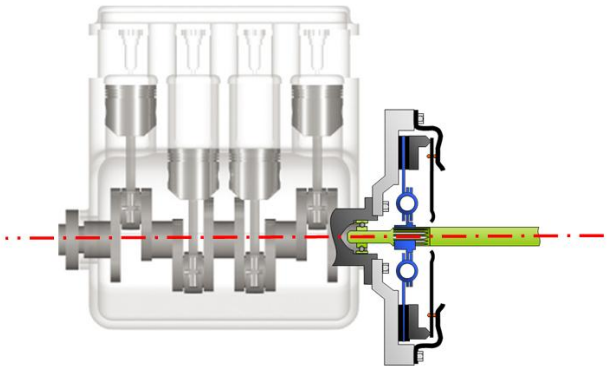
(1) Verification: Technicians are taught the importance of determining the Original Equipment Manufacturers' specifications for the different vehicles and making use of on-line and printed catalogues to verify the correct part numbers applicable per vehicle type and its unique VIN (Vehicle Identification Number). Technicians are further encouraged to do the minimal research on the specific settings and adjustments as prescribed by the different Original Equipment Manufacturers. The consequences of operating outside of these specified parameters are explained with

emphasis on the possibility of premature failure due to incorrect component applications. The mode of delivery is by means of a PPT presentation.

(2) Preliminary inspection: Technicians are taught to conduct a pre-inspection as peripheral systems to the clutch assembly are often overlooked with the result that the original problem that caused the failure is perpetuated. Hydraulic systems are explicated by means of physical models as well as PowerPoint diagrams. All other related components have to be checked to confirm their adherence to specifications. As this section largely revolves around the hydraulic release system, the master cylinder as a key hydraulic component is explained through the photograph below:



(3) Clutch removal: The emphasis during this stage lies on the importance of keeping the engine crank-shaft and transmission-shaft in perfect alignment. Latent errors are often the result of incorrect extrication techniques. The diagram below serves as an example of the graphics that are used in the PowerPoint presentation for explaining this critical centrality:



(4) Failure analysis: This stage requires the grasp of a range of scientific principles such as torque, power, tribology, hysteresis, harmonics, oxidation, friction, torsional-vibration, plastic-deformation of iron and steel, compression and tensile stress, metal fatigue, momentum and inertia.

Trainees are sensitised to the forensic nature of failure analysis. The main purpose of this stage within the programme is to stress the importance of isolating the reasons for failure and to implement counter measures to prevent the same premature failure from taking place again.

(5) Preparation: The principles of tribology and coefficients of friction are stressed in this phase. Good preparation is partly common sense, but certain aspects of the clutch assembly have changed significantly over the years, and a trend exists for Technicians to erroneously apply previously correct actions to modern materials that now require a different approach. Incorrect product handling and their consequences are also explained in this stage.

(6) Installation: Correct use of equipment and common errors that are prevalent during this stage form the centre of focus during the installation stage. Clutch assemblies are becoming more sophisticated every year and they are also becoming more sensitive to previously insignificant rough handling during installation. The consequences of incorrect handling are explicated with the aid of a range of photographs that explain the nature of failures as a result of poor handling. The uses of special installation tools are stressed and the consequences of using questionable alternative tools are explained through the use of photographs.

3.7 Instruments, Validity and Reliability

The four level Kirkpatrick framework is traditionally used for programme evaluation by utilising quantitative methodologies (Kirkpatrick, 1998). This study utilised the survey method for answering sub-question one, the quasi-experiment method (pre-tests and post-tests) for answering sub-question two and the site-observational checklist method to answer sub-question three (Cohen & Manion, 1994). See Table 1 in the annexure for a summary of the links between the research questions, the data collecting instruments and sources, and the information that was expected from these methods. Table 1 also shows the links to analysis and ethical considerations.

3.7.1 Survey: Level one

Sub-question one: *What are the participants' reactions with regard to the training programme?*

This section of the data gathering informed sub-question one, which equated to Kirkpatrick's first level of reactions to the programme. A survey questionnaire (Appendix A) was administered to the respondents directly after the delivery of the training programme in order

to acquire information on their reactions to the programme (Kirkpatrick, 1998). The response items on the survey questionnaire allowed for the respondents to score each item according to a four-point-Likert scale (Thomas,1998).

The satisfaction survey was divided into sections A, B, and C with ratings scale questions informing each section: See Figure 4.1 for for more information on instrumentation for this research.

The survey questionnaire set out to measure the respondent's satisfaction with the programme, the ability of the trainer to hold their interest, the quality and accuracy of the content, and the delivery and the utility thereof by quantifying the response items (Kirkpatrick 1998). Rating scale questions were included in all three sections and trainees had to indicate their opinion by selecting one of the following options:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

Before administration of the survey questionnaire, a pilot study was implemented with the view of identifying possible errors or ambiguity in the content (Aldridge, 2001). Certain survey questions were altered in order to improve the validity and reliability of the instrument during the pilot study by refining and focusing the questions on the construct of interest that it was intended to measure (Aldridge, 2001).

A Cronbach's Alpha coefficient was calculated to measure the internal consistency reliability of the satisfaction survey and the Likert response scales (Cohen, Manion & Morrison, 2007). Inter-item correlations were calculated to check the reliability of individual items and, by doing so, the overall reliability of the survey instrument was improved (Mouton & Marais, 1990). The Cronbach's Alpha coefficient for the ten survey items under Content = 0.802, the Cronbach's Alpha coefficient for the eight survey items under Presenter = 0.883 , and the Cronbach Alpha coefficient for the four survey items under Overall programme = 0.709. The combined Cronbach's Alpha coefficient for all twenty-two items on the satisfaction survey = 0.913, which indicated a high to excellent internal consistency reliability (George & Mallery, 2003). All calculations were performed using SPSS software and checked by the University of Pretoria's Department of Statistics for accuracy. The University of Pretoria's Department of Statistics also assisted with advice and recommendations regarding the reliability of the satisfaction survey instrument.

3.7.2 Pre-test and Post-test: Level two

Sub-question two: *How effective is the training programme in facilitating the acquisition of new knowledge?*

This section of the data gathering informed sub-question two, which equates to Kirkpatrick's second level of learning. Before the delivery of the intervention programme, a written pre-test (Annexure B) was administered to the respondents and a written post-test (Anexure C) was administered directly after the programme (Kirkpatrick 1998). This method of collecting data is a form of quasi-experiment and known as a before and after experiment with no control group (Bailey, 1994). The performance test consisted of a forty item multiple choice type test, intermixed with true/false questions. An example of each of the two types of questions is shown below:

Multiple choice type question

Why is it important to pull the gearbox out as straight as possible?	
(a)	So that the input shaft doesn't bend
(b)	To protect the spigot bearing
(c)	So that the old clutch plate doesn't bend
(d)	So that the diaphragm fingers don't bend
(e)	All of the above

Agree or Disagree type question

Release forks are precision engineered components and very expensive. You have to justify the need to replace the fork. Do you agree or disagree with the following statements? The release fork needs to be replaced:			
		Agree	Disagree
(a)	When there is significant but even wear on both fingertips		
(b)	When there is significant wear on only one fingertip		
(c)	When the pivot points show significant wear		
(d)	When it is slightly bent		
(e)	When it is significantly bent		
(f)	If it's a roller type, the rollers are badly worn		

The pre-test serves the purpose of setting a bench mark against which one can measure the increase in knowledge attained as a result of the intervention programme (Worthen *et al*., 1997). The test questions were directly derived from the content of the intervention programme and measured the constructs that it was intended to measure, thus ensuring content validity (Selltiz, Wrightsman & Cook, 1976; Hammersley, 1987).

It is not possible to employ a control group during this stage of data collection as no alternative programme exists against which to measure the effect of the intervention programme (Bailey, 1994). On each day of presenting the intervention, the pre-test was administered first, thereafter the intervention programme was presented and the post-test was administered at the programme's conclusion without any interruptions, as suggested by Kirkpatrick (1998). An uninterrupted session will limit any extraneous effects of influence on the intervention programme and thereby enhance the validity of the test results (Bailey, 1994). By allowing a time lapse between the pre-test and the post-test, threats to internal and external validity such as history, maturation, statistical regression, testing, instrumentation, and experimental mortality could weaken the prospect of apportioning credit to the effects of the intervention programme (Cohen & Manion, 1994).

The only independent variable (intervention programme) in focus for this research was a training document compiled by the research and development engineers at ZF Germany, which undergoes revision when an important change in an automotive component demands a different treatment from the Automotive Service Technicians. The only dependent variables of concern for this research were the three outcome criteria of: (a) satisfaction with the programme (level one), (b) knowledge gains (level two), (c) behaviour modification (level three), and (d) benefits accrued by participating service centres (Collins, Joseph & Bielaczyc, 2004).

The one independent variable and four dependent variables were of most interest to ZF Services South Africa as focus was explicitly narrowed to obtain a relatively reliable verdict on the programme's inputs and outputs. The independent variable (intervention programme) is thus a very well defined and well described document that looks the same for different populations across the world and only changes occasionally and in a synchronised manner, thereby ensuring its external validity. This instrument can thus be seen as reliable in the sense that it can be replicated at any future stage, measuring the same constructs in the same way (Winter, 2000).

This study was the first in a series of evaluation studies that will be replicated in other provinces and other areas of South Africa. The representativeness of the target population for the purposes of generalisation will only become evident once a larger sample of the entire population has been subjected to the same data gathering instrument. The Hawthorne effect is minimised due to the uninterrupted nature of this quasi-experiment (Cohen & Manion, 1994).

3.7.3 Observation: Level three

Sub-question three: *How effective is the training programme in changing the participants' observable work behaviour?*

This observational checklist (Annexure D) informed sub-question three, which equates to Kirkpatrick's (1998) third level of behaviour. In order to ascertain whether the participants had transferred their learning into new behaviours, service centres that formed the sample population were visited at regular intervals for the sake of observing if the Automotive Service Technicians' behaviour changes were in accordance with the intervention programme's procedural stipulations.

Annexure D is a detailed behavioural observation checklist consisting of forty check items which reflect the programme objectives accurately (Slavin, 1984). This checklist is graded from zero to five, and is scored according to the criterion-referenced model of performance assessment (100% required per item) so that the quality of each observed behaviour can be measured against the procedural requirements as presented in the intervention programme (Slavin, 1984).

This system allowed the researcher to rely on a low-inference type of observation that emphasises objectivity, which is more reliable than a high-inference type of observation whereby the evaluator is immersed subjectively in the evaluation situation (Slavin 1984). The observational checklist items were directly derived from the intervention programme and thus reflected a high degree of content validity, and being a stable procedural document, it is easily replicable in any other setting measuring the exact same constructs thus ensuring a high degree of external validity as well as reliability (Cohen & Manion, 1994). It is impossible to fully know what the effects of experimental mortality, instrumentation, testing, statistical regression; maturation and history are on the data collected as this instrument was applied over a span of twelve months after the delivery of the intervention programme.

3.8 Procedures of data collection and analysis

Thomas (1998:193) explains how descriptive statistics on the survey data and test results are to be processed via computer to yield information on percentages, percentiles, measures of central tendency, measures of variability, and measures of skewness (Thomas 1998:214). Such procedures are valuable tools for establishing the projected effectiveness of the programme under evaluation and for possibly generalizing to the wider population of Automotive Service Technicians. To moderate the effects of sampling error, and for testing for statistical significance, the t-test was applied via SPSS statistical software (Thomas,

1998:215). Table 3.8 provides a summary of the process that was followed regarding inputs, activities and outputs with regards to instrumentation and as mapped in this study's logic model (see Figure 3.1).

Table 3.8: Data collection process followed for this study

Action	Output	Time line
Pilot study	Three colleagues with longstanding experience regarding automotive drivelines and clutches in particular were asked to complete the test and comment on ambiguity and errors. Alterations to wording and photographs in the multiple choice questions were subsequently made.	Six months before start of programme
Pre-test Observation	Before commencement of the first programme event, twenty respondents from participating workshops were made available by their employers to establish pre-programme data on practical installations by means of observation.	Six months before start of programme
Pre-test Written	Before commencement of each programme presentation, the written pre-test of 30 minutes was administered to the group of respondents. Pre-testing commenced at 8h00 on the morning of each presentation and the presentation commenced at 8h30 on completion of the test.	August 2012 to November 2012.
Intervention	The programme presentation spanning one day was delivered to the respondents mainly by means of four PowerPoint presentations. The presentation took place in a training room and various models were available to explicate core principles and demonstrate function and operation. No real clutch fitments took place.	One day per session
Post-test Written	At the conclusion of the theoretical programme presentation, the written post-test of 30 minutes was administered to the group of respondents.	30 minutes
Survey	The satisfaction survey of 10 minutes was completed at the same time directly after the written post-test.	10 minutes
Post-test Observation	Observations of practical clutch installations were conducted during the 12 months after the programme delivery and commenced within the first week of programme offerings. Due to time constraints, availability of respondents, and opportunities for clutch installations only twenty respondents were observed over this twelve month period.	Commenced January 2013 for 12 months.

3.8.1 Survey

Once all survey questionnaires were collected, a process whereby the survey answers are transformed into a data file by allocating a serial identifier to each respondent's questionnaire was followed (Fowler, 2009). In order to reduce errors, the data was codified as per SPSS convention as it appears on the survey instrument and it was checked for any blank fields which may skew the analysis. Where data entries were missing, respondents were contacted to complete the missing information, therefore the assignment of data codes for answers that were missing was not necessary (Fowler, 2009). It should also be noted that test items where respondents did not tick a choice were marked as incorrect.

This researcher was the only person entering the data into the SPSS software for analysis. Having more than one person entering data could detrimentally affect the validity of the process as errors can occur when more than one person enters the data (Fowler, 2009).

A process known as data cleaning was followed by checking for completeness, checking for only legal codes in all fields, and utilising the built-in ability of the software to check for internal consistency (Fowler, 2009). This process resulted in seven data-sets being deemed inadequate due to too much missing information. In some cases, respondents had ticked every single item on the test's multiple choices which rendered such tests completely unusable. Eighty data-sets of the original eighty-seven respondents were regarded as complete and reliable. As some respondents were contacted where errors/omissions were encountered and such errors/omissions were fixed, the data entry process of the survey and tests are according to this researcher's best knowledge 100% accurate (Fowler, 2009).

3.8.2 Pre-test and Post-test

This researcher administered a pre-test before the intervention programme was presented in order to set a bench mark against which the increase in knowledge attained could be measured as a result of the intervention programme. After the intervention programme, a post-test was administered and the differential score between the two could be expressed as a percentage change (Thomas, 1998). Such statistical tools as descriptive statistics and t-tests were utilised to conduct group comparison statistics (Creswell, 2008). Although data was collected from ten different groups, comparisons and correlations between the ten groups were not performed as such activities would have fallen outside of the narrow focus of the research questions. The resulting statistical analysis is presented in tabular and graphical format to highlight the items where gains in knowledge are regarded as satisfactory or unsatisfactory.

3.8.3 Observation

The behavioural observation checklist can be viewed as a practical test (Thomas, 1998). The behavioural observation instrument consisted of forty check-list items which were directly derived from the intervention programme. Each item on this instrument was scored on a scale of zero to five to indicate the quality or completeness of the Automotive Service Technician's adherence to the prescribed procedures in the intervention programme. This analysis is presented in graphical and tabular format in order to highlight the areas that are indicative of either poor or good knowledge transfer.

3.9 Limitations to the Quantitative Approach

This quantitative inquiry served the purpose of delivering a verdict on the effectiveness of the intervention programme in its current form. This researcher purposefully set the boundaries

for data gathering and analysis in a narrow way to exclude processes of a formative nature. The summative purpose and research questions of this inquiry were satisfied by the data yielded from the three instruments as discussed (Creswell, 2008; Weiss, 1998).

The Automotive Service Technicians' own limitations or hindrances in achieving the adjusted learning and behavioural standards as set out by the intervention programme will be more effectively explored in a future qualitative inquiry (Stake, 2004). Hard-numerical data is insensitive to the underlying reasons and causality for poor performance in certain test areas or response items that received a response of "disagree" or "strongly disagree" (Kirkpatrick, 1998). This can be achieved when the phenomenon under study is naturalistically explored by the programme researcher immersing himself/herself in the real-life context of the respondents' world (Stake, 2004).

3.10 Ethical considerations

To meet the ethical requirements as are required for social research, the following ethical aspects discussed by De Vos (2003:62-76) were adhered to:

- Trust: All of the participants/respondents in this study were informed beforehand regarding the nature and objectives of the study. The potential benefits to their organisation and to them as trainees/service technicians were explained to them. This researcher has been open and transparent to the best of his knowledge, and will endeavour not to break the trust gained in any of his actions during and after the completion of this study.

- Informed consent: This was sought from the respondents as well as the owners of the service centres that participated in this study. The correct documentation regarding consent was handed to each respondent for their approval by virtue of a signature as well as their supervisors/employers' and collected before commencement of data collection.
- Privacy and anonymity: Violation of privacy/anonymity/confidentiality: No real names of respondents were or will be used. Each respondent was assigned a sequential number and their identities were and will not be made available to anybody. The observational pre-tests and post-tests were matched with each of the twenty respective respondent's survey-responses and written pre-tests and post-tests by means of this number system.

- Voluntary participation: Respondents were informed that they had the right to discontinue their participation at any point should they feel threatened in any way.
- Safety in participation: Respondents could in some instances be in a vulnerable position, by perceiving that the information required from them could be held against them by employers. No such incidents occurred, but this researcher will remain sensitive towards their fears and will ensure that the information pertaining to them will remain in a safe place. All data-sets will be kept in a safe place.

3.11 Conclusion

This chapter explained the choice of a quantitative research design and the application of the three self-developed instruments which included a satisfaction survey, a written pre-test and post-test and an observational pre-test and post-test. The use of a logic model serving as a theory of change for this study was made clear and it was further explained how the logic model could be manipulated from a utilisation-focused approach in order to position the lens of inquiry for any aspect of the programme that may be of interest at a particular time.

The choice of Kirkpatrick's (1998) four level framework for programme evaluation, forming the conceptual framework for this research, was also explained together with its intended limitations. The sample and the intervention programme were described and the procedures for data-collection and analysis were explained.

4.1 Overview of this chapter

This chapter seeks to answer the main research question of this study namely:

> *How effective is the training programme known as "Guidelines to clutch replacement" in equipping the Automotive Service Technician with the required knowledge and behaviour changes to ensure a fault-free clutch replacement?*

Chapter 4 presents data with interpretations obtained through three self-developed research instruments as portrayed in Figure 4.1 below. The three instruments are discussed in sections 4.3, 4.4, and 4.5.

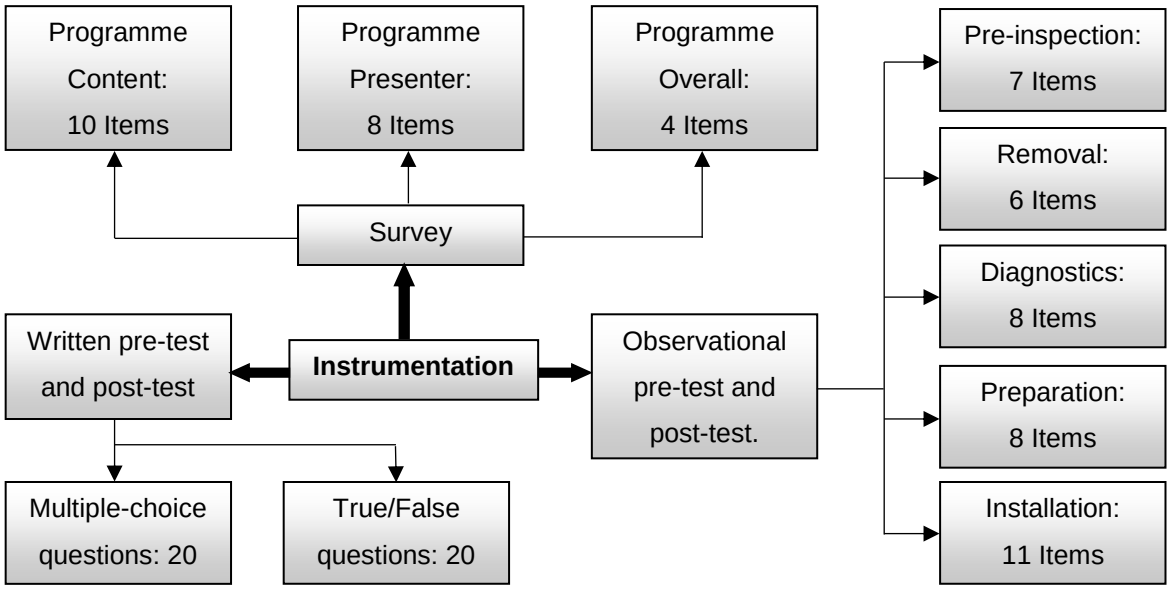


Figure 4.1: Instrumentation, sub-categories and items

Section 4.3 relates to the first sub-question and its stated hypotheses and systematically describes the satisfaction survey instrument that was self-developed and the manner in which it was utilised (see Section 1.9 in Chapter 1 on instrument development). A description of the three categories (Programme content, Programme presenter, and Overall programme) of the survey questionnaire comprising a total of twenty-two items is offered and each question item is individually discussed and analysed by employing frequency tables and histograms.

Each question item is concluded with a short discussion of the findings. Section 4.3 ends with adoption of adoption of the alternative hypothesis and a discussion of the survey items that received the most response choices of “Disagree” and “Strongly disagree”. The twenty-one respondents who made the most frequent response choices of “Disagree” and “Strongly disagree” on the four-point Likert scale that was employed for this survey are also discussed. Section 4.4 relates to the self-developed written pre-test and post-test. The hypotheses and a brief explanation of the coding system employed for statistical analysis with the software package SPSS (see Section 1.9 in Chapter 1 on instrument development) are then offered. Tables explaining the descriptive statistics for this section are presented and further supported with combined frequency tables for the written pre-test and post-test and their respective histograms. Histograms are important tools in determining whether data can be regarded as normally distributed or not. Through the histograms presented in this section, the choices made for this research regarding parametric and non-parametric tests of significance are explained.

Section 4.5 (observational pre-tests and post-tests) is treated much the same as Section 4.4. It is explained in this section why only twenty of the initial sample of eighty respondents was practically observed during their executions of clutch installations. Descriptive statistics and combined frequency tables are offered to statistically explain the data, and histograms round off the statistical representation of the data as processed by SPSS. The choices made with regard to the utilisation of parametric and non-parametric data are explained and this section adopts the alternative hypothesis as stated at the outset of this section. This section is finally concluded by offering a combined graph of the gains attained by the sample of twenty respondents and comparing the written pre-test and post-test scores with the observational pre-test and post-test scores. Concluding interpretations are provided on the extent of learning that was attained and behaviour changes that were observed at the workplace.

4.2 Satisfaction survey questionnaire (Trainee reactions)

In Section 4.2, the first research question is explored and answered by means of a satisfaction questionnaire. The questionnaire consisted of three categories and a total of twenty-two questions seeking clarity around the respondents’ perceptions and satisfaction with the programme content, the presenter, and the overall effect of the programme. The first research question and its null and alternative hypotheses are:

What are the participants’ reactions with regard to the training programme?

Hnull: There will be no significant reaction towards the programme.

Halt: There will be a significant reaction towards the programme.

The data collection instrument employed in this segment of the study is an adaptation of various examples on opinion questionnaires, as offered by Kirkpatrick (1998). The survey questionnaire is divided into the three categories of Content, Presenter skills, and Overall programme. The category on Content consisted of ten questions, the category on Presenter skills consisted of eight questions and the category on Overall programme consisted of four questions. Respondents were asked to respond to each item on a Likert type scale by choosing from Strongly agree, Agree, Disagree, and Strongly disagree. During the completion of this instrument, the respondents were also asked to provide biographical information which included their age, highest qualification and whether they were certified as qualified Automotive Service Technicians. Data was codified and captured with the statistical programme SPSS to represent the three biographical categories as discussed in paragraph 3.5 of Chapter 3. Section 4.2.1 commences with the ten questions contained in the category of programme content for the satisfaction survey questionnaire.

4.2.1 Reactions to questions regarding programme content

This category of the survey questionnaire consisted of ten items designed to gauge the respondents' opinion regarding the content of the programme. With Items 1, 2, and 3 of the category, respondents were asked to give an opinion on the clarity of the programme objectives and whether they had learnt something new and relevant about clutch fitment. The respondents indicated whether they felt equipped to conduct a diagnostic investigation on the vehicle prior to clutch removal and also on the removed components by responding to Items 4 and 5. With Items 6, 7, and 8 the respondents were asked to comment on the pace of the programme presentation, the usefulness of the hand-outs and the way in which they could interact during the programme delivery. Respondents had an opportunity to comment on the quality of the PowerPoint presentation with Item 9 with special focus on the graphics, as this programme is very graphic by nature. Lastly, with Item 10, respondents were asked to identify any errors in the content if indeed any such errors did exist. The ten items in the category of Content, and their descriptive statistics, are discussed in more detail in the following paragraphs.

The ten items in this category were structured to be scored on a four-point Likert scale by choosing one of the following score items: Strongly agree, Agree, Disagree, and Strongly disagree. Frequency tables and bar charts for survey items 1 to 10 follow below with an individual discussion of each item.

Table 4.1: Frequency count of Item 1 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	1.3	1.3	1.3
Agree	24	30.0	30.0	31.3
Strongly agree	55	68.8	68.8	100.0
Total	80	100.0	100.0	

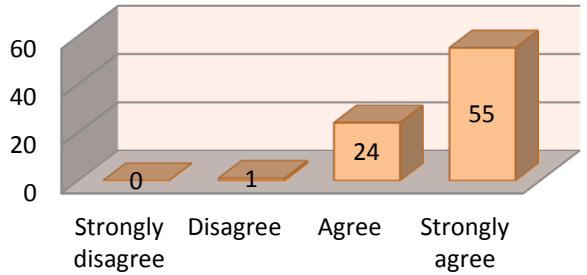


Figure 4.2: Frequency distribution: Item 1 Content

Table 4.2: Frequency count of Item 2 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	2	2.5	2.5	2.5
Agree	22	27.5	27.5	30.0
Strongly agree	56	70.0	70.0	100.0
Total	80	100.0	100.0	

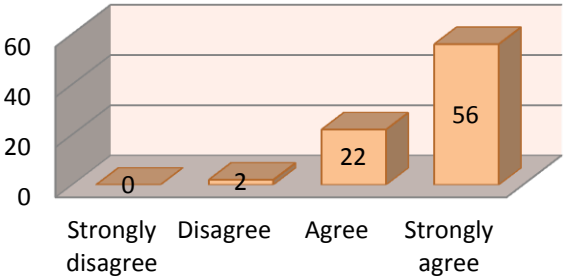


Figure 4.3: Frequency distribution: Item 2 Content

Table 4.3: Frequency count of Item 3 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	2	2.5	2.5	2.5
Agree	20	25.0	25.0	27.5
Strongly agree	58	72.5	72.5	100.0
Total	80	100.0	100.0	

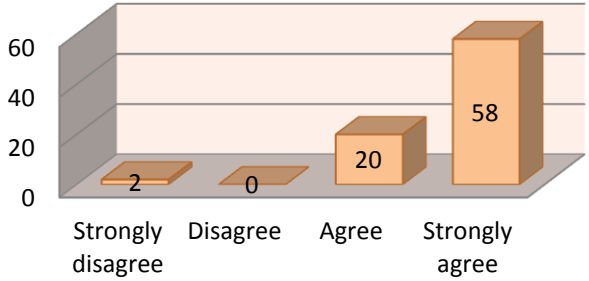


Figure 4.4: Frequency distribution: Item 3 Content

4.2.1.1 Item 1 of programme content: The programme objectives are clear and realistic

The data in Table 4.1 and Figure 4.2 indicate that 68.8% (fifty-five respondents) of the respondents believed that the programme objectives were clear and realistic whilst another 30% (twenty-four respondents) agreed, and only 1.3% (respondent number 76) of the respondents thought that the objectives were not clear and realistic. It may be possible that this negative response was a result of the level of qualification of this respondent as he reported a highest qualification of Grade 12 and is forty years of age. He had not improved his level of qualification since graduating from school and could even have experienced a language barrier as a learning inhibitor (Bloch, 2009).

4.2.1.2 Item 2 of programme content: I learnt something new about clutch fitment

The data in Table 4.2 and Figure 4.3 indicate that 70% (fifty-six respondents) of the respondents strongly believed that they learnt something new about clutch fitment whilst another 27.5% (twenty-two respondents) agreed on this and only 2.5% (two respondents) of the respondents were of the opinion that they did not learn anything new. It may be possible that the 2.5% (two respondents) did not understand the question or that the programme was above their capability level. These two respondents' written test improvements from the pre-test to the post-test improved by only 3% and 5% respectively, which bears witness to their own admission that they had not learnt anything new. These two respondents were interviewed in order to get clarity on their responses.

4.2.1.3 Item 3 of programme content: I found the information relevant to my work

The data in Table 4.3 and Figure 4.4 indicate that 72.5% (fifty-eight respondents) of the respondents believed strongly that the information presented to them was relevant to their work, whilst another 25% (twenty respondents) agreed on this and only 2.5% (two respondents) of the respondents were of the opinion that the information was irrelevant to the work they did. These two respondents (2.5%) were both in their thirties and one of them had a Grade 12 qualification, whilst the other had a Grade 11 qualification. Often, lower qualified Automotive Service Technicians are not entrusted with more important installations and it may therefore be possible that these two respondents had never been involved in complex technical activities such as clutch fitment and may have felt that the content was irrelevant for them (Spitz-Oener, 2006).

Table 4.4: Frequency count for Item 4 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	30	37.5	37.5	37.5
Strongly agree	50	62.5	62.5	100.0
Total	80	100.0	100.0	

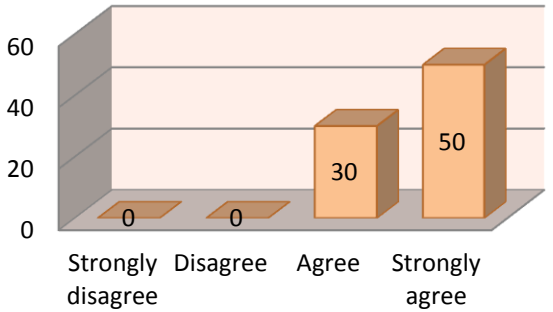


Figure 4.5: Frequency distribution: Item 4 Content

Table 4.5: Frequency count for Item 5 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	3	3.8	3.8	3.8
Agree	33	41.3	41.3	45.0
Strongly agree	44	55.0	55.0	100.0
Total	80	100.0	100.0	

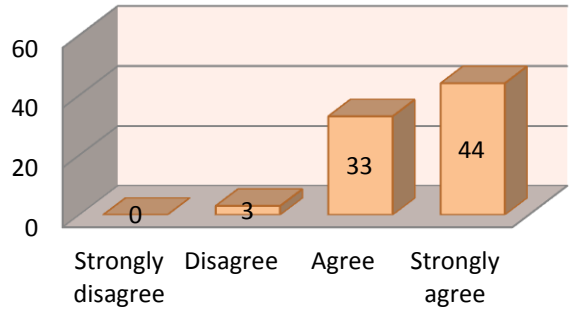


Figure 4.6: Frequency distribution: Item 5 Content

Table 4.6: Frequency count for Item 6 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	5	6.3	6.3	6.3
Disagree	31	38.8	38.8	45.0
Agree	21	26.3	26.3	71.3
Strongly agree	23	28.8	28.8	100.0
Total	80	100.0	100.0	

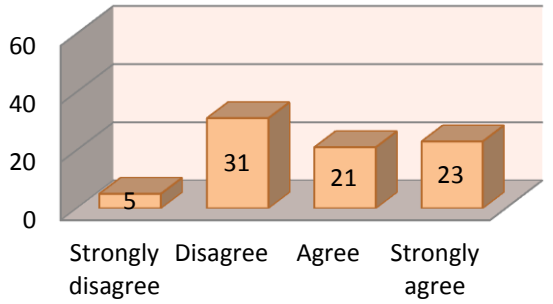


Figure 4.7: Frequency distribution: Item 6 Content

4.2.1.4 Item 4 of programme content: The programme equipped me to successfully conduct a diagnostic pre-inspection of clutch related components

The data in Table 4.4 and Figure 4.5 indicate that 62.5% (fifty respondents) of the respondents believed strongly that the information presented to them would help them to execute a successful pre-inspection, whilst another 37.5% (thirty respondents) agreed on this, which means that 100% of respondents were agreeing at various intensities. All eighty respondents therefore held the belief that the programme empowered them to carry out a diagnostic pre-inspection successfully.

4.2.1.5 Item 5 of programme content: The programme equipped me to successfully evaluate the failed components

The data in Table 4.5 and Figure 4.6 indicate that 55% (forty-four respondents) of the respondents believed strongly that the information presented to them enabled them to evaluate failed components successfully, whilst another 41.3% (thirty-three respondents) agreed on this and 3.8% (three respondents) felt that the programme did not empower them to carry out an evaluation of the failed components. All three of the respondents that chose the response “Disagree” to this item had qualifications no higher than Grade 10 and none of the three were certified Automotive Service Technicians. These respondents may have held this belief due to their low qualification level and they may not have been involved much in clutch fitment due to not being qualified Automotive Service Technicians (Spitz-Oener, 2006). All three respondents scored lowly on the pre-test and their post-test scores were all under 40%.

4.2.1.6 Item 6 of programme content: The pace of the presentation was too fast

The data in Table 4.6 and Figure 4.7 indicate that the sample group was almost equal in their agreement and disagreement on this item. Of the eighty respondents, 28.8% (twenty-three respondents) agreed strongly that the pace of the course was too fast, 26.3% agreed that the pace was too fast, whilst 38.8% (thirty-one respondents) disagreed and 6.3% (five respondents) strongly disagreed that they were comfortable with the pace. The programme clearly failed in this regard as it did not meet the requirements of the majority of respondents from a cognitive processing point of view. If more repetition was allowed for respondents to process the information over an extended period, the performance could have improved (Ebner & Holzinger, 2007). It may also be possible for some of the negative beliefs regarding the utility of the course to shift towards positive beliefs if more time was allowed to process information (Seifert, 2004).

Table 4.7: Frequency count for Item 7 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	6	7.5	7.5	7.5
Agree	29	36.3	36.3	43.8
Strongly agree	45	56.3	56.3	100.0
Total	80	100.0	100.0	

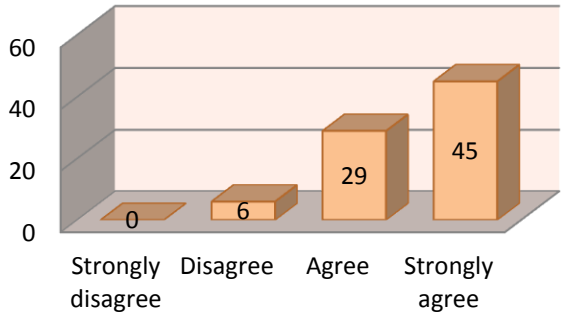


Figure 4.8: Frequency distribution: Item 7 Content

Table 4.8: Frequency count for Item 8 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	2	2.5	2.5	2.5
Agree	25	31.3	31.3	33.8
Strongly agree	53	66.3	66.3	100.0
Total	80	100.0	100.0	

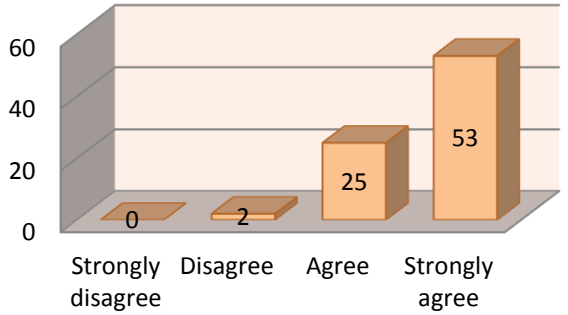


Figure 4.9: Frequency distribution: Item 8 Content

4.2.1.7 Item 7 of programme content: The hand-outs will be helpful to refer back to later

The data in Table 4.7 and Figure 4.8 indicate that a little more than half of the respondents (56.3%) believed strongly that the printed course material was valuable reference material to refer back to later, whilst 36.3% (twenty-nine respondents) of the respondents agreed on this, and 7.5% (six respondents) of the respondents disagreed. It is interesting to note that three of the six respondents that chose a response of "disagree" to this item also believed that the programme did not empower them to successfully evaluate failed components (Item 5). None of the six respondents who chose a response of "disagree" were qualified Automotive Service Technicians and of the six, only two had a Grade 12 qualification. Secondary schools in South Africa where English is not the first language have failed dismally and are continuing to fail in equipping school leavers to be proficient in Mathematics, Science and English where proficiency in English have been found to be one of the strongest predictors of learning (Howie, 2003). The effects of learning through a poorly acquired additional language are far-ranging and include stress, lack of self-confidence, disaffection and alienation (Probyn, 2001). A qualitative follow-up study, would perhaps confirm whether language is indeed a learning inhibitor and a barrier for utilising the printed hand-outs as they were intended to be.

4.2.1.8 Item 8 of programme content: I was given adequate opportunity to interact with the trainer and ask questions

The data in Table 4.8 and Figure 4.9 indicate that 66.3% (fifty-three respondents) of the respondents believed strongly that they had sufficiently interacted with the trainer, whilst 31.3% (twenty-five respondents) of the respondents agreed on this and 2.5% (two respondents) disagreed. Both the respondents who chose a response of "Disagree" also felt that the pace was too fast (Item 6) and they may have felt overwhelmed by the content which may have hampered their desire to interact with the trainer and the group. This is pure conjecture, as qualitative data is not available for clarification, but it may be possible that these respondents were hampered by their English proficiency and their understanding of scientific principles (Probyn, 2001). The one respondent was in his early twenties and held a matric qualification and the other respondent was in his fifties and held a very low school qualification and both had never managed to qualify as Automotive Service Technicians. Seeing that both respondents agreed and strongly agreed respectively that the course was too fast (Item 6) serves as a probable reason for them believing that they did not have sufficient interaction with the trainer.

Table 4.9: Frequency count for Item 9 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	3	3.8	3.8	3.8
Agree	28	35.0	35	38.8
Strongly agree	49	61.3	61.3	100.0
Total	80	100.0	100.0	

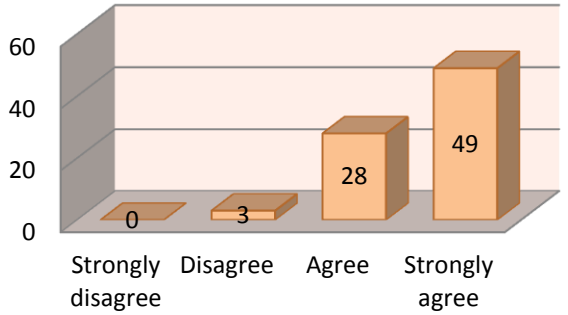


Figure 4.10: Frequency distribution: Item 9 Content

Table 4.10: Frequency count for Item 10 of Content (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	3	3.8	3.8	3.8
Agree	24	30.0	30.0	33.8
Strongly agree	53	66.3	66.3	100.0
Total	80	100.0	100.0	

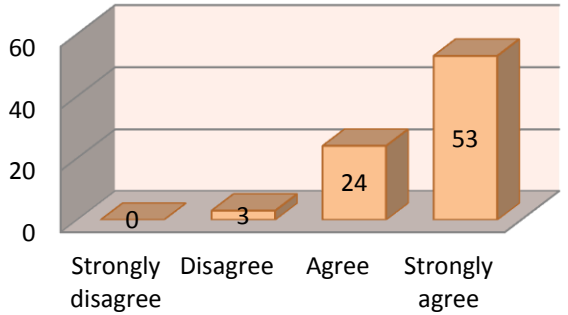


Figure 4.11: Frequency distribution: Item 10 Content

4.2.1.9 Item 9 of programme content: The images of clutches in the PowerPoint presentation were clear

The data in Table 4.9 and Figure 4.10 indicate that 61% (forty-nine respondents) of the respondents believed strongly that the PowerPoint presentation was clear and that the graphics were clear, whilst 35% (twenty-eight respondents) of the respondents agreed on this and 3.8% of the respondents (three respondents) disagreed. The three respondents who chose a response of “Disagree” also held the same negative beliefs regarding Items 5,6,7,8, and 9, which indicates a pattern of negativity by the same respondents regarding the programme. One possible reason for their response of “Disagree” on this item is that they may have had difficulty in interpreting mechanical drawings and figures as contained in the PowerPoint presentation. It would be prudent to perform a qualitative extension to this study and interview these three respondents in order to explore and understand their responses more accurately.

4.2.1.10 Item 10 of programme content: I found the information in the presentation accurate

The data in Table 4.10 and Figure 4.11 indicate that 66.3% (fifty-three respondents) of the respondents believed strongly that the information contained in the programme was accurate, whilst 30% (twenty-four respondents) of the respondents agreed on this and 3.8% of the respondents (three respondents) disagreed. Two of the respondents who chose a response choice of “Disagree” also held the same disagreement responses regarding Items 2, 6, and 10. They believed that the course taught them nothing new regarding clutch fitment, that the pace of the course was too fast, that it did not equip them to carry out any form of diagnostic activities and they believed the content of the course to be inaccurate. Both these respondents failed to improve on their pre-test marks (8% and 5% improvement respectively), and they also achieved dismal marks for their pre-test (13% and 15% respectively). It is clear from their very low scores in the pre-test that they possessed very poor prior knowledge/understanding regarding clutches in general and their negative opinion regarding the accuracy of the programme content cannot therefore be taken seriously as their prior learning on this subject was almost non-existent. The third respondent, who chose a response of “Disagree”, believed that the programme was irrelevant to his work, and believed that the programme failed to equip him with the knowledge to carry out an effective evaluation on failed components. He also believed that the hand-outs were of no value and that the information contained in the programme was inaccurate. He scored 18% for his pre-test and improved his post-test score by 20% which, although significant, is still extremely low.

4.2.2 Reactions for programme presenter

The category within the survey questionnaire which explores the respondents' opinions regarding the skills and knowledge of the programme-presenter comprised eight items. Items 1, 2, and 3 of this category deal with the presenter's enthusiasm regarding the topic, his level of preparation, his technical knowledge and experience on the topic of automotive clutch fitment. Items 4, 5, and 6 deal with how well the presenter explained difficult technical concepts, how well he communicated in general and in comprehensible English, and whether he displayed appropriate sensitivity regarding personal and cultural differences. The last two items, 8 and 9, measure the presenter's ability to capture the interest of the respondents throughout the programme, as well as his ability to pace the programme and cover all the content satisfactorily in the allotted time. The eight items in this category of Presenter were structured to be scored on a four-point Likert scale by choosing one of the following response items: Strongly agree, Agree, Disagree, and Strongly disagree.

Frequency tables and distribution bar charts for the eight items of Presenter follow with an individual discussion of each item.

Table 4.11: Frequency count for Item 1 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	19	23.8	23.8	23.8
Strongly agree	61	76.3	76.3	100.0
Total	80	100.0	100.0	

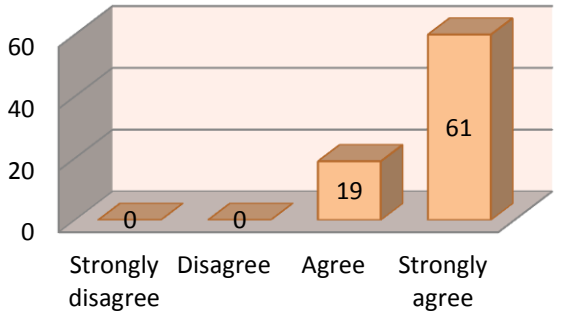


Figure 4.12: Frequency distribution: Item 1 Presenter

Table 4.12: Frequency count for Item 2 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	1.2	1.3	1.3
Agree	16	20.0	20.0	21.3
Strongly agree	63	78.8	78.8	100.0
Total	80	100.0	100.0	

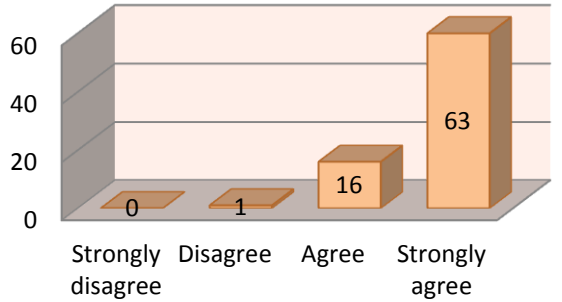


Figure 4.13: Frequency distribution: Item 2 Presenter

Table 4.13: Frequency count for Item 3 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	4	5.0	5.0	5.0
Agree	16	20.0	20.0	25.0
Strongly agree	60	75.0	75.0	100.0
Total	80	100.0	100.0	

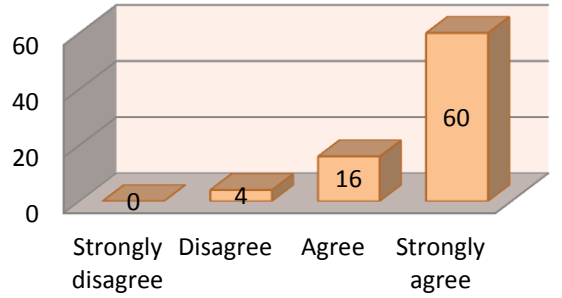


Figure 4.14: Frequency distribution: Item 3 Presenter

4.2.2.1 Item 1 of programme presenter: The trainer was enthusiastic about the topic

The data in Table 4.11 and Figure 4.12 indicate that 76.3% (sixty-one respondents) of the respondents believed strongly and 23.8% agreed (nineteen respondents) that the trainer was enthusiastic about the programme's topic. However, the impact of this item on the effectiveness of the programme would only become noticeable if the programme was offered by more than one presenter so that a comparison in the data could be made available and correlated against scores of several presenters and other opinion items. With more than one presenter presenting the same programme, a baseline could be obtained as a reference marker whereby presenters can be weighed against and improve themselves accordingly (Kirkpatrick, 2008; Praslova, 2010; Arthur *et al*., 2003).

4.2.2.2 Item 2 of programme presenter: The trainer was well prepared

The data in Table 4.12 and Figure 4.13 indicate that 78.8% (sixty-three respondents) of the respondents believed strongly that the trainer was well prepared, whilst 20% (sixteen respondents) of the respondents agreed on this and 1.2% (one respondent) disagreed. The one respondent who chose a response of "Disagree" also indicated that this programme was irrelevant to his work, that the hand-outs were of no value to him and that the PowerPoint presentation was unclear. He improved his post-test score by only 3% which places him as one of seventeen out of the eighty respondents who improved his test score by less than 10%. An interview with this respondent will clarify his reasons for responding in disagreement to some of the items.

4.2.2.3 Item 3 of programme presenter: The trainer is knowledgeable in his subject field

The data in Table 4.13 and Figure 4.14 indicate that 75% (sixty respondents) of the respondents believed strongly that the trainer was knowledgeable in his subject field whilst 20% (sixteen respondents) of the respondents agreed on this and 5% of the respondents (four respondents) disagreed. These four respondents achieved pre-test scores of 33%, 23%, 20%, and 20% respectively and improved their post-test scores by 15%, 18%, 5%, and 18% respectively, which means that their final scores lay between 25% and 48%. These scores suggest that none of these four respondents entered the programme with a high prior knowledge on clutch fitment and neither did their level of knowledge increase significantly after completion of the programme. Not one of these four respondents were qualified Automotive Service Technicians.

Table 4.14: Frequency count for Item 4 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	1.2	1.3	1.3
Agree	20	25.0	25.0	26.3
Strongly agree	59	73.8	73.8	100.0
Total	80	100.0	100.0	

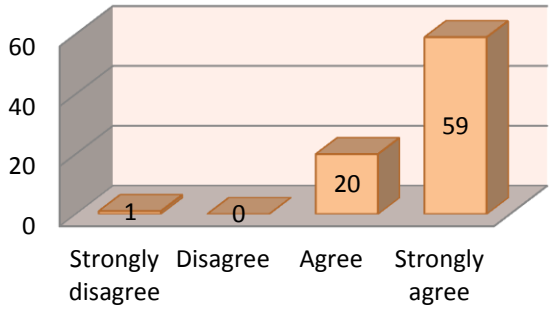


Figure 4.15: Frequency distribution: Item 4 Presenter

Table 4.15: Frequency count for Item 5 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	18	22.5	22.5	22.5
Strongly agree	62	77.5	77.5	100.0
Total	80	100.0	100.0	

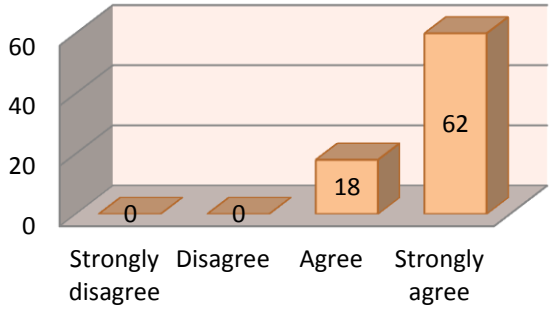


Figure 4.16: Frequency distribution: Item 5 Presenter

Table 4.16: Frequency count for Item 6 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	3	3.8	3.8	3.8
Disagree	3	3.8	3.8	7.5
Agree	21	26.3	26.3	33.8
Strongly agree	53	66.3	66.3	100.0
Total	80	100.0	100.0	

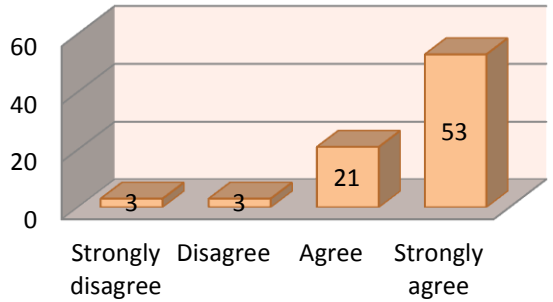


Figure 4.17: Frequency distribution: Item 6 Presenter

4.2.2.4 Item 4 of programme presenter: The trainer explained all the concepts adequately

The data in Table 4.14 and Figure 4.15 indicate that 73.8% (fifty-nine respondents) of the respondents believed strongly that the trainer explained the concepts contained in the programme adequately, whilst 25% (twenty respondents) of the respondents agreed on this and 1.2% of the respondents (one respondent) strongly disagreed. The respondent that strongly disagreed also believed that the programme had no value for him and that the information was irrelevant to the work that he did. This respondent also achieved a low mark in the pre-test (45%) and managed to improve this score in the post-test by only 3%. This respondent was not a qualified Automotive Service Technician. A clear understanding of why this respondent held these particular beliefs can only be determined by scheduling an interview with him.

4.2.2.5 Item 5 of programme presenter: The trainer communicated clearly

The data in Table 4.15 and Figure 4.16 indicate that 77.5% (sixty-two respondents) of the respondents believed strongly that the presenter communicated clearly, whilst 22.5% (eighteen respondents) of the respondents agreed on this with none of the respondents being in disagreement regarding this item.

4.3.2.6 Item 6 of programme presenter: The trainer was sensitive to personal and cultural differences

The data in Table 4.16 and Figure 4.17 indicate that 66.3% (fifty-three respondents) of the respondents believed strongly that the information contained in the programme was accurate. Whilst 26.3% (twenty-one respondents) of the respondents agreed on this and 3.8% (three respondents) of the respondents disagreed strongly, 3.8% (three respondents) of the respondents disagreed. A total of six respondents held the belief that the presenter was insensitive to personal and cultural differences. This statistic is important for future reference as no trainees should ever feel alienated by the presenter but should feel safe and at home in the classroom. Unhappy trainees could become stressed and experience disenfranchisement due to their personal differences, which could affect learning (Probyn, 2001). An interview with these six respondents would be essential in determining the extent of the offense they experienced and the origin of the offense.

Table 4.17: Frequency count for Item 7 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	1.3	1.3	1.3
Disagree	1	1.3	1.3	2.5
Agree	19	23.8	23.8	26.3
Strongly agree	59	73.8	73.8	100.0
Total	80	100.0	100.0	

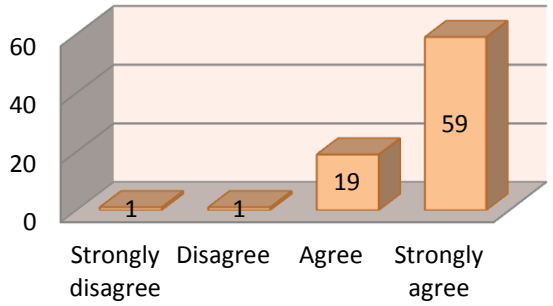


Figure 4.18: Frequency distribution: Item 7 Presenter

Table 4.18: Frequency count for Item 8 of Presenter (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	1.3	1.3	1.3
Disagree	1	1.3	1.3	2.5
Agree	21	26.3	26.3	28.8
Strongly agree	57	71.3	71.3	100.0
Total	80	100.0	100.0	

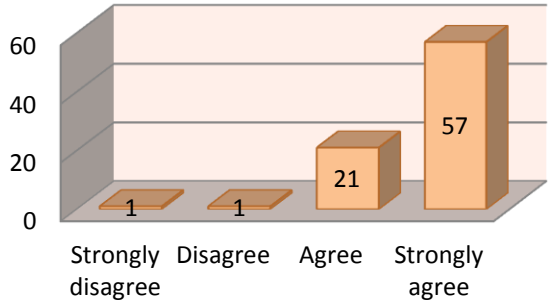


Figure 4.19: Frequency distribution: Item 8 Presenter

4.2.2.7 Item 7 of programme presenter: The trainer presented the content in an interesting way

The data in Table 4.17 and Figure 4.18 indicate that 73.8% (fifty-nine respondents) of the respondents believed strongly that the trainer presented the programme in an interesting way, whilst 23.8% (nineteen respondents) of the respondents agreed on this. 1.3% of the respondents (one respondent) disagreed, whilst another 1.3% (one respondent) strongly disagreed. Neither of the two respondents who made response choices of "Strongly disagree" and "Disagree" to this item were qualified Automotive Service Technicians. Both respondents performed poorly on the pre-test (20% and 28% respectively), and even though their scores improved fairly significantly by 18% and 23% respectively, their post-test scores of 38% and 51% respectively can be regarded as low. It is possible for these two respondents to have experienced the fast pace of the course mixed with a low prior knowledge as difficult and unpleasant (Wood & Lynch, 2002; Seifert, 2004). An interview with these two respondents should help to clarify their negative opinion on this item.

4.2.2.8 Item 8 of programme presenter: The trainer covered the content satisfactorily in the allotted time

The data in Table 4.18 and Figure 4.19 indicate that 71.3% (fifty-seven respondents) of the respondents believed strongly that the trainer covered the programme content satisfactorily in the allotted time, whilst 26.3% (twenty-one respondents) of the respondents agreed on this. 1.3% of the respondents (one respondent) disagreed, whilst another 1.3% (one respondent) strongly disagreed. The two respondents who chose "Strongly disagree" and "Disagree" to this item did not react negatively to any of the other items. This negative reaction by these two respondents seems to be contradicting Item 6 (the pace of the presentation was too fast) and Item 8 (I was given adequate opportunity to interact with the trainer and ask questions).

4.2.3 Reactions for overall programme

The third category of the satisfaction survey measures the possible overall impact of the programme on the respondents and is not specific to any particular construct but utilitarian in nature. The four items explore the respondents' opinions on whether they believed that the knowledge acquired during the course of the programme would translate into altered behaviour at work by the application of the clutch fitment guidelines, and whether they felt challenged to alter previous behaviour.

Table 4.19: Frequency count for Item 1 of Overall programme

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	1.3	1.3	1.3
Agree	33	41.3	41.3	42.5
Strongly agree	46	57.5	57.5	100.0
Total	80	100.0	100.0	

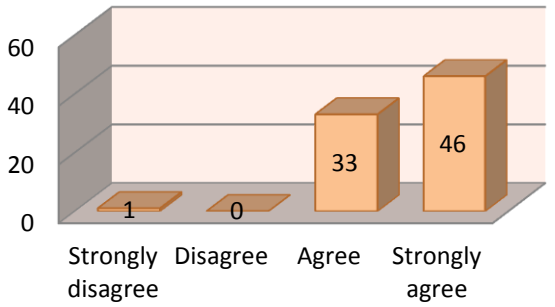


Figure 4.20: Frequency distribution: Item 1 Overall

Table 4.20: Frequency count for Item 2 of Overall programme (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	1	1.3	1.3	1.3
Agree	36	45.0	45.0	46.3
Strongly agree	43	53.8	53.8	100.0
Total	80	100.0	100.0	

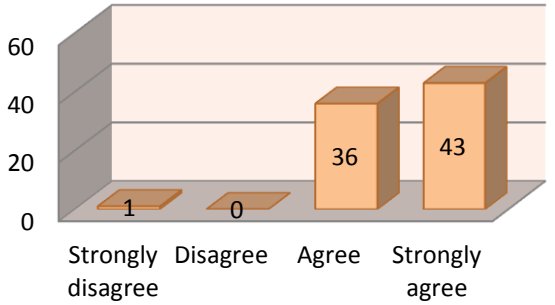


Figure 4.21: Frequency distribution: Item 2 Overall

4.2.3.1 Item 1 of Overall programme: I will be able to apply what I have learnt through the programme when I am back at work

The data in Table 4.19 and Figure 4.20 indicate that 57.5% (forty-six respondents) of the respondents believed strongly that they would be able to apply the knowledge learnt through the programme at their place of work. 41.3% (thirty-three respondents) of the respondents agreed on this and 1.3% of the respondents (one respondent) strongly disagreed. The one respondent who reacted negatively to this item achieved a pre-test score of 43% and a post-test score of 68%, which places him in the higher achieving bracket for this sample. It may be that this respondent did not normally work with clutch related components and was simply being honest about his non-involvement in the fitment of clutches. It would, however, be necessary to interview this respondent to clarify this negative reaction.

4.2.3.2 Item 2 of Overall programme: I was challenged by the content

The data in Table 4.20 and Figure 4.21 indicate that 53.8% (forty-three respondents) of the respondents believed strongly that they were challenged by the programme's content, whilst 45% (thirty-six respondents) of the respondents agreed on this, and 1.3% of the respondents (one respondent) strongly disagreed. The one respondent who chose a response of "Strongly disagree" to this item achieved a pre-test score of 28% and a post-test score of 71% which places him in the highest achieving bracket for this sample. This particular respondent was 32 years of age and held a BSc degree in Mechanical Engineering. Even though this respondent did not often work with the physical installation of components and his prior knowledge on clutch fitment was evidenced as low, his post-test score improved by 43% from 28% to 71%. Because of this respondent's high level of learning experience, it is plausible to suggest that his expertise at information processing is more advanced than that of novice learners in his group, which could explain his high learning outcome and his perception of the programme as not being challenging (Kalyuga *et al*., 2003). One can also reason that a person with a high level of learning experience should have achieved an even higher score on the post-test than the score of 71%. However, research findings support the notion of expert learners often being less efficient when they find themselves learning amongst novice learners as the instructional design offers them too much support, which actually has a reversal effect on learning outcomes (Kalyuga *et al*., 2003).

Based on the pattern of respondents' answers thus far, this researcher is of the opinion that the fast pace of the programme delivery is detrimental in allowing for adequate cognitive processing of the programme's vast content (Probyn, 2001; Boaler & Brown, 2000).

Table 4.21: Frequency count for Item 3 of Overall programme (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly disagree	2	2.5	2.5	2.5
Disagree	1	1.3	1.3	3.8
Agree	31	38.8	38.8	42.5
Strongly agree	46	57.5	57.5	100.0
Total	80	100.0	100.0	

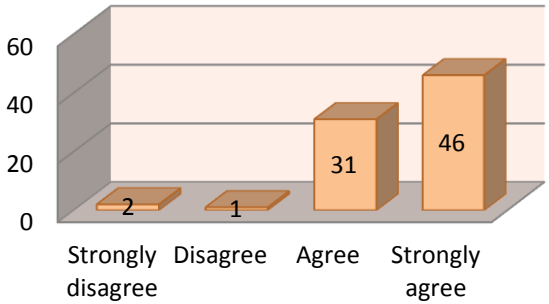


Figure 4.22: Frequency distribution: Item 3 Overall

Table 4.22: Frequency count for Item 4 of Overall programme (n = 80)

	Frequency	Percent	Valid Percent	Cumulative Percent
Disagree	1	1.3	1.3	1.3
Agree	24	30.0	30.0	31.3
Strongly agree	55	68.8	68.8	100.0
Total	80	100.0	100.0	

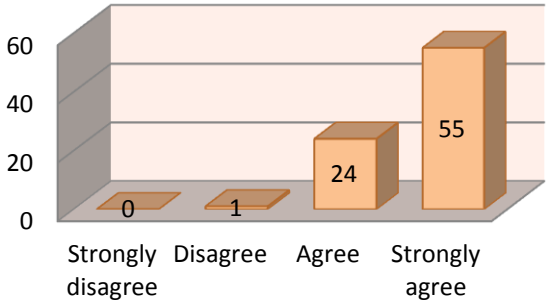


Figure 4.23: Frequency distribution: Item 4 Overall

4.2.3.3 Item 3 of Overall programme: I will execute future clutch installations according to the guidelines contained in the programme

The data in Table 4.21 and Figure 4.22 indicate that 57.5% (forty-six respondents) of the respondents believed that they would conduct future clutch installations according to the guidelines contained in the programme. Whilst 38.8% (thirty-one respondents) of the respondents agreed on this, and 1.3% of the respondents (one respondent) disagreed, another 2.5% (two respondents) strongly disagreed. Their disagreement points to their administrative job description and not to a disagreement in the clutch fitment protocol as promoted in the programme. From anecdotal insights gained while performing post-test observations at the three dealerships in question, the programme protocol was fully adopted by all workshop personnel and fully supported by management. The remainder (seventy-seven respondents) who did not hold such administrative positions thus all agreed that they would follow the guidelines for clutch fitment as promoted by this programme.

4.2.3.4 Item 4 of Overall programme: I regard the overall value of this programme as high

The data in Table 4.22 and Figure 4.23 indicate that 68.8% (fifty-five respondents) of the respondents regarded the overall value of the programme to be very high, whilst 30% (twenty-four respondents) of the respondents agreed on this and 1.3% of the respondents (one respondent) disagreed. The one respondent who made a response choice of "Disagree" to this item achieved a pre-test score of 45% and a post-test score of 48%, which indicates that his learning increased by only 3%. This was one of the lowest recorded for this sample. This particular respondent also proved to be the most negative respondent in this entire sample of eighty.

4.2.4 Summary

4.2.4.1 Summary of frequency count for the satisfaction survey

The data in Table 4.23 shows an additional column where the frequency of positive choices for each item was made by the respondents. These values were calculated by adding the percentages of "Agree" and "Strongly agree" in order to determine the impact of the percentages pertaining to "*Strongly disagree*" and "*Disagree*" responses. By utilising this method, it becomes clear which items could be regarded as outliers in the way that they deviate from the positive trend. The line graphs portrayed in Figures 4.24, 4.25, and 4.26 show which items under the three categories received the highest amount of negative responses. Survey Item "Content 6", "Presenter 3 and 6" and "Overall 3" are clear outliers that warrant further comment.

Table 4.23: Frequency count for Content

	Strongly disagree		Disagree		Agree		Strongly agree		Total		% Positive responses
	N	%	N	%	N	%	N	%	N	%	
Content 1	0	0.0%	1	1.3%	24	30.0%	55	68.8%	80	100%	98.8%
Content 2	0	0.0%	2	2.5%	22	27.5%	56	70.0%	80	100%	97.5%
Content 3	2	2.5%	0	0.0%	20	25.0%	58	72.5%	80	100%	97.5%
Content 4	0	0.0%	0	0.0%	30	37.5%	50	62.5%	80	100%	100%
Content 5	0	0.0%	3	3.8%	33	41.3%	44	55.0%	80	100%	96.3%
Content 6	5	6.3%	31	38.8%	21	26.3%	23	28.7%	80	100%	55%
Content 7	0	0.0%	6	7.5%	29	36.3%	45	56.3%	80	100%	92.6%
Content 8	0	0.0%	2	2.5%	25	31.3%	53	66.3%	80	100%	97.6%
Content 9	0	0.0%	3	3.8%	28	35.0%	49	61.3%	80	100%	96.3%
Content 10	0	0.0%	3	3.8%	24	30.0%	53	66.3%	80	100%	96.3%
Presenter1	0	0.0%	0	0.0%	19	23.8%	61	76.3%	80	100%	100%
Presenter2	0	0.0%	1	1.3%	16	20.0%	63	78.8%	80	100%	98.7%
Presenter3	0	0.0%	4	5.0%	16	20.0%	60	75.0%	80	100%	95%
Presenter4	1	1.3%	0	0.0%	20	25.0%	59	73.8%	80	100%	98.7%
Presenter5	0	0.0%	0	0.0%	18	22.5%	62	77.5%	80	100%	100%
Presenter6	3	3.8%	3	3.8%	21	26.3%	53	66.3%	80	100%	92.6%
Presenter7	1	1.3%	1	1.3%	19	23.8%	59	73.8%	80	100%	97.6%
Presenter8	1	1.3%	1	1.3%	21	26.3%	57	71.3%	80	100%	97.6%
Overall1	1	1.3%	0	0.0%	33	41.3%	46	57.5%	80	100%	98.8%
Overall2	1	1.3%	0	0.0%	36	45.0%	43	53.8%	80	100%	98.8%
Overall3	2	2.5%	1	1.3%	31	38.8%	46	57.5%	80	100%	96.3%
Overall4	0	0.0%	1	1.3%	24	30.0%	55	68.8%	80	100%	98.8%

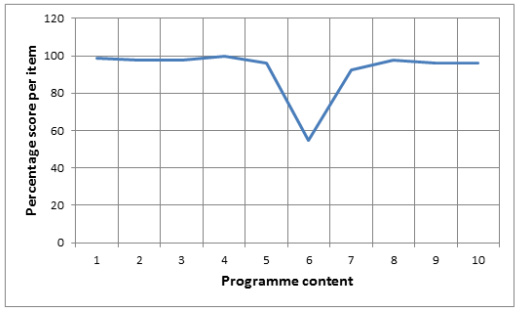


Figure 4.24: Agree and Strongly agree added: Content

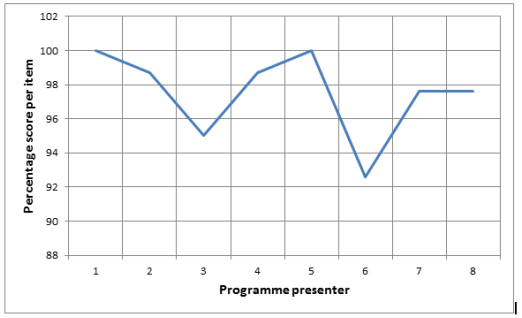


Figure 4.25: Agree and Strongly agree added: Presenter

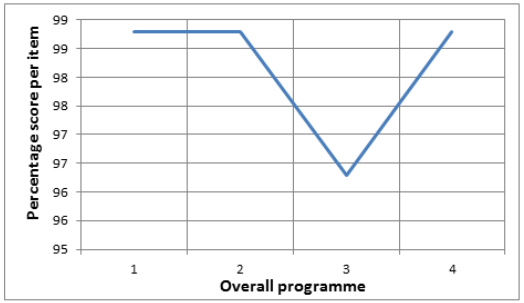


Figure 4.26: Agree and Strongly agree added: Overall

The data in Table 4.23 and Figures 4.24, 4.25, and 4.26 indicate that the respondents scored Item 6 (programme content) the lowest. In other words, 55% of the respondents felt that the pace of the presentation was too fast. The other nine items all received positive scores close to 100%, which highlights the pace of the programme delivery as a negative factor in the effectiveness of the programme, as perceived by the respondents. With regard to the presenter, 7.6% (six respondents) of the respondents felt that the presenter was not sensitive to personal and cultural differences. The reasons for this belief are unclear and could become clear in a qualitative follow-up study. Item 3 received the second lowest score, which indicates that 5% (four respondents) of the respondents felt that the presenter was not knowledgeable in his field. With regard to the overall programme, Item 3 received the lowest score. This means that 3.8% (three respondents) of the respondents were not in agreement that they would execute future clutch installations in the manner suggested in the programme. These three respondents held BSc degrees and were not involved in the physical fitment of clutches (see Section 4.2.3.3). Only 57.5% (forty-six respondents) of the respondents strongly agreed that they would change their clutch installation behaviour in accordance with the suggested guidelines, and 38.8% (thirty one respondents) agreed. A qualitative follow-up study would be prudent in clarifying these beliefs.

4.2.4.2 Summary of respondents who reacted negatively to some survey items

Table 4.24 is a summary of twenty one respondents (row 1) out of the sample of eighty who felt negatively about some aspects of the programme, i.e. these twenty-one respondents either chose “Strongly disagree” or “Disagree” for some of the survey items.

The second row of Table 4.24 explains the SPSS codes for respondent qualifications. Of the twenty-one respondents, three were in possession of a tertiary diploma or degree (SPSS qualification code 1), seven were in possession of a matric certificate (SPSS qualification code 2), and ten were in possession of a Grade 10 qualification (SPSS qualification code 3), and one had a qualification lower than Grade 10.

The third row in Table 4.24 explains the SPSS codes for whether respondents were qualified as Automotive Service Technicians (SPSS code “1”), or whether they were not qualified as Automotive Service Technicians (SPSS code “0”).
The fourth row in Table 4.24 explains the SPSS codes for respondents’ ages. SPSS code “1” = under 25, SPSS code “2” = 25 to 30, SPSS code “3” = 30 to 35, SPSS code “4” = 35 to 40, SPSS code “5” = over 40.

Table 4.24: Distribution of respondent responses (Strongly disagree = 1 and Disagree = 2)

Respondent		1	3	6	13	14	17	26	29	30	33	37	41	42	45	54	55	62	63	72	74	76	Mean
Qualification		3	3	3	1	1	1	2	3	2	2	3	3	3	4	2	3	2	3	2	3	2	
AST		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
Age		5	3	3	4	3	5	5	5	2	4	3	5	5	5	3	5	5	5	4	1	4	
Pre-average	%	28	10	50	35	28	43	38	35	45	33	23	13	20	15	30	18	18	50	433	35	10	29.5%
Post-average	%	50	38	53	78	75	70	68	68	47	48	40	20	25	10	38	38	18	40	68	55	48	48%
Difference	%	22	28	3	43	47	27	30	33	3	15	17	7	5	-5	8	20	0	-10	25	20	38	21%
Content	1																					2	
	2												2		2								
	3									1							1						
	4																						
	5											2		2			2						
	6		2			2	2	2				2	2	2	2			2	2	1	1		
	7								2	2	2	2		2			2		2				
	8										2					2							
	9									2		2		2									
	10												2		2		2						
Presenter	1																						
	2									2				2									
	3																						
	4									1													
	5																						
	6	2	2					2		1								1			1		
	7	2															1						
	8			2					1														
Overall	1																			1			
	2																						
	3				2	1	1																
	4									2													

Discussion of Table 4.24

It is not possible to assign quantitative values to each Likert item response choice as the scale lies on an arbitrary continuum of ordinal values and one cannot assume that these intervals are incrementally equal and have discrete categories (Blaikie, 2003). However, the summary of response items where "1" = Strongly disagree, and "2" = Disagree represented the choices available to the respondents, which can be seen as indictment-responses on the programme by item stipulation. Table 4.24 serves thus as a tool to determine which items enjoyed the most negative responses and which respondents made the most negative responses.

From Table 4.24 it appears that the survey item receiving the most negative choices is Item 6 of Content (The pace of the presentation was too fast). The second most negative item appears to be Item 7 of Content (The hand-outs will be helpful to refer back to later). The third most negative item chosen by the twenty-one respondents who made negative choices was Item 6 of Presenter skills (The trainer was sensitive to personal and cultural differences). This revelation was surprising as care was taken to not offend any respondents in this study. This probably points to misunderstandings and preconceived ideas from the presenter's perspective as to what is and is not deemed offensive in a multi-cultural setting. This is an area worthy of further research. It may be possible for respondents who feel offended by the trainer to have had a negative approach towards the programme from the outset, which could in turn have had an impact on the learning that took place and the eventual changes in behaviour as set out by the course objectives.

Respondents 30, 37, 42, and 55 were the four respondents who scored the most negative items on the survey. Common characteristics shared by these four respondents were that three respondents had a Grade 10 school qualification and were over forty years of age, and one had a matric qualification and was 30 years of age. None of these four respondents were qualified Automotive Service Technicians. Three of the four respondents scored well below the group average of negative scorers (29% group average of twenty-one negative scorers) for the pre-test and all four scored below the group average of negative scorers (48% group average of negative scorers) for the post-test. The percentage difference between the pre-test and the post test for these four respondents are also below the average for this group of twenty-one negative scorers (21% average increase from pre-test to post-test for this group). A major shortcoming of the survey instrument was the exclusion of biographical information on respondents' day to day activities. It would have been helpful to have also included items such as: "have you ever fitted a clutch before?" and "How often do you fit clutches?" and "Do you fit clutches completely on your own or do you require help", or

"For how many years have you been fitting clutches?" This researcher does not know how Respondents 30, 37, 42, and 55 would respond to the above questions which open the door to too many variables that may account for these four respondents holding the beliefs that they do. A qualitative follow-up study will certainly go a long way in providing insights into these unknown facets. Kirkpatrick's (1998) four level framework does not offer instrumentation to reliably measure cause and effect with regard to such variables as motivation and cognition on programme outcomes (Yardley & Dornan, 2012; Johnson, Flores & Henderson, 2004; Grohmann & Kauffeld, 2005).

4.2.5 Conclusion for the satisfaction survey questionnaire

Although the overwhelming opinion from the respondents points to a programme that can be deemed as effective in terms of satisfaction with the content and the way in which it was presented, there are areas of concern. The biggest concern is that more than half (55%) of the respondents were of the opinion that the pace of the course was too fast. This singular negative point has the potential to impact heavily on the quality of the programme's final product with regard to the amount of learning improvement, attitudinal changes, and behaviour change at the work place.

The data also indicates that a large number (41.3 %) of the respondents had obtained lowly school qualifications (Grade 10 and lower), with only 12.5% of the respondents having obtained some form of post-matric qualification. Another factor impacting further on the pace of the course was the fact that most of the respondents did not have English as a first language and learning in a second language, especially where technological terminology is concerned, is known to hinder learners with certain barriers to cognitive processing (Probyn: 2001).

The fact that 62.5% of the respondents had not obtained formally certified Automotive Service Technician registration with relevant education and training institutions adds further concern. The data in this study point to the low state of prior knowledge of this sample and the neglect from the automotive sector over the past twenty years to redress the lack of training amongst lower qualified Automotive Service Technicians. The effectiveness of this programme should significantly improve by extending the duration of the course to stretch over several days. Further formative research is required for clarification purposes.

Apart from the pace being too fast, instructional material that was provided as hand-outs was amongst the items that were most negatively commented on by a sub-group of twenty-one respondents who were identified as the group that made all the negative survey responses.

It would be prudent to research this matter further and re-design the instructional material to be especially useful for later reference material after the respondents have returned to their place of work.

It may also be possible for respondents to have held back from asking questions interactively during the programme's delivery due to the fast pace, as well as a possible unwillingness to display their low level of prior knowledge due to a fear of being ridiculed (Newman, 2002). The quantitative data of this study was unable to shed light on deeper seated prohibitive factors that need to be addressed in an improved version of the programme. It is essential to conduct a qualitative follow-up study and in so doing augment the initial findings of this summative evaluation.

4.3 Written pre-test and post-test

In Section 4.3, the second research question is explored and answered by means of a written pre-test and post-test consisting of a performance test of forty items. The question paper is not divided into categories, but nevertheless covers three essential aspects of clutches in general and clutch fitment in particular. The first aspect relates to the general function and operation of clutches. Sixteen of the forty items were formulated to measure constructs of this aspect. The second aspect relates to diagnostic activities before and after clutch removal; and fifteen of the forty items were formulated to measure constructs of this aspect. The third aspect relates to physical extrication, preparation and fitment of new clutch components, which is covered by the remaining nine items of the forty item test. The items covering these three aspects of the programme were not grouped as categories in the test, but rather randomly mixed as the principles contained in the three categories do not operate in isolation, but are fully integrated in real workshop conditions. The second research question of this study and its null and alternative hypotheses are stated as follows:

> *How effective is the training programme in facilitating the acquisition of new knowledge?*
>
> Hnull: The programme will not be effective in facilitating the acquisition of new knowledge regarding clutch fitment.
>
> Halt: The programme will be effective in facilitating the acquisition of new knowledge regarding clutch fitment.

The coding of the scores in SPSS was performed by ascribing the number 1 to every correct answer and the number 0 to every incorrect answer. The post-test questions were identical

to the pre-test questions, but the order of the questions was scrambled in order to minimise the effect of respondents recollecting the answers given in the pre-test. This was done in an attempt to encourage the respondents to think about the question and its answer and not just merely regurgitating the same answer given in the pre-test.

4.3.1 Descriptive statistics for the written pre-test and post-test

The following section presents the findings for the written pre-test and post-test and the histograms for the written pre-test and post-test. The frequency tables range from Table 4.25 up to Table 4.36 and the histograms range from Figure 4.27 up to Figure 4.34. Discussion of these tables and figures commences in paragraph 4.4.3.

Table 4.25: Descriptive statistics for the written tests

		Pre-test average	Post-test average
N	Valid	80	80
	Missing	0	0
Mean		36.93	55.38
Std. Error of Mean		1.855	1.949
Median		38.00	55.00
Mode		50	70
Std. Deviation		16.591	17.429
Variance		275.260	303.782
Skewness		-.132	-.520
Std. Error of Skewness		.269	.269
Kurtosis		-.710	.255
Std. Error of Kurtosis		.532	.532
Range		70	88
Minimum		0	5
Maximum		70	93
Sum		2954	4430
Percentiles	10	13.00	38.00
	20	20.00	40.60
	25	24.25	45.00
	30	28.60	48.00
	40	33.00	50.00
	50	38.00	55.00
	60	43.00	60.00
	70	48.00	68.00
	75	50.00	70.00
	80	52.40	70.00
	90	58.00	75.00

Discussion of Table 4.25

During the completion of the written pre-test and post-test, respondents were encouraged to answer all questions and as this request was highly emphasised, no missing values were reported for the sample of eighty. The mean score for the pre-test is 36.93% and the mean score for the post-test is 55.38%, which indicates an average improvement of 18.45%. The pre-test average score of 36.93% points to the low level of prior knowledge with which the eighty respondents entered the programme; this supports the problem statement of this study.

Even though this group managed to improve their average score on the post-test by 18.45%, the final average for the group at 55.38% is rather low. Minimum scores on the pre-test were 0 and improved to 5% on the post-test. Maximum scores on the pre-test were 70% and improved to 93% on the post-test. It is here where the limitations of the chosen conceptual framework become evident. The three quantitative instruments employed in this study yielded strict summative information on response outcomes and performance outcomes without providing the researcher with any support for making substantive inferences. In other words, why is the post-test average at 55.38% so low? Is the programme ineffective? Do the respondents have learning difficulties?

This limitation regarding causality is in line with some of the harshest criticism that the Kirkpatrick (1998) four level framework has been facing over the years (Holton, 1996). The framework does not accommodate for the rich variety of outcomes that can be evaluated using mixed methodologies (Quan and Qual), nor does it explain how or why such outcomes are caused by particular elements of complex interventions (Yardley & Dornan, 2012). Yardley and Dornan (2012:101) describe the limitation to the Kirkpatrick (1998) four level framework in saying that, “It tends only to be used to measure anticipated outcomes and ignores unanticipated consequences. That is, it asks ‘Was outcome X achieved as intended, or not?’ rather than ‘What were the outcomes of this intervention?’”

Table 4.26 represents the frequency count for the average scores attained on the written pre-test and this data is graphically represented in Figure 4.27.

Table 4.26: Frequency distribution for written pre-test average (n = 80)

Scores (%)	Frequency	Percent	Valid Percent	Cumulative Percent
0	1	1.3	1.3	1.3
8	1	1.3	1.3	2.5
10	5	6.3	6.3	8.8
13	4	5.0	5.0	13.8
15	1	1.3	1.3	15.0
18	3	3.8	3.8	18.8
20	2	2.5	2.5	21.3
23	3	3.8	3.8	25.0
28	4	5.0	5.0	30.0
30	4	5.0	5.0	35.0
33	5	6.3	6.3	41.3
35	6	7.5	7.5	48.8
38	3	3.8	3.8	52.5
40	4	5.0	5.0	57.5
43	6	7.5	7.5	65.0
45	3	3.8	3.8	68.8
48	2	2.5	2.5	71.3
50	7	8.8	8.8	80.0
53	3	3.8	3.8	83.8
55	4	5.0	5.0	88.8
58	4	5.0	5.0	93.8
65	3	3.8	3.8	97.5
70	2	2.5	2.5	100.0
Total	80	100.0	100.0	

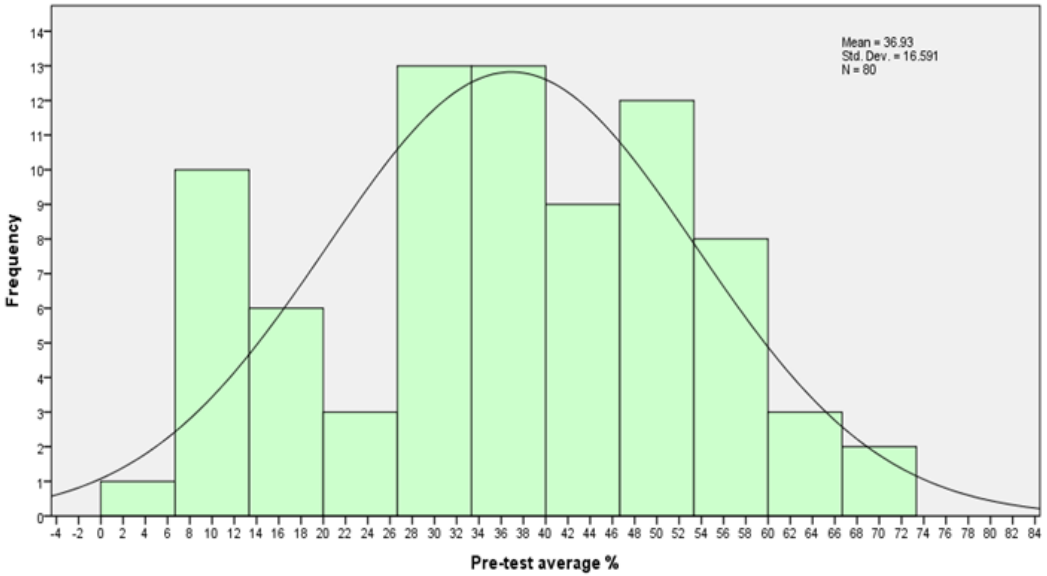


Figure 4.27: Histogram for written pre-test

Discussion of Table 4.26 and Figure 4.27

The data in Table 4.26 and Figure 4.27 on the previous page points to a distribution that is somewhat outside of the expectations for a normally distributed data set, with the disturbance in the normal curve caused by a high concentration (ten respondents) of average scores between 7% and 13%. For the data distribution curve to have remained normal, a concentration of three to four respondents in the range of 7% to 13% would have been regarded as normal. Similarly, the average score range of 20% to 27% is represented by three respondents, whereas a higher number (ten to eleven respondents) would have yielded a normal distribution. A similar drop in respondents (two respondents) expected to achieve scores in the mid 40% is also noticeable. The data indicates that the mean score of 36.93% divides the group almost equally into respondents that scored below this average and respondents that scored above this average, which indicates that the data is not positively or negatively skewed.

Table 4.27 represents the data that was collected for the written post-test and the frequency distribution of performance scores and is graphically presented in Figure 4.28.

Discussion of Table 4.27 and Figure 4.28

The post-test data in Table 4.27 and Figure 4.28 on the next page shows a marked increase in the group average where the pre-test average score of 36.93% improved by 18.45% to a post-test average score of 55.38%. The histogram in Figure 4.28 shows a slightly skewed data distribution towards the positive with slightly more than half of the sample (forty-three respondents) achieving average scores below the mean of 55.38% and thirty-eight respondents scoring above the mean of 55.38%. The normal distribution is skewed by the absence of about five respondents who ought to have scored between 21% and 33% instead of the three that fall within that segment. The mid 40% segment would have been more normally distributed if another three respondents had scored percentages in that segment. The segment between 60% and 66% is also not normally represented and would have been regarded as normal with the inclusion of another eight respondents on top of the two that occupy that segment. The segment of 46% to 53% is populated by seventeen respondents and should be at around eleven respondents for the distribution to be normal. The segment between 67% and 80% is also over-populated by about eight respondents.

Table 4.27: Frequency distribution for written post-test average

Scores (%)	Frequency	Percent	Valid Percent	Cumulative Percent
5	1	1.3	1.3	1.3
10	1	1.3	1.3	2.5
18	1	1.3	1.3	3.8
20	1	1.3	1.3	5.0
25	2	2.5	2.5	7.5
30	1	1.3	1.3	8.8
38	5	6.3	6.3	15.0
40	4	5.0	5.0	20.0
43	2	2.5	2.5	22.5
45	4	5.0	5.0	27.5
48	7	8.8	8.8	36.3
50	4	5.0	5.0	41.3
53	6	7.5	7.5	48.8
55	3	3.8	3.8	52.5
58	3	3.8	3.8	56.3
60	6	7.5	7.5	63.8
65	2	2.5	2.5	66.3
68	4	5.0	5.0	71.3
70	8	10.0	10.0	81.3
73	2	2.5	2.5	83.8
75	6	7.5	7.5	91.3
78	3	3.8	3.8	95.0
80	2	2.5	2.5	97.5
83	1	1.3	1.3	98.8
93	1	1.3	1.3	100.0
Total	80	100.0	100.0	

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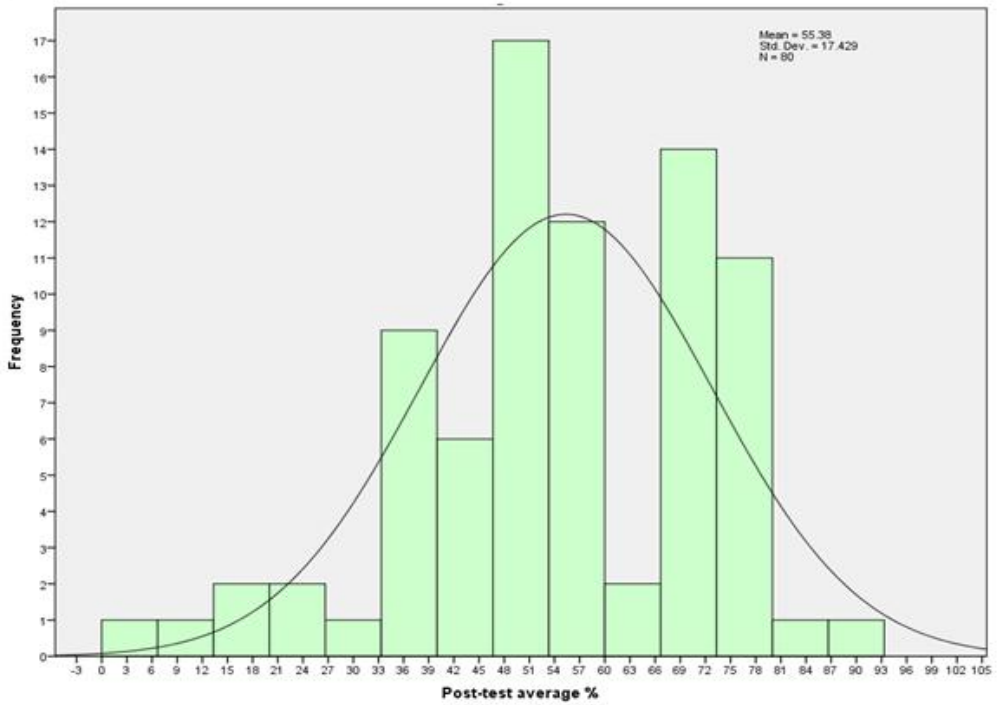

Figure 4.28: Histogram for written post-test

4.3.2 Test of significance

As explained in Chapter 3, Section 3.8, a dependent or paired samples t-test was performed by SPSS software in order to determine the statistical significance of the difference between the pre-test and the post-test for the purpose of adopting or rejecting the stated hypotheses. Table 4.28 presents a summary of the t-test results.

Table 4.28: Dependent or paired samples t-test (Written tests)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Preave	36.93	80	16.591	1.855
	Postave	55.38	80	17.429	1.949

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Preave & Postave	80	.663	.000

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Preave and Postave	-18.450	13.980	1.563	-21.561	-15.339	-11.804	79	.000

Discussion of Table 4.28

On average, respondents achieved significantly greater results in the post-test (M = 55.38, SE = 1.949), than the pre-test (M = 36.93, SE = 1.855, t(79) = -11.8, $p < .05$, r = .638). It can therefore be concluded that the change in scores from the pre-test to the post-test did not take place by chance or due to any other external influence, but can rather be attributed to the effectiveness of the intervention programme. The null hypothesis is therefore rejected and the alternative hypothesis is adopted.

4.3.3 Conclusion for the written pre-test and post-test

The line-graphs in Figure 4.29 offer a quick visual perspective of the difference in the scores between the written pre-test and the post-test for the forty items.

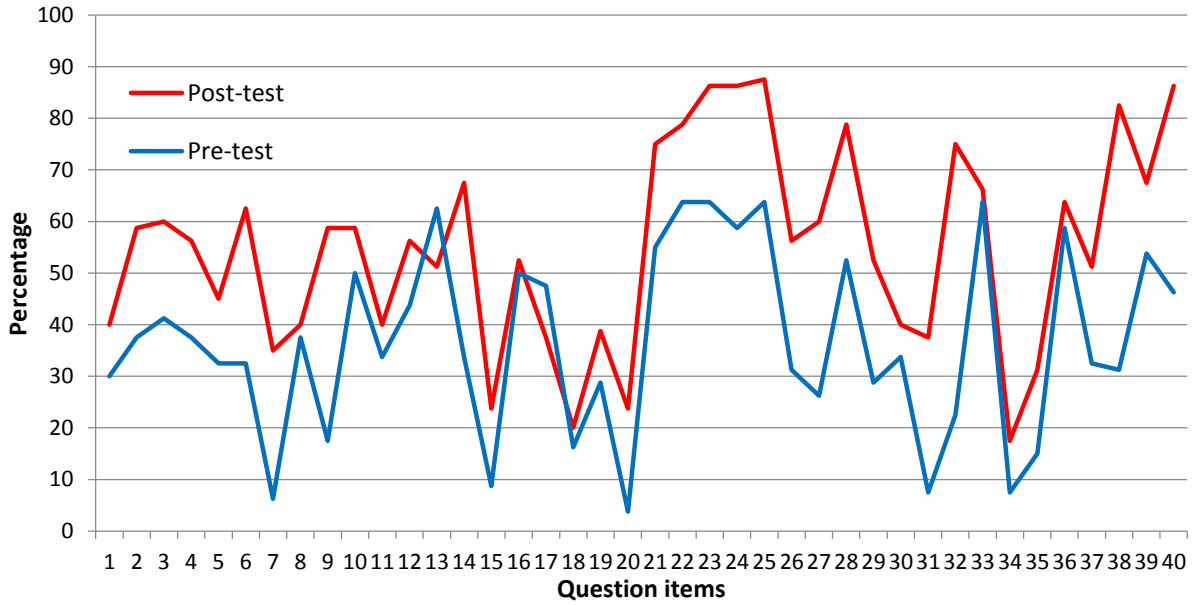

Figure 4.29: Graphical comparison between written pre-test and post-test

Although most items showed a significant increase in performance, some items scored extremely low in the pre-test, and even though the difference to the post-test can be deemed as significant, the score value is still very low for that item to be deemed as effective learning taking place. In other cases the difference in score improvement is so low that it is negligible and in some instances the post-test recorded poorer results than the pre-test. Of the forty items, in only nine did the respondents manage to achieve percentage scores of 50% or higher (Items 13, 21, 22, 23, 25, 28, 33, 36, and 39). In considering 30% and below as the poorest items of achievement, twelve items can be counted as achieving the poorest results namely: Items 1, 7, 9, 15, 18, 20, 27, 29, 31, 32, 34, and 35. Very poor improvements on the post-test were recorded for Items 8, 11, 13, 16, 18, 33, and 36.

It would be prudent to take note of the items in which the respondents scored the lowest on the pre-test as an indicator of poor entry knowledge characteristics. The programme's effectiveness could be enhanced by focusing on areas where poor levels of prior knowledge have been identified and where low post scores have been recorded. According to the constructivist theory of learning, prior knowledge is essential for processing and assimilating new knowledge (Kraus, 2001). There may also be learning difficulties from the respondents' point of view regarding understanding certain concepts which could influence poor post-test

results. However, seeing that the areas of weakness are established in pre-tests and post-tests, more attention should be given in those areas during presentations.

4.4 Observational pre-test and post-test

Section 4.4 of this study revolves around the practical application of the content of the intervention programme for clutch fitment. Observations of practical clutch fitments were performed in order to answer the third research question of this study namely:

> *How effective is the training programme in changing the participants' observable work behaviour?*
>
> Hnull: The programme will not be effective in converting the behaviour of respondents' to become aligned with the proposed protocol for clutch fitment.
> Halt: The programme will be effective in converting the behaviour of respondents' to become aligned with the proposed protocol for clutch fitment.

As many observations as possible of actual practical clutch fitments were attempted, but the researcher settled on twenty observations prior to the delivery of the programme, followed by a repeat observational visit to the participating Automotive Service Centres after respondents had been exposed to the programme (see Chapter 3 for detail on the sample frame of twenty respondents). It was not possible to observe more than twenty respondents due to the unplanned nature in which vehicle clutches fail and also because of time constraints; it would require several years of observations in order to visit all eighty respondents.

The manner in which respondents were chosen for observational sessions was executed purely outside of the control of the researcher and driven by the availability of vehicles that required clutch installations. The researcher was called periodically when vehicles became available for clutch installations and, when schedules allowed for, observations on clutch fitment were carried out prior to the programme offering. The researcher stopped collecting observational data purposefully when the twentieth respondent's observation was concluded due to severe time constraints. Needless to say, the observational pre-test sample of twenty respondents became the observational post-test sample in order to execute a dependent paired samples t-test later on. Because of the small sample frame of twenty respondents, generalisations to the greater automotive community in Gauteng could be seriously flawed (Fan, Thompson, & Wang, 1999).

The researcher combined the first two steps of the six-step clutch fitment protocol into one checklist category as “Vehicle pre-inspection” as step one and step two of the clutch fitment protocol are closely related (See Section 3.6 of Chapter 3 on the clutch fitment programme). The observational pre-test and post-test was conducted by grading the activities of the respondent against checklist-items covering the five categories of clutch fitment, namely: Vehicle pre-inspection (seven check items), Clutch removal (6 check items), Failure diagnosis (8 check items), Preparation (8 check items), and Fitment (11 check items). These forty check items spanning the five observational categories were scored on a sliding scale of 0 to 5. Check items that were regarded as total non-compliance were scored by allocating a “0”. A “1” was allocated if the check item was deemed 20% accurate; a “2” was allocated when the score item was deemed 40% accurate; a “3” was allocated when the score item was deemed 60% accurate; a “4” was allocated when the score item was deemed 80% accurate; a “5” was allocated when a full score on the check item was achieved. This strategy enabled the researcher to quantify installation activities per quality of execution by focusing on forty individual actions.

4.4.1 Descriptive statistics for observational pre-test and post-test

The following section presents the findings for the observational pre-test and post-test as well as the histograms for the observational pre-test and post-test. The frequency tables range from Table 4.30 up to Table 4.31, and the histograms range from Figure 4.30 up to Figure 4.31.

Table 4.29 presents the descriptive statistics for the observational pre-test and post-test averages for the sample of twenty respondents.

Table 4.29: Descriptive statistics for practical pre-test and post-test

		Observation pre-test average	Observation post-test average
N	Valid	20	20
	Missing	60	60
Mean		28.15	80.25
Std. Error of Mean		3.312	3.334
Median		26.00	81.00
Mode		26	73
Std. Deviation		14.812	14.910
Variance		219.397	222.303
Skewness		.659	-.766
Std. Error of Skewness		.512	.512
Kurtosis		-.496	.410
Std. Error of Kurtosis		.992	.992
Range		50	56
Minimum		11	43
Maximum		61	99
Sum		563	1605
Percentiles	10	12.00	60.10
	20	13.00	69.40
	25	13.50	71.50
	30	15.90	73.00
	40	21.20	76.60
	50	26.00	81.00
	60	29.60	86.80
	70	37.50	91.40
	75	39.75	93.50
	80	44.00	94.80
	90	50.50	98.80

Whereas the written pre-test and post-test average improved from 36.93% with 18.45% to 55.38%, the observational pre-test and post-test improved from an average of 28.15% with a factor of 52.1% to arrive at an average post-test score of 80.25%. The written pre-test and observational pre-test data show that this sample of Automotive Service Technicians not only possessed a very poor level of entry knowledge regarding automotive clutches, but the practical fitment of clutches can be deemed to have been at an even poorer level. A surprising development in the execution of the observational test is the huge differential between the observational pre-test and post-test of 52.1%, which is more than double the differential posted for the written tests.

Table 4.30 presents the data gathered for the observational pre-test for a sample of twenty respondents with regard to the range of scores that was captured and the frequency count of those scores. This data is graphically represented in Figure 4.30.

Table 4.30: Frequency count for observational pre-test (n = 20)

Scores (%)	Frequency	Percent	Valid Percent	Cumulative Percent
11	1	1.3	5.0	5.0
12	2	2.5	10.0	15.0
13	2	2.5	10.0	25.0
15	1	1.3	5.0	30.0
18	1	1.3	5.0	35.0
20	1	1.3	5.0	40.0
23	1	1.3	5.0	45.0
26	3	3.8	15.0	60.0
32	1	1.3	5.0	65.0
34	1	1.3	5.0	70.0
39	1	1.3	5.0	75.0
40	1	1.3	5.0	80.0
45	1	1.3	5.0	85.0
46	1	1.3	5.0	90.0
51	1	1.3	5.0	95.0
61	1	1.3	5.0	100.0
Total	20	25.0	100.0	
Missing	60	75.0		
Total	80	100.0		

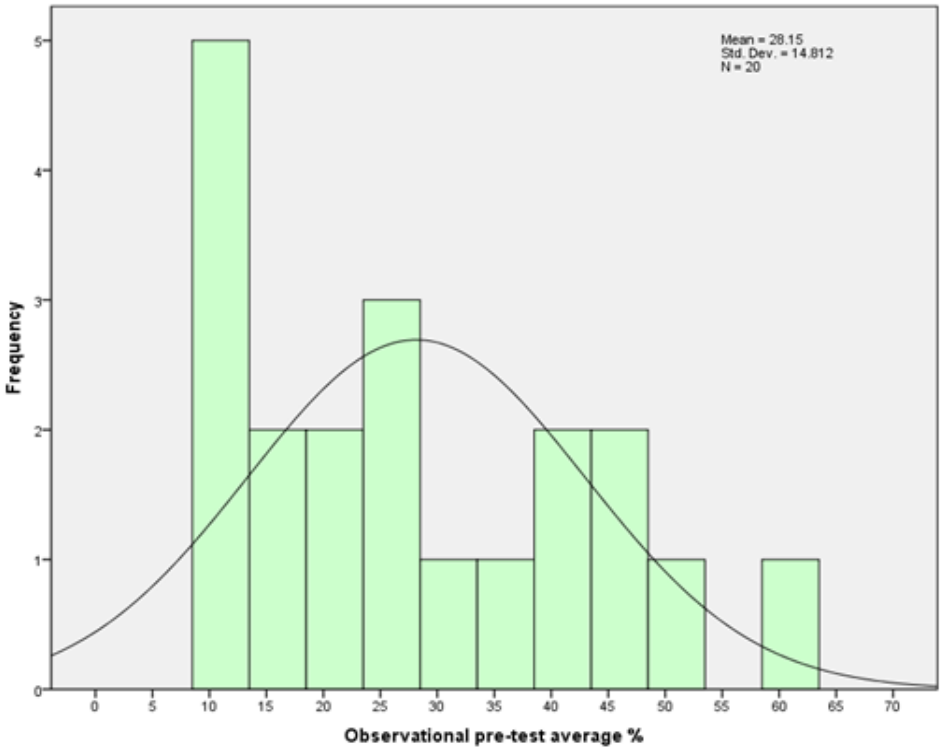

Figure 4.30: Histogram for observational pre-test

Discussion of Table 4.30 and Figure 4.30

At first glance, the curve shape in Figure 4.30 on the previous page indicates that the distribution is slightly positively skewed with twelve of the twenty respondents having scored below the average of 28.15%, and eight respondents having scored above this average. Table 4.30 on the previous page points to a minimum score of 11% and a maximum score of 61%. An obvious outlier is the cluster of five respondents that scored extremely low between 11% and 13%. Only two respondents managed to score slightly more than 50% on the observational pre-test, which reinforces the notion in the general automotive industry that Automotive Service Technicians are not properly trained on all topics for fault-free execution of repairs to vehicles.

Table 4.31 introduces the data collected for the observational post-test for the sample of twenty respondents with regard to performance scores and frequency counts of those scores. This data is graphically represented in Figure 4.31.

Discussion of Table 4.31 and Figure 4.31

Figure 4.31 on the next page shows that the distribution is slightly negatively skewed with ten of the twenty respondents having scored below the average of 80.25% and the other ten respondents having scored above this average. The average increase from 28.15% to 80.25% is a remarkable improvement in performance and does not correlate well with the smaller increase reported on the written pre-test and post-test. One has to bear in mind that only a quarter of the original sample group participated in the observational segment of this study and this high percentage increase could be lower if the entire sample participated in this segment. A comparison graph is offered later on whereby the written tests of the twenty respondents of this observational segment are compared with their observational test scores. The data however points to the possibility that the effectiveness of the programme in changing workplace behaviour is far superior to the actual gain in conceptual and procedural knowledge. It may also be possible that the gains in conceptual and procedural knowledge are higher than what had been measured on the written test. It may very well be a verbal/written language barrier that accounts for the lower written score improvement and points to a higher level of insight gained with relation to the actual execution of the principles as contained and promoted in the programme.

Table 4.31: Frequency count for observational post-test

Scores (%)	Frequency	Percent	Valid Percent	Cumulative Percent
43	1	1.3	5.0	5.0
60	1	1.3	5.0	10.0
61	1	1.3	5.0	15.0
69	1	1.3	5.0	20.0
71	1	1.3	5.0	25.0
73	2	2.5	10.0	35.0
75	1	1.3	5.0	40.0
79	1	1.3	5.0	45.0
80	1	1.3	5.0	50.0
82	1	1.3	5.0	55.0
85	1	1.3	5.0	60.0
88	1	1.3	5.0	65.0
90	1	1.3	5.0	70.0
92	1	1.3	5.0	75.0
94	1	1.3	5.0	80.0
95	1	1.3	5.0	85.0
97	1	1.3	5.0	90.0
99	2	2.5	10.0	100.0
Total	20	25.0	100.0	
Missing	60	75.0		
Total	80	100.0		

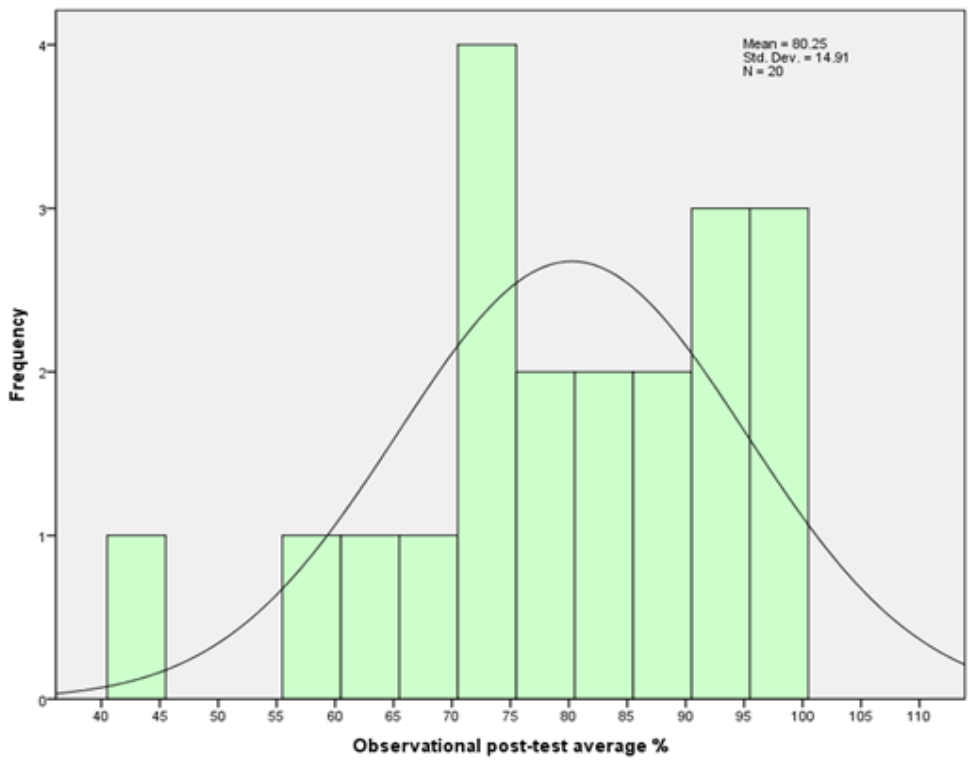

Figure 4.31: Histogram for observational post-test

4.4.2 Test of significance

This segment of the study was treated in a similar manner as Section 4.3.2 (the segment on the written pre-test and post-test). Both the observational pre-test histogram (Figure 4.30) and the observational post-test histogram (Figure 4.31) do not conform to the true shape of the normal bell curve.

As with the written tests, the observational tests were processed utilising parametric test procedures (dependent paired samples t-test) as well as non-parametric test procedures (Wilcoxon signed ranks test). It was decided to report the results of the t-test (see Table 4.32) due to its robust nature, but it is worthwhile mentioning that both the parametric tests and non-parametric tests support similar statistical findings.

Table 4.32: Dependent or paired samples t-test (Observational test)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Preave	28.15	20	14.812	3.312
	Postave	80.25	20	14.910	3.334

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Preave & Postave	20	.346	.135

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Preave and Postave	-52.10	16.992	3.8	-60.052	-44.148	-13.712	19	.000

Discussion of Table 4.34

On average, respondents achieved significantly greater results in the post-test (M = 80.25, SE = 3.334), than the pre-test (M = 28.15, SE = 3,312, t(19) = -13.712, p < .05, r = .908). It can therefore be concluded that the change in scores from the pre-test to the post-test did not take place by chance or due to any other external influence but can rather be attributed

to the effectiveness of the intervention programme. The null hypothesis is therefore rejected and the alternative hypothesis is adopted.

4.4.3 Conclusion for observational pre-test and post-test

Figure 4.32 offers a visual comparison of the written pre-test and post-test scores as compared with the observational pre-test and post-test scores for the twenty respondents that participated in this segment of the study.

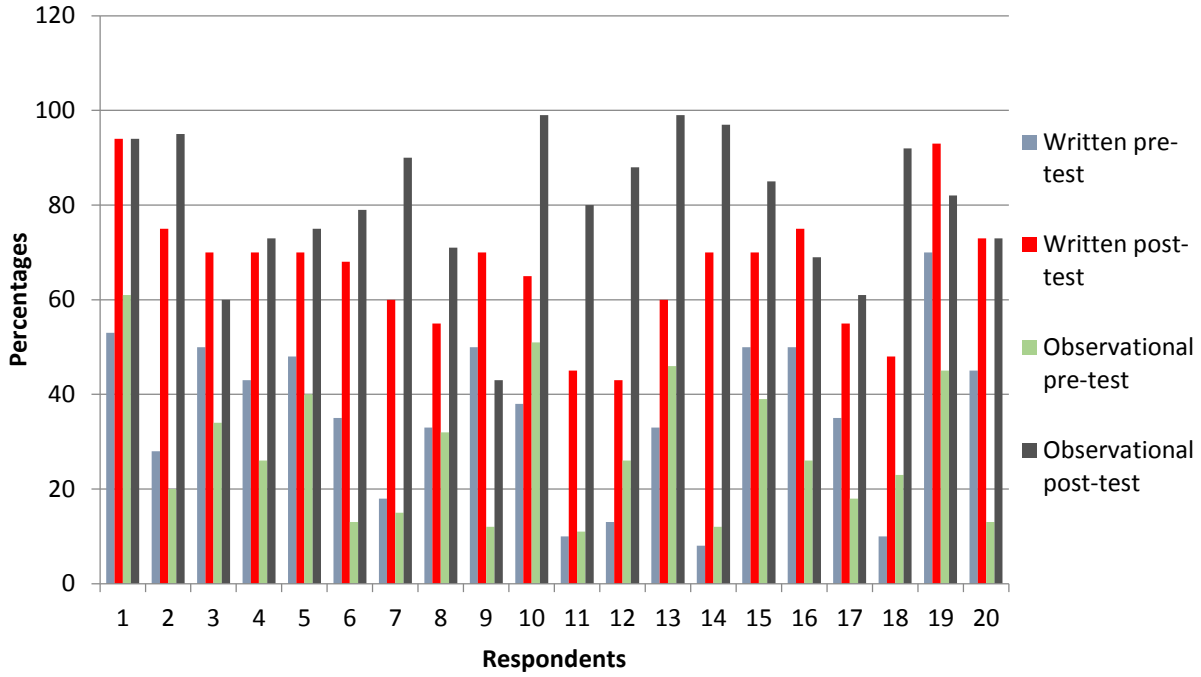

Figure 4.32: Graphical comparison of the written pre-test and post-test and the observational pre-test and post-test

It is encouraging to note that the five poorest performers in this group of twenty with scores of under 20% on the initial written pre-test (respondents 7, 11, 12, 14, and 18) are amongst the highest performers in the observational post-test. These five respondents were also amongst the lowest performers in the observational pre-test. It is also interesting to note that respondents 11 and 12 who both hold low school qualifications displayed scores in the 40% range for their written post-tests, which cannot be considered as a high level of change in their learning, yet compared with respondents 3, and 4 who scored in the 70% range on the written post-test and who both hold tertiary diplomas, respondents 11 and 12 executed better clutch installations than the higher schooled respondents 3 and 4.

When tested on the actual installation of clutches, most of the twenty respondents displayed a remarkable understanding and recollection of the principles that were taught in the

intervention programme. There seems to be a disconnect between the performance levels of the written test and the observational test that begs further exploration. This researcher is of the opinion that a pattern emerged whereby this disconnect could possibly be explained at the hand of respondents' difficulty in interpreting the multiple-choice written questions and the answering thereof. Although there is an appearance that this group that may not have learnt the new concepts and procedures to the desired level as presented by the written test-data, the practical outcome of most of the respondents at their workplace indicate that a higher level of learning did indeed take place.

When this researcher performed the pilot study at the beginning of this research on colleagues and peers, he neglected to include a second pilot study on a sample group of the same characteristic of the actual sample group of eighty respondents. In hindsight, this revelation must be identified as a serious flaw and unintended limitation of this study.

4.5 Conclusion

The application of the three instruments in Chapter 4 informed several points of interest. Even though care was taken during the compilation of the satisfaction survey, it is evident that it lacked in providing data on several levels of criteria. Biographical data should have been expanded to include such questions as:

1) Have you fitted a clutch before?
2) Approximately how many clutches have you fitted?
3) Do you work alone when fitting clutches?
4) For how many years have you been fitting clutches?

This added information would have assisted in understanding written scores as well as observational scores better. It may also be possible to develop an ex-post-facto type instrument whereby the historical way in which clutches were fitted could be determined according to a range of items reflecting the preferred clutch installation protocol. Such an instrument would obviate the need to perform time-consuming pre-intervention observations as it could be self-performed. It may be problematic to follow the same procedure for the post-intervention observation as the desire to please may motivate respondents to score their installations very highly.

Eighteen of the twenty-two satisfaction survey items were of a utility nature and four were of an affective nature. The researcher is of the opinion that the utility of the information gathered from the satisfaction survey will be helpful with personal improvement as well as programme improvement, but that the specificity of the survey criteria excludes too many

vital criterion variables that can be useful for measuring cause and effect (Alliger *et al*., 1997). Even though the tests of significance (see Section 4.3.2 and 4.4.2) suggest that the programme had indeed been the cause of the learning improvement and the observed improvement in transfer of knowledge, this inference is made with the exclusion of many other internal and external variables such as motivation, self-efficacy, attitude, rewards, and other contextual factors that are too expansive to mention here (Holton, 1996; Bates, 2004; Arthur *et al*., 2003; Alliger *et al*., 1997; Haupt, 2008).

Kirkpatrick's (1998) four level framework cannot operate as an instrument of causality as has been established by other researchers and confirmed in this study. This limitation is in line with many of the criticisms of this evaluation framework. Scientifically valid connections between survey data and test data could not be made as it would have amounted to mere speculation without substance.

This research is strictly a summative study seeking a verdict as to the effectiveness of the programme and therefore an interpretation of the negative aspects of the collected data falls outside of the stated research questions. However, in order to provide a truthful verdict on the programme's effectiveness, areas where negativity was reported and poor improvement in test scores were reported should also be clarified as pertaining to faulty elements in the programme or other extraneous variables. Arthur *et al*. (2003:277) puts it in perspective:

> If student ratings are to be used as indicators of teaching effectiveness, then an appropriate test of the ratings/grades relationship would require that they must be correlated with a more relevant—that is, uncontaminated and non-deficient measure of learning than grades.

Thus, the usefulness of student ratings of programme effectiveness is a function of the conceptual criterion of interest (Arthur *et al*., 2003). Broucker (2009) performed research in specifying very particular criteria of interest through applying extensive elements with regard to trainee characteristics, programme characteristics, and organisational characteristics. Broucker (2009) employed The Learning Transfer System Inventory (LTSI) instrument which was developed by Holton, Bates & Ruona (2000) and applied statistical procedures that included descriptive statistics, explorative factor analysis and regression analysis through the SPSS software. These procedures proved to be successful in determining relationships between independent and dependent variables such as how participants used their knowledge in their daily work (transfer), the extent to which they use it as a reflection framework, the added value of the programme to their career, and self-efficacy.

Yardley and Dornan (2012:100) agree with Arthur et al. (2003) and Broucker (2009) with regard to the limitations associated with Kirkpatrick's (1998) four level framework and state:

> The model does not allow for the rich variety of outcomes that can be evaluated using qualitative as well as quantitative methodologies, nor explain how or why such outcomes are consequential to particular elements of complex interventions. It tends only to be used to measure anticipated outcomes and ignores unanticipated consequences.

Yardley and Dornan (ibid) find that Kirkpatrick's (1998) four level framework involves so many implicit assumptions that the four levels are adequate for use only in relatively simple instructional designs, short-term endpoints and beneficiaries other than trainees. From this point of argument, Kirkpatrick's (1998) four level framework may be more suited to programmes such as the one under study than more advanced lengthy programmes. The programme under study spans only one day, the essence of the content is to introduce a clutch fitment protocol comprising six steps with varying degrees of complexity contained in the individual activities of the six steps, which could possibly be contrived as a formula of sorts. Roughly half of the programme is conceptual in nature and the other half is procedural in nature. It could be asked if it is perhaps the conceptual half which contains scientific principles such as tribology, power, torque, strength of materials and harmonics that caused respondents to experience difficulty with learning, as is evidenced by the low written pre-tests and relatively small differential in the written post-test. The instrumentation used in this study is incapable of answering such a question as respondent characteristics (such as motivation, attitude, self-efficacy), programme characteristics and statistical procedures are deficient of the finer nuances required in determining causality (Arthur *et al.*, 2003; Broucker, 2009).

Kirkpatrick (1998) explains that his initial idea with the four levels was conceived when he observed how technical training could be measured by the reactions of learners, their learning, application of their learning and in a quick and easy way prove to organisations the results of the technical training (Yardley & Dornan, 2012). Yet, even though Kirkpatrick's (1998) four level model achieved a summative verdict on the utility of the programme, the gains in knowledge and the extent to which respondents (sample frame of twenty) had implemented the knowledge requires further clarification. Unless it is understood how and why effects are consequential to particular elements of the intervention, it will be difficult to refine future training to maximise benefit (Yardley & Dornan, 2012). Many attributions posited to explain negative responses and poor written test performance (such as language difficulties, poor prior learning, age, qualifications, pace, diversification) remain

unsubstantiated conjecture in the absence of a conceptual framework that is based on the collective principles of sound learning, transfer of learning and evaluation theory.

In conclusion, the research findings are supportive of an intervention programme that seems to have assisted participating respondents in executing much improved clutch installations. The reaction survey findings seem to support the alternative hypothesis that the programme is well liked and that respondents found it to be useful. Some item responses would assist in improving presentation skills and instructional design. The written pre-test and post-test data has highlighted knowledge areas where most respondents have very poor prior knowledge, which will help to focus training on those areas. The same applies to areas of poor performance on the post-test. Instruction can be altered to focus more on the areas where poor test differentials were measured. It would be impossible to make significant improvements to the programme as a whole as findings are more descriptive as to the “does it work” than to the “why does it work” of this programme evaluation.

5.1 Overview of this chapter

This chapter presents a synopsis of the preceding chapters, a summarised discussion of the answers to the research questions, and a reflection on how this research informed the researcher. Recommendations for technical training personnel, designers and evaluators of programmes, organisational policy makers, and future research suggestions are provided. The research was guided throughout by the main question and three sub-questions:

> *Main research question: How effective is the training programme known as "Guidelines to clutch replacement" in equipping the Automotive Service Technician with the required knowledge and behaviour changes to ensure a fault-free clutch replacement?*

Sub-question one: *What are the participants' reactions with regard to the training programme?*

Sub-question two: *How effective is the training programme in facilitating the acquisition of new knowledge?*

Sub-question three: *How effective is the training programme in changing the participants' observable work behaviour?*

5.2 Overview of the study

Technological advances in the international automotive sector influence the supply chain of modern vehicle design, manufacture, and maintenance. The focus for this study settled on an intervention programme for clutch fitment designed specifically for service centres responsible for such maintenance and repairs. The quality of automotive maintenance-and-repair work is largely a function of the congruency between the current conceptual-and-procedural-knowledge that Automotive Service Technicians possess and the specific product-knowledge as encapsulated by the various technologies and sciences found in particular automotive components.

Several researchers agree on three key areas with regard to automotive training. Firstly, the evolutionary nature of rapid technological advances are the drivers behind the incongruences in the three knowledge areas of product knowledge, conceptual knowledge, and procedural knowledge, as is evidenced by various segments of the automotive industry

(Anastassova *et al*., 2005; Chougule *et al*., 2011). Secondly, the mechanism of closing the gap between the existing incongruences of the three knowledge areas resides in the domain of education and training (Karaali *et al*., 2011; Sunaoshi *et al*., 2005). Thirdly, mainstream and intervention programmes need to be continuously developed and evaluated for effectiveness by original equipment manufacturers (OEM's) in collaboration with their various partnering constituencies around the globe (Ersoy & Kucuk, 2010; Michalos *et al*., 2010; Anastassova & Burkhardt, 2009).

A literature search on programme evaluation was conducted with specific reference to the characteristics of effective programmes and those of adult learners in order to maintain the focus of this research contextually within the programme and its recipients, and how the programme performed for these recipients. The conceptual framework for this research was derived from Kirkpatrick's (1998) four level framework for programme evaluation due to its utility value and due to the ease in which it supported this research in providing answers to the initial project as commissioned by ZF Services SA management. By virtue of its four-level nature, Kirkpatrick's (1998) framework guided the research design as a quantitative, quasi-experimental study by way of three statistical data-collection instruments namely: (a) quantitative satisfaction survey, (b) written pre-test and post-test, and (c) observational pre-test and post-test.

5.3 Limitations of this study

The Kirkpatrick (1998) four-level framework for programme evaluation was employed in this study. This provided a utilisation-focused structure of inquiry with regard to the effectiveness of the intervention programme known as "guidelines to clutch fitment". Intentional and unintentional limitations include the following:

a) This research limited the application of Kirkpatrick's (1998) fourth level in the sense that statistical analyses could not be applied due to the lack of data. Fourth level data collection is longitudinal by nature and by implication requires the collection of data over several years. It was therefore decided to apply Kirkpatrick's (1998) first three levels in the form of statistical instruments and merely comment on the fourth level anecdotally. Kirkpatrick's fourth level focuses on the results of the programme in terms of the benefits derived from the programme such as monetary gains through better quality installations and is impossible to statistically measure within the time limitations of this research (see Table 1.4 in Section 1.9.4 for more detail on Kirkpatrick's (1998) results level).

b) A second intentional limitation of this study was the sample size of eighty and the fact that the sample was populated from the Gauteng province only. This research entailed a very high degree of travel and physical input in order to present the intervention programme on ten different occasions at ten different locations. For all ten of these events the three test instruments had to be applied, which took up a lot of time. The statistical strength of a relatively small sample of eighty respondents may make statistical generalisation to the larger population unreliable.

c) The third research instrument (observational pre-test and post-test) took up the most time as each pre-test and post-test per respondent took two days to perform. The implication of this time-factor resulted in only twenty of the original eighty respondents having taken part in this part of the research. As the Gauteng region is known to be the hub of the South African economy, outlying regions such as Kuruman, Lephalale, and Malalane may not yield similar data should the same research be conducted in those regions. From personal experience, I discovered that training opportunities outside of the economic hub areas in South Africa tend to become quite limited the further service centres are situated from economic epicentres. This statement is merely based on observation and should be surveyed in order to establish it as fact. A follow-up correlational study between the various economic hubs and their outlying areas could prove to be a worthwhile supplement to this research. A follow-up study would provide valuable formative data for future programme development, sensitising the programme to the diversified characteristics of the South African population. The Gauteng region was chosen for the focus of this research because of its proximity to the researcher's domicile and because it represented more than sixty percent of ZF's economic activity.

d) The summative nature of this research imposed a limitation on the variety of statistical procedures that could have been performed in addition to the ones that were performed. The application of other statistical procedures, such as regression analysis and factor analysis, would greatly enlarge the scope of this research to include both summative and formative data. Such data would remove the lens of inquiry from the narrow perspective of the stated research questions of this study (see Section 2.4.4.6, Chapter 2).

e) An unintentional limitation of this research became apparent towards the conclusion of this research in identifying the large gap between written test score improvements and observational test score improvements. This researcher suspects that the written tests could have been out of context with the verbal and written language skills of the sample group due to the pilot study having been performed on highly qualified peers

rather than a sample of respondents more representative of the overall characteristics of the sample group. Future applications of this research must comprise written tests that are altered according to the way in which the eighty respondents of this current research reacted to the written tests and the way in which an analysis of their answers informed this part of the study.

f) The presenter of the programme conducted the presentation in English, which may have limited the understanding and cognitive processing of some respondents who do not speak English as a mother tongue and who may not have mastered English fully as a second language. The presenter was not able to present the content in any of the other South African languages and besides that limitation; the engineering terminology contained in the programme did not have suitable translations in most of the other languages (Probyn, 2001).

g) The scope of the study was limited by approaching the instrumentation and collection of data from a post-positivist-quantitative paradigm with the exclusion of formative research questions, thereby focusing on the summative outcome of the intervention. This research design limited the power of clarification in establishing cause and effect between levels and making substantive inferences with regard to satisfaction survey responses and pre-tests and post-tests scores. The exclusion of qualitative data collection strategies was a severe limitation in determining "why did the programme work?", as the focus from the outset was to determine "did it work?"

h) The research excluded correlations of variables such as: qualifications, prior learning experience, prior knowledge, language, clutch installation experience, learner characteristics, presenter characteristics, and organisational characteristics. This study also did not attempt to correlate reaction results (level one) with levels, two, three, and four as research has shown such cause-effect clarifications to have almost no relationship with each other except in the case where reaction response items were of a utility nature and not an affective nature (Alliger *et al*., 1997).

5.4 Revisiting the research questions

5.4.1 Sub-question 1: Affective/Utility domain (satisfaction with the programme)

What are the participants' reactions with regard to the training programme?

5.4.1.1 Programmatic content, presenter skills and overall programme

Seventy-eight respondents felt that they were afforded adequate opportunity to interact with the trainer and that the programme had taught them something new and relevant about

clutches. These seventy-eight respondents' enthusiasm in having interactively participated in the programme seemed to strongly suggest that the programme's content did not repeat any prior knowledge and had thus succeeded in enriching respondents' knowledge in the category of clutch fitment. Apart from one respondent being in disagreement, seventy-nine respondents felt that the programme objectives were clear and realistic; that the trainer was well prepared and explained concepts clearly; that they were challenged by the content and would strive to implement the clutch-fitment-protocol at work as they regarded the overall programme as very high. Seventy-seven respondents felt that the PowerPoint presentation was clear, that the content was accurate and that the programme had empowered them to execute accurate failure analyses on clutch components in future. Almost half of the respondents felt that the pace of the presentation was too fast, and six respondents felt that the hand-outs were of no value and that the trainer was insensitive to personal and cultural issues. Of the eighty respondents, only seventeen respondents chose response choices of disagree or strongly disagree to some of the survey items, which indicates that seventy-nine percent of the sample had made positive responses to the satisfaction survey.

The data and results supporting the above findings of the satisfaction survey were discussed in detail in Chapter 4. The three survey items that received the poorest scores were Content Item 6, Content Item 7, and Presenter Item 6, and will be addressed again in section 5.6 under recommendations.

5.4.2 Sub-question 2: Cognitive domain (learning that took place)

> *How effective is the training programme in facilitating the acquisition of new knowledge?*

The written pre-test and post-test developed for this level is in accordance with Kirkpatrick's (1998) second level of learning, which is usually tested by means of performance tests before and after the intervention. The average score (of 36.93%) reported for the written pre-test for the sample of eighty respondents suggests that the level of entry-knowledge of respondents before receiving the intervention programme was rather poor. After completion of the intervention programme, the average score measured on the post-test increased by a factor of 18.45% to 55.38% (see Tables 4.28 and 4.29, and Figures 4.27 and 4.28). According to the paired samples t-test that was performed to test the significance of this statistical outcome, the difference in pre-test scores and post-test scores are more likely to have been caused by the intervention programme. The programme is thus perceived as

effective in improving respondents' knowledge on clutch fitment as is evidenced by the test differential. However, I make this statement cautiously as I have not tested the influence of other dependent variables on the effect of learning and transfer of learning. Personal respondent characteristics, extraneous characteristics and organisational characteristics have been isolated from this study and could prove to affect the efficacy of the intervention programme.

Considering all that has been said above, the post-average of 55.38% is however still relatively low when one considers the fact that a clutch installation should be performed at a 100% accuracy level for premature failure not to set in. Although the increase in knowledge is deemed statistically significant, the programme has not been as effective because the performance level for a clutch fitment should be no less than 100% as anything less than 100% could mean that an important step in the protocol has been compromised. The discussion around sub-question three in Section 5.4.3 sheds more light on the perceived low performance on the written tests and provides important insights by including the observational results of practical installations.

5.4.3 Sub-question 3: Outcome domain (behaviour modification)

How effective is the training programme in changing the participants' observable work behaviour?

The observational tests developed to measure this part of the research followed the installation protocol closely and was designed to measure Kirkpatrick's (1998) third level of behaviour (transfer of learning). The average score on the observational pre-test for twenty of the eighty respondents was calculated to be 28.15% and improved by a factor of 52.1% to a post-test average score of 80.25%. This finding seems to contradict the written test finding as learning had been measured at a significantly lower average of 55.38%. Yet, the observational data seems to suggest that learning had indeed taken place on a high level and the transfer of learning was evident as positive behaviour modification when respondents were observed during the execution of clutch installations.

The t-test that was performed on the data-yield from the twenty respondents supports the finding that the programme could be taken as being responsible for the increase in installation performance. The t-test also indicates that the difference between pre-intervention performance and post-intervention performance could not likely be ascribed to any external influence. One would have expected an observed clutch installation to have reflected the low increase in clutch installation knowledge, however the 52.1% differential

between the observational pre-test and post-test is almost three times greater. As I have been following the development of this research with interest, I believe a pattern is emerging whereby poor prior knowledge of clutches and clutch fitment is amplified by an intervention programme that is high in technological content, fast-paced and presented in English only. Engineering terminology could be a stumbling block if English is not a participant's first language and this could perhaps explain the performance differential between the written tests and the observational tests.

The relatively low written pre-test average of 36.93% and the even lower observational pre-test average of 28.15% seem to support the problem statement of this study that Automotive Service Technicians in South Africa do not possess the necessary up to date knowledge for the execution of error-free clutch installations. The fact that the twenty respondents performed better on the practical (observational test) component of this research than in the academic (written test) component is perhaps an indication that the programme could perform even better if a weightier practical component were added to the almost pure PowerPoint presentation. Considering the differential between the written post-test average of 36.93% and the observational post-test of 80.25%, the possibility exists for conceptual knowledge gains to have been less than procedural knowledge gains as the written tests lean more towards conceptual knowledge and the observational tests lean more towards procedural knowledge (refer to Section 3.4.4.2 for information on the relationship between conceptual knowledge and procedural knowledge).

5.4.4 Outcome domain (results modification)

This part of the research relates to Kirkpatrick's fourth level (results) and was not formally measured, as was explained in Chapter 1, Section 1.9. Outcome results for this intervention programme could take on a variety of forms and could offer benefits to different entities in the supply-chain of clutches (see Table 1.4 in Chapter 1). The ultimate effectiveness of the intervention programme on clutch fitment could only be measured by monitoring the rate of installation failures and on installations performed by the eighty respondents of this study. This process would have to stretch over many years as a clutch installation could prove to be faulty within hours or could last for many years. Clutch installations lasting in excess of ten years are not unheard of. Participating service centres would have to keep an accurate log of clutch failures with detailed analyses of the reasons for failure, and such data should eventually be compared with previously kept data of failures before the intervention. This kind of study should be designed as a longitudinal investigation over time. Kirkpatrick (1998) stresses though that favourable survey responses and high scores on written and observational tests do not necessarily guarantee favourable results for the parties involved in

the programme activities. A precise instrument would have to be developed to measure benefits accrued by all related parties.

The only way of establishing some measure of results in the short-term is to monitor complaints from customers where premature failure has not yet taken place, but where some anomaly is detected. This researcher has anecdotally learnt in the past six months that certain “come-backs” have indeed been experienced to be on a lower level than before the intervention and that respondents are generally more proud of their workmanship. One distributor of ZF products has reported a marked reduction in the warranty-returns of one particular part-number where errors in installations were previously rife, but after completion of the programme warranty-claims on that particular part-number became almost non-existent. This particular distributor of ZF products was so satisfied with the effect of the intervention-training that they embarked on a nation-wide campaign to offer the clutch-installation intervention programme as a special addition to their normal training offering.

5.4.5 The main research question

How effective is the training programme known as “Guidelines to clutch replacement” in equipping the Automotive Service Technician with the required knowledge and behaviour changes to ensure a fault-free clutch replacement?

Kirkpatrick (2008) believes that training programmes should be highly enjoyable for the participants in a training scenario as it is more likely for participants to learn and apply what they have learnt if they experienced the training as pleasant. Kirkpatrick (1998) hastens to mention that learning and the transfer of learning is not necessarily a given fact even in the event where trainees experience a training programme to be pleasant. Kirkpatrick (1998) also states that the transfer of learning can only realistically take place once learning has taken place and proportionally so. He adds that even in cases where a high degree of learning has taken place, the transfer of knowledge may or may not take place.

The three instruments employed in this research were designed to measure respondent satisfaction with the programme, the improvement in knowledge regarding clutch fitment, and the transfer of newly learnt concepts with the supporting evidence of modified behaviour during the installation of clutches. On all three of these counts, a perception has developed of an effective programme and especially in the behaviour modification stage which forms the platform on which benefits of varying kinds could take root. Even though certain aspects of the programme have been found to be lacking, replicating training sessions on the same model should yield similar results. The only way to determine the general effectiveness

would be to replicate this study with respondents from other regions of the country as new sample groups and compare such findings with this research. In order to isolate the intervention programme as the main contributor to knowledge acquisition and behaviour modification, criteria spanning the domain of respondent characteristics, trainer characteristics, and organisational characteristics need to be included in future instrumentation.

5.5 Reflection

The research strategy, discussed in Chapter 3, was based on a quantitative quasi-experimental design with a quantitative satisfaction survey added. The satisfaction survey instrument on its own would not have answered the research questions of this study as it would have lacked the data gathering capacity to yield useful information on the knowledge gained by respondents and the level of behaviour modification of the respondents. A pure qualitative satisfaction questionnaire would have probably provided a richer personal reflection per respondent where certain responses to survey items could have been expounded on through focus groups and interviews.

A combination of quantitative and qualitative elements as a research design would have yielded statistical data per survey item with a qualitative explanation per response item as to the nature of the response. However, bearing in mind, the aim of this study was not to find out why the programme is effective or not effective, but rather to determine if the programme is effective or not and this purpose thus underpinned the quantitative quasi-experiment of this study.

When the written and observational pre-tests and post-tests were designed at the beginning of this study, I expected a close relationship between the successes and failures of the written tests and the successes and failures of the observational tests. The quantitative data collected for both the written tests and observational tests were not as closely related as I expected. This is merely an observation as correlation procedures were not performed to authenticate this statement regarding this disassociation. This obvious anomaly cannot be explained by the quantitative data without leaning heavily on speculation. A qualitative component to the study would have perhaps explained this anomaly to some extent as it would have been informed by rich interaction with the respondents through interviews and focus groups. However, the research questions of this study do not require an explanation of anomalies as the focus is on effectiveness and not on the reasons for effectiveness or ineffectiveness.

I am therefore of the opinion that the quantitative nature of this research design was adequate for determining whether respondents were satisfied with the programme, whether they learnt new knowledge, and whether transfer of knowledge had taken place with the evidence of modified behaviour.

5.6 Recommendations

Several recommendations, as informed by the findings of this study are proposed.

5.6.1 Recommendations for technical trainers and policy makers

This programme was not effective in every area of teaching new concepts and procedures and therefore the possibility exists for the theory of change underpinning this study to be lacking in the crucial area of “barriers to learning”. Programme planners and trainers ought to become intimately acquainted with the audience that the programme is intended for in terms of culture, gender, ethnicity, background, qualifications, experience and, by implication, perform pilot studies guided by these variables. The findings of this study suggest that the programme had not added value to some respondents in terms of learning and the delivery method had been found to be unsatisfactory by others. A better understanding of the characteristics of the target audience would certainly add value to the programme and perhaps eliminate certain elements of the programme before they become part and parcel of the programme’s future structure.

5.6.2 Recommendations for further research

Kirkpatrick’s (1998) four level framework for programme evaluation served this study well as a summative study, but qualitative data is vital for ironing out the unknown issues for failure in certain areas and should form part of a future similar programme-evaluation study, as recommended by Weiss (1998). Unknown issues that were identified during the course of this study include:

1) Language as a barrier to learning. Some barriers to learning were discussed in Chapter 2, but a more focused investigation is required to determine the exact status of language as a possible barrier.
2) Prior knowledge as a barrier to learning (written and verbal): most cognitive processing theorists agree on the role that prior knowledge plays in the assimilation of new knowledge. Care must be taken when programmes are designed based on the assumption that crucial prior knowledge or experience is in place for the target audience.

3) Pace of presentation: Intervention programmes may not always be designed for heterogeneous audiences, therefore the pace and repetition of concepts may have to be factored into the available time for the intervention delivery, especially in groups that consist of both expert and novice learners.

4) PowerPoint slide presentation in the place of tangible models: the ease and pace of PowerPoint presentations could easily overwhelm an audience and inhibit their ability to process information. This is an area requiring further research.

Both quantitative and qualitative research designs could be applied to Kirkpatrick's (1998) four level framework as it is nested inside a logic model that spans the process-evaluation and product-evaluation categories for a utilisation-focused approach inclusive of both summative and formative programme-evaluation approaches. Constructing a logic model for future programme evaluations similar to this programme under study should be underpinned by a well thought theory-of-change (see Section 2.3.4 in Chapter 2). The individual steps in the process and product stages of the evaluation should be made explicit within the logic model so that the evaluation could be easily duplicated by other individuals in the training department or duplicated exactly for other groups.

It may be prudent to conduct mini formative-studies as part of the normal day-to-day training activities and to analyse the data of these mini-studies regularly as a managerial action in order to gather complimenting summative and formative data at the same time. This could be made possible by employing a combination of quantitative and qualitative designs. These designs could establish weaknesses more effectively, execute corrective strategies and perform mini studies again on other small groups until obvious shortcomings have been addressed adequately.

In a country such as South Africa where regions can differ significantly in terms of culture and ethnic compositions, as well as qualities of education, it may be prudent to execute such mini-studies in geographically significant areas such as Cape Town, Durban, Polokwane, Nelspruit, and Bloemfontein so that these five major centres and their unique identities could be compared with each other. These five economic hubs could shed valuable light on programme delivery methods and strategies for knowledge transfer with the added value of quantitative data being expounded upon by qualitative data. A rich picture could develop which may certainly add to the formative side of programme planning and development, as well as programme evaluation as the vehicle to programme excellence.

Great care should be taken with self-developed instruments as the conceptual criterion of interest could easily be weakened harming the validity or credibility of research findings, and in some cases even rendering them worthless. It may be prudent to include an instrument developed by Holton (2005) known as the Learning Transfer System Inventory (LTSI) or other similar methodologies. The LTSI inventory covers sixteen vital areas of the categories of learner-characteristics, programme-characteristics and organisational-characteristics, which equips researchers with the statistical power (such as factor analysis and regression analysis) to explain causality. Scrutiny of such studies as, for example, performed by Broucker (2009) where methodologies were incorporated for successful clarification of cause-effect variables could assist researchers in determining relevant conceptual criteria of interest.

Future similar studies should also take care to design satisfaction surveys with the utility of the programme in mind; such data has shown to correlate more reliably with learning and transfer of learning than affective-type survey items (Alliger *et al*., 1997). Care should also be taken to include helpful biographical information such as probing past work experience, probing past learning experience, and probing prior knowledge and administering more than one pilot test as a means to isolate problematic responses from different respondents with differing characteristics. Such biographical information should assist researchers in deciding if certain respondents are actually unsuitable for the population cross-section that forms their research sample. During analysis and interpretation of the statistics, I often questioned whether certain respondents had in fact ever been involved in clutch-fitment before; a few extra biographical questions would have eliminated such uncertainties. Service centre owners may have sent employees along for the training with the hope of starting to involve such employees with clutch fitments. Such respondent data could have been easily identified and excluded from the research as the intervention programme was designed for experienced fitters of clutches who merely need to be updated regarding modern clutch technology.

As a conceptual framework, Kirkpatrick's (1998) four level framework leans more towards summative studies where the focus is on immediate outcomes, and the programme to be evaluated is a relatively simple intervention, as was the case with this study. The four level framework in its original form is not suitable for more complex programmes and interventions, especially when the evaluation purpose is to evaluate the process and product of the programme under study. In that case, both formative and summative evaluation strategies ought to be incorporated. In more complex programmes, clarifications of cause and effect variables are essential for programme improvement.

Giangreco *et al*. (2008) propose that the four level framework could indeed be utilised in such cases and that the criticism levelled against some aspects of the framework are not conclusive should evaluators apply more rigour to the evaluation. Giangreco *et al*. (2008) call for renewed efforts in programme evaluation to adopt the four level framework as a conceptual framework in order to test popular criticism through the application of different research methodologies. Researchers should also not assume that an evaluation can be everything to everybody; in fact, the overall goal to consider when deciding on an evaluation design is how to arrive at the most beneficial information to key stake-holders in the most cost-effective and realistic method.

Finally, and in particular for programme evaluations performed in the automotive field, it is recommended for programme designers and evaluators to form stronger bonds with distributors and users of their product so that long-term results of training programmes could be better monitored and reliable statistical measures of benefit to all parties be reported. Kirkpatrick's (1998) fourth level where results are measured with regard to all types of benefits, including monetary benefits, could be measured only if training providers and training customers work together in collecting reliable and valid data through agreed upon research strategies.

5.7 Conclusion

The research had its inception as a commission from the human resources department of ZF Services South Africa. The task was simple: "determine whether the ZF training approach works or not". One programme in the ZF curriculum known as "Guidelines to clutch fitment", was chosen as clutch fitment in general proved to be an area of concern because the warranty department was plagued by warranty claims as shown in ZF's records. Forensic failure analysis conducted on prematurely failed clutches by the ZF warranty department determined that a significant proportion of failed clutches could be ascribed to incorrect fitment procedures.

The training programme was developed in Schweinfurt Germany as an answer to similar problems experienced in Europe. After extensive training in Germany, some adaptations were made to the programme to suit the vehicle population and its unique characteristics in the South African context.

To answer the question of "does the programme work?" the Kirkpatrick (1998) four level framework was applied to evaluate the programme's perceived effectiveness from a "satisfaction with the programme" point of view, together with an assessment regarding the

quality of learning and the effectiveness of the transfer of knowledge to meet the learning outcomes. Quantitative self-developed instruments were established and the data sets were processed and analysed by SPSS software.

Eighty-seven respondents from the experimentally accessible population of Automotive Service Technicians in Gauteng were made available by their employers, of which twenty were made available for observational tests. The findings suggest that the programme was well liked by the respondents and that they perceived its utility to be of a high value. Data from the tests suggest that knowledge on clutches had improved by almost 20%, but considering that the average prior knowledge was measured at 36.93%, the final post-test average of 55.2% was relatively low bearing in mind that clutch fitments need to be 100% compliant with the proposed protocol to be deemed fault-free. However, the twenty respondents who were observed during practical clutch installations obtained a post-test average of 81%, which suggests that transfer of learning did indeed take place.

Although the programme has been identified to have certain shortcomings, the researcher is satisfied with the way in which respondents had universally adopted the clutch fitment protocol during clutch fitment at their place of work. However effective the perceived outcome of the programme may be, it must be stressed that respondent characteristics and organisational characteristics were not included as variables in testing the finer nuances of the programme's effectiveness and therefore any successes or failures reported may or may not be entirely attributed to the effect of the intervention programme.

Anecdotal insights provided by workshop personnel and Service Centre management seem to suggest that certain familiar "comebacks" have been stemmed. A time-series study would shed more light on the permanence of the results and benefits accrued by the service centres who participated in this research. Future similar research should take note of the limitations and recommendations proposed earlier in this chapter for possible improvement.

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Appendix A: Satisfaction Survey

A Content

	ITEM	Strongly agree	Agree	Disagree	Strongly disagree
1	The programme objectives are clear and realistic.				
2	I learnt something new about clutch fitment				
3	I found the information relevant to my work.				
4	The programme equipped me to successfully conduct a diagnostic pre-inspection of clutch related components.				
5	The programme equipped me to successfully evaluate the failed components.				
6	The pace of the presentation was too fast.				
7	The hand-outs will be helpful to refer back to later				
8	I was given adequate opportunity to interact with the trainer and ask questions.				
9	The images of clutches in the PowerPoint presentation were clear.				
10	I found the information in the presentation accurate.				

B Presenter skills

	ITEM	Strongly agree	Agree	Disagree	Strongly disagree
1	The trainer was enthusiastic about the topic.				
2	The trainer was well prepared.				
3	The trainer is knowledgeable in his subject field.				
4	The trainer explained all the concepts adequately.				
5	The trainer communicates clearly.				
6	The trainer was sensitive to personal and cultural differences.				
7	The trainer presented the content in an interesting way.				
8	The trainer covered the content satisfactorily in the allotted time.				

C Overall program

	ITEM	Strongly agree	Agree	Disagree	Strongly disagree
1	I will be able to apply what I have learnt through the programme when I am back at work.				
2	I was challenged by the content.				
3	I will execute future clutch installations according to the guidelines contained in the programme.				
4	I regard the overall value of this programme as high.				

Appendix B: Written pre-test

Organisation:	**Trainee number:**	**Date:**
This test consists of 44 questions. You may choose one possible answer by circling a,b,c,d or e or as it applies to each question. **There are five sub-questions each for questions 21, 22, 23, and 24. Make a cross in the appropriate block if you agree or disagree with the statements in those questions.**		

1	**A clutch shudder could be caused by:**
(a)	Loose or broken engine or gearbox mountings
(b)	A bent release fork
(c)	Contaminated hydraulic fluid
(d)	The clutch plate is too small
(e)	None of the above
2	**A driver of a vehicle complains of a slipping clutch. What could be the cause of this?** **Choose one of the following:**
a)	A leaking concentric slave cylinder
(b)	A leaking gearbox oil seal
(c)	An over-greased gearbox spigot shaft
(d)	An incorrectly adjusted slave cylinder
(e)	All of the above
3	**Which of the following conditions can cause grating/scratching gear changes?**
(a)	When a clutch plate doesn't release properly
(b)	When the input shaft is rusty, dirty or damaged
(c)	When the clutch plate is bent
(d)	When the spigot bearing is seized
(e)	All of the above
4	**The hydraulic clutch release system is sometimes to blame for a clutch that doesn't release properly. Choose the most likely cause from the possibilities below:**
(a)	Flexible hoses are perished
(b)	There is air in the system
(c)	There is a leak somewhere in the system
(d)	The clutch plate is bent
(e)	All of the above
5	**The driver of a vehicle complains that the clutch pedal feels hard when pressing it. Choose a possible cause for this from the list below:**
(a)	The slave cylinder needs adjustment
(b)	The master cylinder needs adjustment
(c)	The clutch pedal needs adjustment
(d)	The release fork is badly worn
(e)	None of the above
6	**Why is it important to pull the gearbox out as straight as possible?**
(a)	So that the input shaft doesn't bend
(b)	To protect the spigot bearing
(c)	So that the old clutch plate doesn't bend
(d)	So that the diaphragm fingers don't bend
(e)	All of the above

7	**When removing the gearbox, it is good practice to place the gearbox on some wood. Why is this good practice?**
(a)	To not damage the gearbox sump
(b)	To protect the bolt-down surface of the bell-housing
(c)	To prevent the workshop floor from becoming contaminated with oil
(d)	All of the above
(e)	None of the above
8	**Why is it good practice to loosen the bolts on the clutch cover assembly in a cross-wise manner and only a little bit at a time?**
(a)	To prevent the stretch bolts from breaking
(b)	So that the cover assembly doesn't suddenly fall of
(c)	So that the clutch cover doesn't bend due to unequal stresses
(d)	So that the flywheel doesn't bend due to unequal stresses
(e)	All of the above
9	**When do you make the decision to have the flywheel skimmed?**
(a)	When it becomes shiny
(b)	When you can see and feel grooves on the surface
(c)	Every second or third clutch change, depending on the condition of the cracks
(d)	At every clutch change
(e)	Only when the clutch has been slipping
10	**When does the spigot bearing work the hardest?**
(a)	In top gear
(b)	In low gear
(c)	When the clutch is released
(d)	When the clutch is pressed
(e)	During hard acceleration
11	**What is the most serious consequence of a missing or heavily worn out spigot bearing?**
(a)	The clutch will slip
(b)	The input shaft can float forwards and backwards
(c)	The clutch plate will be out of centre with the flywheel
(d)	All of the above
(e)	None of the above
12	**A customer complains about noise, slipping and chatter? You examine the bearing and find grooves worn into the contact face. What may have caused this damage?**
(a)	Riding the clutch (resting your foot on the clutch pedal during driving)
(b)	Incorrect release system adjustment
(c)	A defective master cylinder
(d)	All of the above
13	**A customer complains about harsh engagement and chatter. You examine the disk and find that the hub splines are worn. What may have caused this?**
(a)	Worn pilot bearing
(b)	Engine/transmission misalignment
(c)	Slipping the clutch for too long
(d)	A and B

14	**On inspection of a clutch plate, you find that the torsion damper has completely collapsed. What could have caused this?**	
(a)	Driver abuse	
(b)	The clutch plate was mounted backwards	
(c)	The rivets were not strong enough	
(d)	An overload on the release bearing	
15	**On inspection of a clutch plate, you find strike marks on the stop pins. What may have caused this? (See arrow)**	
(a)	Overloading	
(b)	Torsion damper springs are too soft	
(c)	Driver abuse	
(d)	Driver uses the clutch as a brake	
16	**Customer complains of slipping and chatter. You examine the disk and notice grooves in the friction material. What may have caused this?**	
(a)	Contamination	
(b)	Driver abuse	
(c)	Improper flywheel resurfacing	
(d)	Slipping the clutch	

17	**Customer complains of chatter and release problems. You examine the pressure plate and find that the distribution of the marks are uneven. What may have caused this?**	
(a)	Improperly skimmed flywheel	
(b)	Bent tangential leaf springs	
(c)	Bent release fork	
(d)	Driver abuse	
18	**Customer complains of chatter, noise and release problems. You examine the clutch plate and find that the hub has broken off from the carrier plate. What could have caused this?**	
(a)	Aggressive acceleration	
(b)	Overloading	
(c)	Disk/transmission misalignment	
(d)	Harsh down shifting	
19	**Customer complains of chatter and a slipping clutch. You examine the pressure plate and find streaks of grease/oil on the carrier plate. What could have caused this?**	
(a)	The grease in the release bearing came out	
(b)	The gearbox oil seal failed	
(c)	The engine oil seal failed	
(d)	The hub splines were over greased	

20	**A tangential leaf spring is found to be damaged. What could have caused this?**	
(a)	Aggressive downshifting or miss-shifting	
(b)	Dropping the clutch during pull-off and spinning the wheels	
(c)	Driving in a high gear at low speed (lugging)	
(d)	All of the above	

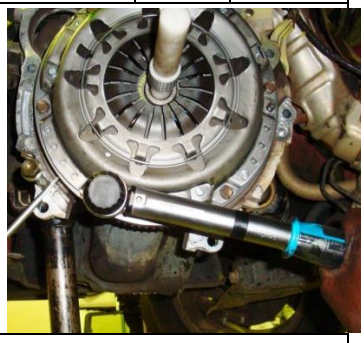
21	**Release forks are precision engineered components and very expensive. You have to justify the need to replace the fork. Do you agree or disagree with the following statements? The release fork needs to be replaced:**		
		Agree	Disagree
(a)	When there is significant but even wear on both fingertips		
(b)	When there is significant wear on only one fingertip		
(c)	When the pivot points show significant wear		
(d)	When it is slightly bent		
(e)	When it is significantly bent		
(f)	If it's a roller type, the rollers are badly worn		
22	**Indicate if you agree or disagree with the following statements regarding flywheels and the skimming of flywheels:**		
		Agree	Disagree
(a)	If it is shiny, roughen it with sandpaper until the shine is gone		
(b)	When the wear indicator groove is still visible, it doesn't need skimming		
(c)	You only skim it when there are visible hot spots		
(d)	The general rule is to skim the flywheel with every third clutch replacement		
(e)	For a potted type flywheel, remove exactly the same amount of material on both the friction surface as well as the bolt down area during skimming		
(f)	Skim if the cracks are small, but replace if the cracks are quite big		
23	**The following applies to pressure plates; do you agree or disagree with these statements?**		
		Agree	Disagree
(a)	The pressure plate face must be 100% flat and parallel		
(b)	When the clutch pedal is fully pressed, the pressure plate moves about 7mm away from the flywheel		
(c)	Push and pull type pressure plates pivot at exactly the same points		
(d)	Pressure plates must be the same thickness as the flywheel		
(e)	When the clutch is pressed, the diaphragm spring pulls the pressure plate away from the flywheel		
(f)	The diameter of the pressure plate determines the amount of torque that can be transmitted.		
24	**The following preparation applies for a new clutch installation; indicate if you agree or disagree**		
		Agree	Disagree
(a)	Wash the oily layers off the flywheel and pressure plate thoroughly with diesel		
(b)	Sand the flywheel until the shininess is gone		
(c)	Use grease or *coppaslip* to lubricate the input shaft splines and hub splines		
(d)	Be very careful when you align the clutch plate with the naked eye		
(e)	File the locating pins on the bell-housing and flywheel round again if they are worn oval		
(f)	Grease the guide tube well for the new-generation plastic sleeve bearings to function well		

Appendix C: Written post-test

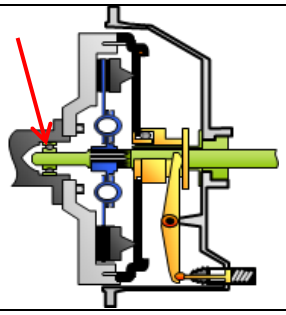
ORGANISATION		DATE			2012
TRAINEE NAME		NUMBER			

INSTRUCTIONS: This test consists of 24 questions. You may choose one possible answer by circling a,b,c,d or e as it applies to each question.
There are five sub-questions each for questions 1, 7, 18 and 22. Make a cross in the appropriate block if you agree or disagree with the statements in those questions.

1	**The following are good preparation activities for a new clutch installation:**		
		Agree	Disagree
(a)	Sand the flywheel until the shininess is gone		
(b)	Use grease or *Coppaslip* to lubricate the input shaft splines and hub splines		
(c)	File the locating pins on the bell-housing and flywheel round again if they are worn oval		
(d)	Grease the guide tube well for the new-generation plastic sleeve bearings to function well		
(e)	Clean the dirt off the flywheel and pressure plate with diesel or paraffin		

2	**Why is it good practice to loosen the clutch cover assembly in a cross-wise manner and only a few turns at a time?**	
(a)	To keep the tension in the stretch bolts the same all the time	
(b)	So that the cover assembly doesn't suddenly fall of	
(c)	So that the clutch cover doesn't bend due to unequal stresses	
(d)	So that the flywheel doesn't bend due to unequal stresses	
(e)	All of the above	

3	**When do you make the decision to have the flywheel skimmed?**
(a)	When it becomes shiny
(b)	When you can see and feel grooves on the surface
(c)	Every second or third clutch change, depending on the condition
(d)	At every clutch change
(e)	When the clutch has been slipping

4	**When does the spigot bearing work the hardest?**	
(a)	In top gear	
(b)	In low gear	
(c)	When the clutch is released	
(d)	When the clutch is pressed	
(e)	During hard acceleration	

5	**What is the most serious consequence of a missing or heavily worn out spigot bearing?**
(a)	The clutch will slip
(b)	The input shaft can float forwards and backwards
(c)	The clutch plate will be out of centre with the flywheel
(d)	All of the above
(e)	None of the above

6	**A customer complains about noise, slipping and chatter? You examine the bearing and find grooves worn into the contact face. What may have caused this damage?**	
(a)	Driving with a foot resting on the clutch	
(b)	Incorrect release system adjustment	
(c)	A defective hydraulic release system	
(d)	All of the above	
(e)	None of the above	

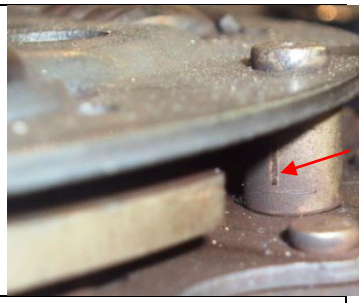
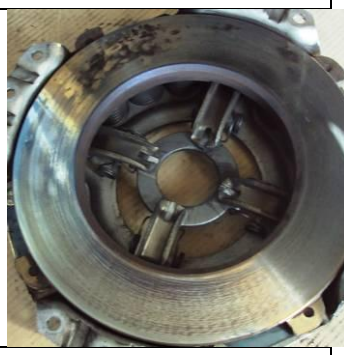
7	**The following applies to pressure plates**	Agree	Disagree
(a)	Pressure plates must be the same thickness as the flywheel		
(b)	When the clutch is pressed, the pressure plate moves about 7mm away from the flywheel		
(c)	The pressure plate face must be 100% flat		
(d)	When the clutch is pressed, the diaphragm spring pulls the pressure plate away from the flywheel		
(e)	The diameter of the pressure plate determines the amount of torque that can be transmitted.		

8	**A customer complains about harsh engagement and chatter. You examine the disk and find that the hub splines are worn. What may have caused this?**	
(a)	Worn pilot bearing	
(b)	Engine/transmission misalignment	
(c)	Driver abuse	
(d)	A and B	
(e)	None of the above	

9	**A clutch shudder could be caused by:**
(a)	Loose or broken engine or gearbox mountings
(b)	A bent release fork
(c)	Contaminated hydraulic fluid
(d)	The clutch plate is too small
(e)	None of the above

10	**On inspection of a clutch plate, you find severe damage on the torsion dampers. What could have caused this?**	
(a)	Abusive driving	
(b)	The clutch plate was mounted backwards	
(c)	The rivets were not strong enough	
(d)	An overload on the release bearing	
(e)	Torsion damper springs are too weak	

11	**A driver of a vehicle complains of a slipping clutch. What could be the cause of this? Choose one of the following:**
(a)	A leaking concentric slave cylinder
(b)	A leaking gearbox oil seal
(c)	An over-greased gearbox spigot shaft
(d)	An incorrectly adjusted slave cylinder
(e)	All of the above

12	**On inspection of a clutch plate, you find strike marks on the stop pins. What may have caused this? (See arrow)**	
(a)	Overloading	
(b)	Torsion damper springs are too soft	
(c)	Driver abuse	
(d)	Driver uses the clutch as a brake	
(e)	All of the above	
13	**Which of the following conditions can cause grating/scratching gear changes?**	
(a)	When a clutch plate doesn't release properly	
(b)	When the input shaft is rusty, dirty or damaged	
(c)	When the clutch plate is bent	
(d)	When the spigot bearing is seized	
(e)	All of the above	
14	**Customer complains of slipping and chatter. You examine the disk and notice grooves in the friction material. What may have caused this?**	
(a)	Contamination	
(b)	Driver abuse	
(c)	Improper flywheel resurfacing	
(d)	Slipping the clutch	
(e)	All of the above	
15	**The hydraulic clutch release system is sometimes to blame for a clutch that doesn't release properly. Choose the most likely cause from the possibilities below:**	
(a)	Flexible hoses are perished	
(b)	There is air in the system	
(c)	There is a leak somewhere in the system	
(d)	The slave cylinder is poorly adjusted	
(e)	All of the above	
16	**Customer complains of chatter and release problems. You examine the pressure plate and find that the distribution of the marks is uneven. What may have caused this?**	
(a)	Improperly bolted to flywheel	
(b)	Bent tangential leaf springs	
(c)	Bent release fork	
(d)	Driver abuse	
(e)	All of the above	
17	**The driver of a vehicle complains that the clutch pedal is hard to press. Choose a possible cause for this from the possibilities below:**	
(a)	The slave cylinder needs adjustment	
(b)	The master cylinder needs adjustment	
(c)	The clutch pedal needs adjustment	
(d)	The release fork is badly worn	
(e)	None of the above	

18	**Release forks are precision engineered components and very expensive. You have to justify the need to replace the fork. Do you agree or disagree with the following statements? The release fork needs to be replaced:**		
		Agree	Disagree
(a)	When there is significant wear on only one fingertip		
(b)	When the pivot points show significant wear		
(c)	When it is slightly bent		
(d)	When it is significantly bent		
(e)	When there is significant but even wear on both fingertips		
19	**Customer complains of chatter, noise and release problems. You examine the clutch plate and find that the hub has broken off from the carrier plate. What could have caused this?**		
(a)	Aggressive acceleration		
(b)	Harsh deceleration		
(c)	Disk/transmission misalignment		
(d)	Harsh down shifting		
(e)	All of the above		
20	**When removing the gearbox, it is good practice to place the gearbox on some wood. What makes this good practice?**		
(a)	To not damage the gearbox sump		
(b)	To protect the bolt-down surface of the bell-housing		
(c)	To prevent the workshop floor from becoming contaminated with oil		
(d)	All of the above		
(e)	None of the above		
21	**Customer complains of chatter and a slipping clutch. You examine the clutch plate and find streaks of grease/oil on the carrier plate. What could have caused this?**		
(a)	The grease in the release bearing came out		
(b)	The gearbox oil seal failed		
(c)	The engine oil seal failed		
(d)	The hub splines were over greased		
(e)	The concentric slave cylinder is leaking		
22	**The following applies to flywheels and the skimming of flywheels:**		
		Agree	Disagree
(a)	You can skim if the cracks are small, but replace if the cracks are quite big		
(b)	You only skim it when there are visible hot spots		
(c)	The general rule is to skim the flywheel with every third clutch replacement		
(d)	For a potted type flywheel, remove exactly the same amount of material on both the friction surface as well as the bolt down area during skimming		
(e)	If it is shiny, rough it with sandpaper until the shine is gone		

23	**A tangential leaf spring is found to be damaged. What caused this?**	
(a)	Aggressive downshifting or miss-shifting	
(b)	Dropping the clutch during pull-off and spinning the wheels	
(c)	Driving in a high gear at low speed (lugging)	
(d)	All of the above	
(e)	None of the above	

24	**Why is it important to pull the gearbox out as straight as possible?**
(a)	So that the input shaft doesn't bend
(b)	To protect the spigot bearing
(c)	So that the old clutch plate doesn't bend
(d)	So that the diaphragm fingers don't bend
(e)	All of the above

Appendix D: Observational checklist

Organisation:		**Trainee number:**						
Vehicle type:		**Pre-inspection date:**						
Vehicle type:		**Post-inspection date:**						
Item	**Observational criteria**	**Quality score**						
1	**Pre-inspection**	**0**	**1**	**2**	**3**	**4**	**5**
1.1	Consult OE specifications						
1.2	Disconnect negative battery terminal						
1.3	Safety: Chocks, Jacks, Lifts, Trestles						
1.4	Articulation of complaint						
1.5	Clutch pedal free play						
1.6	Hydraulic system						
1.7	Hydraulic fluid vs Mineral oil						
2	**Clutch removal**	**0**	**1**	**2**	**3**	**4**	**5**
2.1	Gearbox in top gear						
2.2	Gearbox bolt removal (diagonal and incremental)						
2.3	Tools						
2.4	Slings and jacks						
2.5	Centrality of shafts						
2.6	Placing of gearbox						
3	**Diagnostics**	**0**	**1**	**2**	**3**	**4**	**5**
3.1	Release bearing						
3.2	Release fork						
3.3	Spigot bearing						
3.4	Flywheel						
3.5	Cover assembly						
3.6	Friction disk						
3.7	Spigot shaft						
3.8	Bell housing						
4	**Preparation**	**0**	**1**	**2**	**3**	**4**	**5**
4.1	Flywheel (skim, specs, locators)						
4.2	Spigot bearing						
4.3	Oil seal						
4.4	Stretch bolts						
4.5	Flywheel timing position						
4.6	Torque procedure						
4.7	Lubrication procedure						
4.8	Cleaning						
5	**Installation**	**0**	**1**	**2**	**3**	**4**	**5**
4.1	Correct parts as per OE						
4.2	Driven plate allignment						
4.3	Driven plate orientation						
4.4	Driven plate handling						
4.5	Cover assembly (bottom bolt, lever support, spigot ring)						
4.6	Tool selection and application						
4.7	Torque procedure						
4.8	Release bearing location (pull, push, circlip)						
4.9	Centrality of shafts						
4.10	Splines (meshing, flange manipulation)						
4.11	Bleeding procedure						

Appendix E: Table 1: Questions, instruments, reliability, validity, and ethics.

Research Questions	Data generating Instruments and sources	Expected information: Trainees need to describe:	Objectivity and trustworthiness (instruments and analysis)	Ethical considerations
Sub-question One What were the participants' reactions with regard to the training program?	Closed-ended survey questionnaire on a Likert scale administered to trainees Quantitative	Pleasantness of experience Competence of trainer Satisfaction with duration Satisfaction with PPT Satisfaction with program content	Correct sampling. Minimize sampling error Administer directly after the presentation Ensure all questionnaires are completed and collected Likert scale for precision Clarify puzzling items Sequence of questions to follow a categorized structure Position the order of questions favorably within categories (funneling) Conduct a pilot study choosing respondents with similar characteristics Inferential and descriptive statistics	Participants are offered the right to participate or not Ensure anonymity through the use of pseudonyms Explain purpose of the research to the participants Get the participants permission Don't be judgmental or critical
Research Questions	**Data generating Instruments and sources**	**Expected information: The extent to which trainees can:**	**Objectivity and trustworthiness (instruments and analysis)**	**Ethical considerations**
Sub-question Two How effective was the training program in facilitating the acquisition of new knowledge?	**Pre-tests/Post-tests** Will have the same questions, but the order will change. Administered to the Automotive Service Technicians before the program and directly afterwards Quantitative	Answer a combination of multiple choice questions on clutch operation, intermixed with true/false question Describe the functions of the parts of a clutch assembly Describe the correct clutch fitment protocol Diagnose failures	No control group. No other possible treatment/program exists A minimum of 30 respondents Administer before and directly after the intervention Validity: ensure that the correct factors are measured accurately by means of content validity Internal consistency of test Include biographical data in order to test the normative validity of the test instrument Questions must reflect stated learning objectives Item appropriateness: objectives Kuder-Richardson formula 21(KR21) for reliability Item analysis for effectiveness Descriptive and inferential statistics	Keep results confidential Participants are offered the right to participate or not Ensure anonymity through the use of pseudonyms Explain purpose of the research to the participants Get the participants permission

Research Questions	**Data generating Instruments and sources**	**Expected information: The extent to which trainees can demonstrate or describe:**	**Objectivity and trustworthiness (instruments and analysis)**	**Ethical considerations**
Sub-question Three How effective was the training program in changing the participants' observable job behaviour?	**Observations of:** Clutch fitment by AST	The correct clutch fitment procedure Pre-inspection techniques Clutch fitment preparation Fault-finding procedure Verification of application Extrication procedure	Use qualitative checklist to collect step by step commentary that can be compared with the step by step instructions of the program. Low-inference observations of behaviour Guard against systematic bias Reliability is enhanced using two observers. This is not possible for this study. Observe soon after the program and again at a later stage Hawthorne effects	Participants are offered the right to participate or not Ensure anonymity through the use of pseudonyms Explain purpose of the research to the participants Get the participants permission Don't be judgmental or critical Discuss observation schedule with participants

Appendix F: Invitation to participate in study

Tel: (012) 420 5631
Fax: (012) 420 5637
E-mail: grietjie.haupt@up.ac.za
Groenkloof Campus

Faculty of Education

INVITATION TO PARTICIPATE IN STUDY

Dear Sir

I am a student at the University of Pretoria doing my Master's degree in Technology Education, and I wish to invite you to participate in my research. The topic of my research is about how effective the training programme for clutch fitment is.

I invite you to share with me your unique opinion on the programme which you are about to listen to and share with me your feelings about the usefulness of the programme from your perspective. I also invite you to participate in a short multiple choice test before we commence with the programme and directly after the programme. I also invite you to allow me to be a non-participating observer at a later stage when you physically fit a clutch. I collect my subject content and knowledge from Service Technicians in the field and will find your assistance in this regard very helpful. I will record some video footage during the clutch installation session which will assist me with the compilation of future training programmes. I will not embarrass you at any stage and will not use images of you in any future training material except if you wish for your images to be used in future training programmes.

My research will help to:

- Identify shortcomings in the training programme
- Develop improved training programmes for the future
- Adapt the training programme according to your recommendations
- Identify other topics that require similar training for a future training session
- Improve the fitment of clutches

Attached hereto is an information sheet concerning the terms of your participation which should assist you in your decision to partake in this research or not. If you are willing to partake in this research, please fill in the attached consent form and hand it back to me.

This research will form part of my Masters dissertation at the University of Pretoria, Department of Mathematics, Science and Technology Education. Please do not hesitate to contact me should you have any further questions.

Vernon Candiotes
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✉ vernon.candiotes@zf.com

SUPERVISOR: Grietjie Haupt

Appendix G: Information sheet explaining the terms of participation

Tel: (012) 420 5631
Fax: (012) 420 5637
E-mail: grietjie.haupt@up.ac.za
Groenkloof Campus

Faculty of Education

INFORMATION SHEET FOR EXPLAINING THE TERMS OF YOUR PARTICIPATION

Researcher: Vernon John Candiotes
Supervisor: Dr. WJ Rauscher
Co-Supervisor: Mrs. G Haupt

Research Title:

An evaluation of an intervention programme on Automotive Service Technicians using Kirkpatrick's framework

Introduction
I am currently a Masters student at the University of Pretoria doing research for my dissertation. The research is about how effective the training programme for the fitment of clutches is in irradicating unnecessary errors and identifying the areas in the training programme that is lacking and need to be improved.

Purpose of this research
The rapid rate by which new technologies are introduced to the automotive industry require companies such as ZF to implement training programmes by which Service Technicians can be informed regarding to the design changes of components and the procedural changes for the fitment of the components. To measure the effectiveness of this programme is essential for ZF as all future programmes will benefit in its design as it will take its cue from this programme once all the problems associated with it are known and addressed.

Participant selection
ZF is part and parcel of the family of products that form the core of services that the E-car franchises offer the South African Motorist. Your Service Centre has been chosen to participate in this study as you are representative of the qualities that ZF stands for. Your experience and unique perception of the Automotive World forms a crucial ingredient to the usefulness of this study.

Voluntary participation
Your participation in this research is voluntary. You may decline to participate in this research. It will have no bearing on your job or any work related evaluations. At any stage, you may decide to withdraw your participation without any reason , even if you agreed earlier. Should you choose to withdraw, all refernces to your participation will be excluded from the final report.

Research procedures
If you choose to partake in this research, the procedure will be as follows: Before the commencement of the programme presentation, a multiple choice test will be administered which will take about twenty minutes to complete. The programme will then be presented and at its conclusion you will again be administered with a multiple choice test on clutches. You will also be asked to complete a short survey of about 10 minutes regarding your opinion of the programme and its content and usefulness. At a later stage, the programme presenter will observe you while doing an actual clutch installation and video record some of the activities. These video recordings will not be viewed by anyone other than the presenter of the programme. The video recordings will be compared with other installations by Service Technicians who have not been exposed to the programme. The video recordings will afterwards be locked up in a safe at the University of Pretoria.

Language of proceedings
All communication will be conducted in English

Possible risks
There is a risk that you may say some things which you may fear will land up in the wrong hands. I do not wish for you to divert from the technical content of the responses that are required from you, except if you wish to add information that may highlight a problem that has not been identified before and you feel comfortable to do so. All information gathered from you will remain with the presenter of the programme and afterwards be locked up in a safe or destroyed should that be your wish.

Possible benefits
There are no personal immediate benefits for you as a participant, but your participation is likely to add value and important insight into the strenghths and weaknesses of the programme and the identification of areas that may not be adequately covered by the programme. Your input will likely add to the improvement of the programme over time and also affect the design of future training programmes in a positive way.

Reimbursement
You will not be provided with any material incentive to partake in the research.

Confidentiality
For the purposes of this research, your name will not appear on the pre-test and post-test, the opinion survey as well as the observation session checklist. Instead, a number will be assigned to you whereby I can group your two tests, your survey and your observation test together. It will nor be possible for anybody to identify you from any documents gathered by me. I will keep the information collected from you private and locked up once removed from your place of work. Any information shared to the wider public will be in statistical form and make no mention of you or your place of work ensuring your anonimity.

Sharing the results
The information collected during the programme and the observation session will be statistically analysed by myself and form part of my full dissertation for my Master's degree at the University of Pretoria, Education Faculty. For the completion of my M.Ed degree I have to write a full dissertation of my findings that will be kept at the library on the Groenkloof Campus, as well as an article to be submitted and published by an academic journal for the broader community and academia.

Right to refuse or withdraw
Your participation in this research is voluntary and you may choose to withdraw at any time during the programme and collection of data by means of tests, surveys or observation checklists without any

explanation or reason. You may review your tests and survey answers at any time and remove certain comments if you choose to do so.

What to do if you want to partake
If you wish to partake, please fill in the form that will be given to you on the day that the programme will be delivered and please sign the form. Should you wish to contact me regarding the proposed research, I can be contacted at:

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This proposed research has been approved by the University of Pretoria and subscribes to all rules and regulations of the Code of Ethics for Research (Rt. 429/99). If you wish to find out more about the ethical considerations, you are welcome to address your questions to: ethics.education@up.ac.za.

Thank you for taking this time to read the information sheet.

Regards

Vernon Candiotes

Tuesday, 8 November 2011

PEASE COMPLETE THE CONSENT FORM HERETO ATTACHED

Appendix H: Participant consent form

CONSENT FORM FOR PARTICIPATING IN TESTS, SURVEYS AND PRACTICAL CLUTCH FITMENT

Please complete all sections of this form, as it is mandatory for your participation in this research:

Name of Participant:_____

Contact number: _____ preferred time being contacted: between _____ and _____

E-mail address: _____

Would you like to participate in this study by way of?

Multiple choice tests on clutches	**YES / NO**
Opinion Survey	**YES / NO**
Observation of clutch fitment	**YES / NO**

I have read the foregoing information (information sheet), or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study.

Signed at _____ on this _____ day of _____ 2011

_____
Participant

Office use:

I, Vernon Candiotes, have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

- A pre-test and post-test of approximately 20 minutes each will be conducted
- An opinion survey of approximately 10 minutes will be conducted
- An observation of a clutch fitment will be conducted and video recorded

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.
A copy of this consent form will be provided to the participant within 24 hours of receiving it.

Signed at _____ on this _____ day of _____ 2011

_____
Vernon Candiotes

Appendix I: Application for conducting research

Tel: (012) 420 5631
Fax: (012) 420 5637
E-mail: grietjie.haupt@up.ac.za
Faculty of Education

08 November 2011
The Service Centre Owner/ Manager_____
[Service Centre Address]

Dear Sir/Madam

APPLICATION FOR CONDUCTING RESEARCH AT YOUR SERVICE CENTRE

As previously discussed with you telephonically, ZF is offering your Service Centre a free training course on the correct fitment of clutches. I am a student at the University of Pretoria doing my Master's degree in Technology Education and wish to apply to conduct research at your Service Centre as part of the delivery of the training programme.

The topic of my research is "An evaluation of an Automotive training programme on clutches"

I would like to do a pre-test as well as post-test with your Service Technicians on clutches and also ask their opinion regarding the training programme by means of a short survey. I also ask your permission to conduct an observation of the actual fitment of a clutch at some later stage and as is convenient to you. I will be able to make a judgment as to the effectiveness of this programme by observing the effect that the training programme has had on the fitment of a clutch by your Service Technicians. The information gathered from your Service Technicians will enable me to identify short-comings in the training programme and effect useful changes for future follow-up courses that ZF will make available to you free of charge.

The information gathered from your Service Technicians will be treated as highly confidential and kept in a safe vaulted room during the course of my studies and eventually transferred to a safe vaulted room at the University of Pretoria. No persons will at any stage be known or be made known by name and neither will your Service Centre be known or be made known by name to anybody. The training that is offered by ZF is unconditional and should you prefer not to participate in this research, the clutch training will still go ahead as ZF has the well-being of you and your Service Technicians as well as your organization at heart as a primary motivation for offering this training.

Please do not hesitate to contact me if you have any further questions.

Yours Sincerely

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