Effect of computer based training and testing on structured on-the-job training programs

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ABSTRACT

Human capital is the only resource within an organisation that can learn. Developing high levels of competence in employees is one of the most challenging issues in organisations. Off-the-Job training programs either miss the mark or are too far away from the performance setting to have the desired impact on employee competence. Studies have shown that unstructured On-the-Job Training (OJT) leads to increased error rate, lower productivity and decreased training efficiency, compared to structured On-the-Job Training(S-OJT).

The proven efficiency and effectiveness of S-OJT make it especially suitable to meet this challenge. Though S-OJT has been around for a while there has not been a proper integration of technology into the process. Every training approach, including S-OJT, is merely a means to an end, not an end in itself. The use of S-OJT helps to develop consistent appropriate levels of employee competence. When employees have these competencies e.g. better knowledge of the production processes, they can increase productivity, complete projects on time, lower defect rates, or achieve other outcomes of importance. These are the outcomes that matter to the organisation and the effectiveness of S-OJT should be judged from this perspective.

Researchers have consistently found that one way to improve learners' success is to increase the frequency of exams. Classes meet for a set number of times. An instructor's decision to give more exams typically means that students have less time for learning activities during class meetings. How then can one have the best of both worlds, increasing the number of assessments and at the same time having enough time for learning activities? This can only be accomplished by integrating computer-based assessment into **S-OJT** programs.

Computer-based testing and training can provide flexibility, instant feedback, an individualised assessment and eventually lower costs than traditional written examinations. Computerised results create opportunities for teaching and assessment to be integrated more than ever before and allow for retesting students, measuring growth and linking assessment to instruction.

This research aims to evaluate the effectiveness of integrating computer-based testing and training into S-OJT programs using the Air Separation unit of **Sasol Synfuels** as a case study.

The null hypothesis is used to investigate the draw backs of OJT and S-OJT programs. A framework is also developed for the effective integration of CBT into S-OJT programs.

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Acknowledgement

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Abbreviations

S-OJT	Structured On-the-Job Training
OJT	On-the-Job Training/Unstructured On-the-Job Training
CBT	Computer-based Training/Testing
PBT	Paper-based Training/Testing
ASU	Air Separation unit
HRM	Human Resource Management
HC	Human Capital
IT	Information Technology
SPC	Senior Process Controller
PC	Process Controller
SS	Sasol Synfuels
DSS	Decision Support Systems
EU	European Union

Key Words

Structured On-the-Job Training

On-the-Job Training/Unstructured on-the-job Training

Computer-based Training/Testing

Paper-based Training/Testing

Air Separation unit

Human Resource Management

Human Capital

Information Technology

Senior Process Controller

Process Controller

Sasol Synfuels

Decision Support Systems

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CHAPTER ONE
INTRODUCTION

The chemical industry was born in the middle of the eighteenth century as a result of the demands created by other industries (Aftalion, 1991). The chemical industry is an important engine of wealth creation (Corporation, 2010). Its products are often important to the way in which human society meets its needs and can offer solutions to other sectors of industry in their pursuit of sustainable development, such as the energy and waste disposal sectors.

The chemical industry is a big business, both in the United States and the European Union (EU). In the United States, the chemical industry is a $450 billion business, one of the largest sectors in the economy. The more than 66 000 chemical facilities across the nation employ more than one million workers. Over five million jobs in the United States are related to the chemical industry, with impacts on health care, agricultural, construction, and automotive industries. The European chemical industry is a global force, controlling 28 percent of global output. Employing some 1.7 million people, it is one of the top industries in most EU member states. In the EU three million jobs are dependent on it. Worldwide, the chemical industry produces four hundred million tons of products, worth 1 244 billion [euro] (approximately $1.6 trillion) (Beebe, 2006).

While the chemical industry has significantly reduced emissions, it remains a major source of pollution. The industry is also a leading producer of toxic products and a contributor to the depletion of the ozone layer. The threat of damage to the environment by accident or explosion also exists at chemical facilities. An accidental release of chemicals could result in serious damage to the local community, the environment, and even the national and global economy (Beebe, 2006).

The practice of occupational health today has evolved from the work of Thackrah in the early nineteenth century. Initiatives of Government, employers and later employees drove forward the concept of employee health and safety, particularly in relation to physical health. Following the Second World War two new developments shifted the focus, and shaped the practice of occupational health practice today: the recognition that mental health was of

significance in the workplace; and the use of health promotion techniques to produce a more effective work force (Ann Fingret, 1995).

Human capital is one of the greatest assets to any company (Davenport, 1999). Calculating the value of human capital (**HC**) to a company is not easy. Human capital is totally different to other forms of capital or monetary capital (Lionel J. Beaulieu, Boulder, CO). With rare exception, **HC** simultaneously represents the single greatest potential asset and the single greatest potential liability that an organisation will acquire as it goes about its business. While there are other intangible assets, HC is the only intangible asset that can be influenced, but never completely controlled, invested in wisely, or wasted thoughtlessly, and still have tremendous value (Lionel J. Beaulieu, Boulder, CO). These distinguishing features are what make HC unique, and also what make it an elusive asset (Lionel J. Beaulieu, Boulder, CO).

On-the-Job Training (**OJT**) is the process in which one person passes job knowledge and skills to another person (John M. Barron, 1997). On-the-Job Training (**OJT**) is a very effective form of training and widely used within the chemical industry (Broadwell, 1986). The most common form of **OJT** is informal, where a new employee is assigned to work with an experienced employee and learn the job while doing it. The purpose of moving from an informal **OJT** program to a structured **OJT** program is to verify consistency of training and standardisation of performance. This would ensure that the employees have the training, knowledge and experience to perform their jobs.

Traditional unstructured **OJT** training methods have some advantages like low cost, are task based and are well suited for small groups (Broadwell, 1986). The disadvantages are that the training is inconsistent, incomplete, lacks founding principles and the trainee most of the time learns the trainers' principles which may not be 100% correct (Broadwell, 1986).

Unlike unstructured OJT, structured On-the-Job Training(S-OJT) is a planned process of developing competence in units of work by having an experienced employee train a novice employee at the work setting or a location that closely resembles the work setting. This definition makes four points clear (Hawthrone, 1987a).

First, like other planned training approaches, S-OJT achieves training objectives reliably and predictably. Secondly the training occurs for the expressed purpose of passing along the

ability to perform specific units of work or tasks. The term unit of work refers to the discrete sets of behaviours and outcomes that characterise what all people do on their jobs, ranging from front-line employees to senior managers (Hawthrone, 1987a). Thirdly, S-OJT emphasises that the training will occur on a one-on-one basis. In practice, S-OJT might necessarily involve several trainees with a single trainer. Fourthly the training will occur where the work is actually done or in a setting that is similar to the work setting (Hawthrone, 1987a).

Most people have faced the challenge of learning new knowledge and skills as part of their job. Training programs are designed to make learning easier and less threatening. There are basically five levels of human competence namely: novice, specialist, experienced specialist, expert and master (Sims, 1990).

In the chemical industry training forms an integral part of human capital development in line with the Occupational Health and Safety Act **(OHSACT)** of South Africa (Occupational Health and Safety Amendment Act, No. 181 of 1993). Not all training occurs off-site. In fact, most learning in the chemical industry occurs as a result of training that is conducted in the work setting itself, not in a training classroom (Jacob, Jones, & Neil, 1992). It is obligatory by law that evidence of this training is kept for record purposes in the event of an incidence or accident; such records are used for legal and appraisal purposes. The record is also used for performance assessment and is required by the law **(OHSACT)** of South Africa.

Profitability is defined as the efficiency of a company or industry at generating earnings (Chimps, 2008). Profitability is expressed in terms of several popular numbers that measure one of two generic types of performance: "how much they make with what they've got" and "how much they make from what they take in" (Chimps, 2008). Profitability of a company is determined by major components: total revenue, total expense, taxes interest, depreciation, cost etc. (Chimps, 2008). All other components remaining constant, revenue and cost have a significant impact on the profitability of a company; it's either you increase revenue or you decrease cost.

There are two general benefits to creating a software solution that would impact on the profitability of a business. The software must have the ability to increase revenue or decrease cost (Chimps, 2008). The software might have the ability to open up new markets, to create

new opportunities or reduce the cost of doing business. Because of the extra capacity that computer software gives people, many people are up to four times more efficient at their jobs than they were and this is having a marked effect on the bottom line of many companies (Encyclopedia, 2010).

Researchers have consistently shown that one way to improve learners' success is to increase the frequency of exams, test and quizzes. Since training can only be set for a fixed number of times, an instructor's decision to give more exams typically means that students have less time for learning activities during training meetings. This research would attempt to solve this problem by integrating computer-based assessment into the structured on the job-training programs. Computer-based testing can provide flexibility, instant feedback, an individualised assessment and eventually lower costs than traditional paper examinations.

Computerised results create opportunities for teaching and assessment to be integrated more than ever before and allow for retesting students, measuring growth and linking assessment to instruction. Computer-based testing (CBT) creates new possibilities for more effective testing when compared to tests that are delivered on paper in a classroom. Computer-based testing software systems are relatively easy to learn, with a learning curve of about what you would expect when starting to use a spread sheet program. The facilitator would be able to create a schedule and administer the tests. The learners would also be able to schedule and take a test at their own convenience. The test result would be sent back to the facilitator remotely.

1.1 BACKGROUND TO STUDY

Sasol Synfuels a subsidiary of the Sasol group is in the business of producing chemicals, energy, liquid fuels and gases for the local (South African), regional and international market (Sasol Corporation, 2008), Sasol is a multi-billion dollar company with huge capital investments on equipment (Sasol Corporation, 2008). This equipment requires huge human resources to optimise its use (Sasol Corporation, 2008). It is therefore important for employees to be trained and re-trained to operate the equipment safely and optimally.

Training is a legal requirement under the **OHSACT** of South Africa. It becomes paramount that evidence of training delivered to employees must be kept safely and securely. In 2008,

Sasol invested R345 million (US$48 million) in employee training and development of its almost 34 000 employees worldwide (Sasol Corporation, 2008). Keeping evidence of training for 34 000 employees is still being done manually; therefore, there is a need for a more efficient and effective assessment and data management system.

Over the past 70 years, researchers have consistently found that one way to improve learner's success is to increase the frequency of exams (Graham ,p8, 2000). For example, Keys reported a 14% improvement when tests were given weekly instead of monthly, Pikunas and Mazzota found that performance was 10% higher when tests were given weekly instead of every 6 weeks, and Graham found a 4% increase just from the addition of unannounced quizzes. However, when classes meet for a set number of times, an instructor's decision to give more exams typically means that students have less time for learning activities during class meetings.

Sasol process operations employees go through an S-OJT program which has four levels of training. Learner process controllers come in fresh on level one. The level one training would be for a particular plant system, the operations employee would be required to work through all the levels before becoming a senior process controller (SPC), which is the expert level. Level one is regarded as novice while level 4 is regarded as expert (Hawthrone,p180-200, 1987a).

Fig 1.1: Training levels in SASOL (Salso Corp, 2002)

1.2 PROBLEM DEFINITION/STATEMENT

Sasol Synfuels departmental business architecture divides departments into areas and these areas into sections and a section into units. Each unit is subdivided into systems and a system comprises of equipment (Sasol Corporation, 2008) as shown in fig 1.2.

Employees are required to take various levels of tests. These tests are for all equipment in all systems in every section for every unit (Area). A conservatively estimated 10 million tests have been taken since the inception of Sasol Synfuels and this amount is expected to grow geometrically due to the increase in business activities and expansion projects (Anonymous-2008).

Sasol adopts an on-the-Job training model for new hires. The system of training can be categorised as structured but the delivery method is paper-based testing and training.

For the purpose of this research, the problem associated with the current training model would be grouped into:

- Tangible problems, and
- Intangible problems
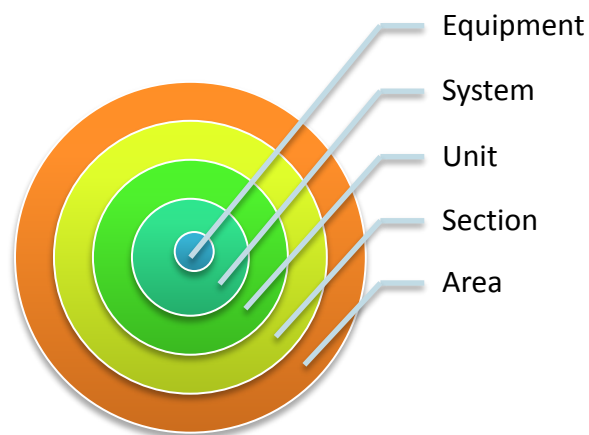
Fig 1.2: Departmental divisions adopted in SASOL (Sasol Corp, 2007)

1.2.1 Tangible Problems

The word tangible means capable of being perceived especially by the sense of touch (Lexico Publishing Group LLC, 2008) Tangible problems that arise from the current training model are:

1. The high cost of stationery. Interviews conducted with training officers of training departments showed that the annual cost of stationery in most units of Sasol Synfuel is estimated to be R500 000(Sibiya, 2007). Multiplying this by the number of departments potentially ends up in a huge cash investment on stationery only.
2. The cost of storage of hard copy test papers that are easily destroyed by fire and pests.
3. There are not always back up or archiving capabilities.
4. Files cannot be copied or transferred and it is difficult to search and retrieve information from the archives.
5. Man-hours are wasted marking test scripts. These man-hours could be used to improve the content of training material.
6. Presently the document storage facility of each department is compartmentalised. This means that each department stores its own data. This reduces the availability of information to other departments.
7. The marking of test scripts is sometimes subjective, given the influence of the human factor.
8. The scheduling of tests is not on an on-demand basis, as training officers have to be present to administer tests.

1.2.2 Intangible Problem

Intangible has a different meaning depending on the *context*: In business, intangibles are commonly referred to as intangible assets or intellectual capital (Wikipedia, 2010). In law, legally created intangibles are referred to as intellectual property and include trademarks, patents, customer lists, and copyright (Wikipedia, 2010). In sports, intangibles typically refer to the value driver that differentiates one team's performance from another (Wikipedia, 2010). For the purpose of this research, an intangible is an expenditure of time on an activity by a person (such as leveraging know-how, knowledge, collaboration, relationships, systems, and process).

The intangible problem that the current training model creates is that the testing time encroaches on the training time. In training centres, eight (8) hours are available for training daily. Of this, four (4) hours are available for practical training, one and half (1.5) for evaluation .The remaining time, roughly two (2) hours, is spent on facilitation courses (Anonymous-2008).

If the training coordinator allocates time to marking of test papers, there would likely be a deficit of training time and quality. Taking a look at the Air Separation Unit (ASU) of the utilities department in **SS** there are currently 14 new learners at the ASU unit. It would take about 16 hours for a facilitator to mark each study unit. There are 5 study units in each of the 4 levels of the training curriculum. Doing the simple calculation it would take the training officer roughly 320 hours (40 days) to mark all test papers, excluding testing time and sorting time. An instructor's decision to give more exams typically means that students have less time for learning activities during class meetings. How then can one have the best of both worlds, increasing the number of tests and at the same time having enough time for learning activities?

1.3 AIMS AND OBJECTIVES OF THE RESEARCH

The main aim of this research is to:

1. Experimentally determine which is a more efficient and effective training method S-OJT or OJT.
2. Empirically study the effect of computer-based and paper-based training/testing on the structured On-the-Job Training (S-OJT).
3. Develop a framework for the integration of computer-based training/testing with S-OJT.

The specific objectives are:

1. To use the null hypothesis to investigate the drawbacks of OJT.
2. To use the null hypothesis to investigate the drawback of S-OJT.
3. To investigate the effect of computer-based training/testing on S-OJT.

The main deliverable will be the development of:

1. A framework for integrating computer-based training and testing into S-OJT programs in the chemical industry.

1.4 SUMMARY/CONCLUSION

Chapter one (1) introduced the need for training and the role it plays in the chemical industry. The chapter also gave an overview of the two (2) dominant training approaches: the structured and unstructured On-the-Job training. The tangible and intangible challenges associated with these training approaches were discussed.

Chapter two (2) will focus on reviewing available literature on the subject. This will include: the history of training, what training is and is not, the need for training, wrong reasons for training and the challenges of developing employees' expertise. The next chapter will take a deep look at S-OJT, the concerns of off-site and on-site training programs and a systematic view of OJT and computer-based testing.

CHAPTER TWO
LITERATURE REVIEW

The systems of approach to training have been a fashionable catch phrase for some time now. It has not always been clear what its advocates meant by it, nor was there any clear idea of what a training system looked like. There was, and still is, some value in the idea of trying to describe training activities as though they were systems (Sims,p80, 1990).

Training systems analysis is the process of breaking the whole training process into its component parts and relating these parts to each other and to the organisation as a whole (Sims,p120, 1990). The objective of training systems analysis is to enable trainers to acquire better understanding of the behaviour of the whole training system by studying the behaviour and interactions of its parts.

Training systems analysis should be viewed as a strategy for improving decision making (for example, prioritising training needs and allocating resources to meet those training needs) (Sims,p120, 1990). More specifically, the goal of training systems analysis is to plan, design, develop, conduct and evaluate the utilisation of available training resources in such a way as to achieve organisational goals by the most efficient and effective means possible.

The purpose of this chapter is to present a literature overview of training, its history, why we need training, computer-based assessment and information management systems. The chapter would also give a generalised, integrated, and conceptual picture of evaluating training programs. Toward this end, this chapter will highlight the importance of applying a system perspective to training.

2.1   History of training

Worker training can be traced back to biblical times, with ancient Egyptians overseeing hordes of slaves being "trained" as well as driven by foremen, often of the slaves own nationality. Training was direct, task-oriented, and on-the-job (Sims,p134,1990). The evaluation of that training was simple and based entirely on the outcomes of the employees' efforts.

Orientation, a major form of twentieth-century worker training, was also provided in biblical times although less systematically than it is now. Similarly, OJT, task-oriented training was

made available through apprenticeship programs primarily for manual and artistic work (Hawthorne et al,p 34, 1983).

The beginning of the Industrial Revolution was characterised by a substantial growth of human knowledge and rapidity of change, as evidenced by the number of patents in the first half of the nineteenth century (Steinmetz ,p 56, 1976). Despite the creativity and originality that fostered the Industrial Revolution, references to training during that period failed to address such approaches to production or to business, attending more to specific task learning.

The formation of "factory schools" (Hoe and Company in New York in 1872 is one example) coincided with the building of factories requiring skilled workers, such as trained machinists for manufacturing printing presses, during a period when business was good. Similar schools were subsequently started by Westinghouse, General Electric, and Baldwin Locomotive Works in 1888, 1901, and 1907 respectively (Hawthrone, 1987a).

Prior to World War I, training was largely a local matter. Employment patterns were characterised by seasonal fluctuations and high turnover prior to the Depression. While the data are fragmented, less than 50 percent annual turnover was unusual, and the median in normal times was 80 percent. Turnover could be as high as 125 percent of unskilled and semiskilled workers (Hawthrone, 1987a).

Orientation and training of workers were essential to industrial firms in order to maintain some corporate stability. Frederick Taylor's industrial engineering concepts influenced the technical, skill specific training methods (Hawthorne et al, 1983). Furthermore, retraining was important, since many employees moved from industry to industry, a pattern that adumbrated the retraining concerns for skilled and semiskilled workers as the Depression came to an end. What makes retraining somewhat different in the 1980s is the widespread retraining needs of white-collar, college-educated employees, in contrast to blue-collar workers.

Partly because of the wartime emphasis on the supervisor's role, as well as the advancement of the behavioral sciences and the growth in the size of corporations, interest in management development increased during the 1950s. The focus was on liberal education experiences for

top-level executives. It was thought that technically trained managers needed exposure to the liberal arts to develop into sophisticated corporate leaders.

Colleges and universities were the major source of that kind of corporate education; well-known programs were offered by Dartmouth College and Princeton University (Hawthorne et al, 1983). Harvard University offered its first Advanced Management Program in 1945 (Fred Pine, 2000). In 1955 General Electric offered the first long-term internal executive education program, which lasted nine weeks (Fred Pine, 2000).

In 1958 orientation was the most common corporate education program; it was developed to stem attrition as well as to foster loyalty to the firm (Allen, 202). Sharp and Oughton, Inc. conducted a survey in 1968 and found that orientation, safety programs, supervisory training, and management training were the most frequent offerings (Allen, 202). The 1960s were characterised by growth and diversification in business, and the entry of women and minorities into business not open to them until then (Hawthorne, 1987a). A dominant theme of the 1970s in training and education was the growing formalisation of course work. A few corporations formalised their courses into traditionally styled "corporate colleges" (Hawthorne et al, 1983) while others developed company-sponsored courses.

2.2   What is training?

The term training refers to the acquisition of knowledge, skills, and competence as a result of the teaching of vocational or practical skills and knowledge that relate to specific useful competencies (Throne et al, 2007). In addition to the basic training required for a trade, occupation or profession, observers of the labour-market recognise today the need to continue training beyond initial qualifications: to maintain, upgrade and update skills throughout working-life. People within many professions and occupations may refer to this sort of training as professional development. Some commentators use a similar term for workplace learning to improve performance: training and development. One can generally categorise such training as *on-the-job* or *off-the-job* (Throne et al, 2007):

- On-the-job training takes place in a normal working situation, using the actual tools, equipment, documents or materials that trainees will use when fully trained. On-the-job training has a general reputation as most effective for vocational work.

- Off-the-job training takes place away from normal work situations, implying that the employee does not count as a directly productive worker while such training takes place. Off-the-job training has the advantage that it allows people to get away from work and concentrate more thoroughly on the training itself. This type of training has proven more effective in inculcating concepts and ideas.

Training differs from exercise in that people may dabble in exercise as an occasional activity for fun. Training has specific goals of improving one's capability, capacity, and performance. There is a perception that training would normally have an expectation, aim, objective, structured contents and evaluation (Throne et al, 2007). Facilitative training normally works well with groups. Through personal energy and creativity the facilitator encourages individuals and groups to excel.

In training today there should be a combination of active participation and information giving (Throne et al, 2007). Training it is changing. Many traditional centres of skills training have disappeared and been replaced by distance learning resource centres, line manager coaching and special motivational training events off-site (Throne et al, 2007).

With the development of blended learning, some training has been completely removed from a classroom environment and made available online. In some financial institutions and call centre environment training is very much linked to legislation, where consistency of delivery is essential (Throne et al, 2007).

2.3 Why organisations training?

As the demands of foreign competition, increased efficiency, and the second industrial revolution spread, organisations are coming to regard training expenses as no less a part of their capital costs than plants and equipment. The total training outlay by U.S. firms in 1986 was $30 billion and rising (American Society for Training and Development, 1986, July).

In 1987 private-sector employers spent an estimated $32 billion providing approximately 38.8 million employees (31% of the total civilian labour force) with 1.2 billion hours of formal training and development (Lee, 1987). A study, by *Training* magazine (1989),

estimated that organisations with one hundred or more employees would spend $44.4 billion for formal training that year, up from $39.6 billion spent in 1988.

In addition to the above figures, most organisations pay employees for 100% of the time they spend in training, and 82% of total training hours take place during company time (Gordon, 1986). This represents a significant investment in the human resources; training is big business and getting bigger.

The most obvious reason for training is that it should meet a need; however, many Human Resource Management (HRM) specialists must still answer the question: "How do you tell the difference between good and bad training?" In many training situations it may be apparent that some training programs provide better results than other training, but it is not always obvious what makes the difference.

Organisations expect employees who are responsible for the completion of certain work to complete that work properly; as a result, organisations want to have only the good kind of training, rather than the bad. Thus, they must find out what makes the difference.

It is much easier to define the results of good training than to define the action of good training. If, after training, an employee can do what he or she couldn't do before the training, and if the training did not take too long and didn't cost too much, we conclude that the training was "good" (Broadwell, 1975). On the other hand, if, when the training is over, the employee still cannot do the job for which he or she was trained, then the training may have been all "bad."

"May" can be used because the training may have been all right, but other conditions, such as location, attitude and motivation of the employee, time of the day, or the employee's lack of ability, may have made the training fail.

Motorola typifies the rising commitment to and investment in training. Motorola has committed itself to a training-budget of 2% of each employee's salary. It spent $44 million in 1986 alone. Eight hundred Motorola employees have full-time training duties, while 200 training vendors (outside suppliers) and 360 in-house subject-matter experts' assist.

Motorola budgets about 1% of annual sales (2.6% of payroll) for training (Brody, p.87, 1987).

It even trains workers for its key suppliers, many of them small-to-medium-size organisations without the resources to train their own people in such advanced specialties as computer-aided design and deficit control. Taking into account training expenses, wages, and benefits, Motorola's total annual training cost amounts to about $90 million (Brody, p.87,1987).

The results have been dramatic, according to a company spokesperson: "We've documented the savings from the statistical process control methods and problem-solving methods we've trained our people in. We're running a rate of return of about 30 times the dollars invested--which is why we've gotten (sic) pretty good support from senior management" (Brody, p.87, 1987).

A study by the Work in America Institute confirms that organisations have also realised the benefits of retraining their employees. The study found that retraining current workers for new jobs is more cost-effective than firing them and hiring new ones, not to mention the difference that retraining makes to employee morale (Brody, p.87, 1987). And in "downsizing" industries where there are no alternatives to furloughs, unions are working with management to help retrain displaced workers (Cascio, 1989).

2.3.1 Wrong Reasons for Training

Training because it meets a need is sometimes overlooked in organisations by HRM specialists. There are many wrong reasons for training. Bad training can be directly tied to some of the wrong reasons for training which include: (Jacob et al, 1992)

1) **We train employees because we always have:** Training for this reason probably means the organisation's training programs are still teaching the same subjects, with the same training methods that they've used for years. This behaviour pattern persists even though very few jobs in the organisation remain the same year in and year out. The jobs change because technology changes. The employees change for better or worse for many reasons. HRM policies change, so the organisation may be getting employees who are more or less skilled than before, more or less competent than before, more or less knowledgeable than before. If the organisation's training hasn't

changed, then the organisation probably isn't meeting its goals as well, even though at one time training was doing a nearly perfect job (Broadwell, 1975).

2) **The employees expect it:** Why do employees expect to be trained regardless of the circumstances? Employees probably don't all expect this, but there must be a reason why some of them expect this kind of thing. Employees may think, like some supervisors and managers, that "we always have had training, so I guess we always will have it." There is the possibility that employees look forward to training because it is time off their regular job. No production is required. Other employees replace the trainees, so they are justifiably excused from doing their work.

Neither of these is a very good reason for expecting training, and the results obtained from such training aren't likely to be very satisfactory. After all, employees who are "going along for the ride" can't be expected to settle down and learn new things for their jobs!

There are other reasons for training that aren't any more valid than the ones mentioned so far. "We train because the money is in the budget," or "because time is allowed in the work schedule and we have to report a certain amount of training in the semi-annual report." In reality, these reasons aren't always spoken in so many words, but actions speak much louder than words. This kind of attitude can be recognised by such things as scheduling training for the wrong employees, or just to meet a monthly training quota.

Whether training has been scheduled for the wrong employees, or because a certain amount of training has to be reported, isn't the point here. What does matter is that there ought to be a better reason for training, and certainly a stronger commitment by everyone especially the one doing the training as to the place and value of training.

It is as unfair to employees to train them just to meet training quotas as it is to train them under such conditions that little or no learning can take place, and then to hold them accountable for results based on their knowledge of what was supposed to have been learned (Broadwell, 1975).

2.3.2   Valid Reasons or Purposes for Training

There are perhaps other reasons given for training that aren't good enough to justify the time, effort, and money, but now it is important to understand some valid or major purposes of training. (Carrell et al, 1989) mentioned three valid reasons for training listed below:

1. To improve performance. Employees who perform unsatisfactorily because of a deficiency in skills are prime candidates for training. This focuses on the removal of performance deficiencies, whether current or anticipated, that are the result of the employee's inability to perform at the desired level. Although training cannot solve all problems of ineffective performance, a sound training program is often instrumental in minimising those problems.

2. To update employees' skills. Managers in all organisations must always be aware of technological advances that will make their organisations function more effectively. Especially relevant to organisations that are rapidly incorporating new technologies is to make the current work force more flexible and adaptable. Technological change often means that jobs change. Thus, employee skills must be updated through training so that technological advances are successfully integrated into the organisation.

3. To promote job competence. Sometimes a new or newly promoted employee will not possess the skills and abilities required to be competent on the job. The match between the employee's skills and abilities and the requirements of the job will ultimately affect the employee's performance and competence. First, employee selection systems are not perfect. Even when tests, interviews, and other data indicate a high probability of job success, an applicant may prove incompetent on the job. No selection device is able to predict success or failure all the time, and training is often necessary to fill the predicted or actual gap between the new employees.

2.4 Determining training needs

Training is needed whenever organisational goals can be furthered by improved employee performance. Training is one of the major ways in which employers develop employees to meet organisational objectives and business plans. The success of organisational training can be enhanced when training is *planned* by the organisation.

Planning implies a process of analysis, consideration of alternatives, and decision making. Planning is particularly crucial in training because, without careful and complete planning, resources are certain to be wasted. Without sound planning, training programs are not likely to support the plans and objectives of the organisation as a whole.

Too often, training programs have reflected fads, expediency, even caprice. They have been initiated in response to the quick sell or a desire to "keep up with the Joneses." These get-rich-quickly schemes increase the likelihood of ineffective training programs, and eventually they must be replaced by more systematic approaches.

The next step in planning an effective training program, after the pre-assessment phase is to determine what training is needed throughout the organisation. Any discussion of training, therefore, must begin with an analysis of the need for training and a specific plan. In effect, the HRM specialists are preparing a training forecast, which is a major step in a training systems model.

In some cases, the determination of training needs is a fairly straightforward process that may be conducted without an extensive analysis of the organisation. For example, all new employees normally undergo orientation training. An impending technological change such as the introduction of new computer hardware will automatically require the need for training those affected. On the other hand, determining training requirements to resolve deficiencies in skills or to address career developmental needs necessitates much greater analysis by training personnel. To identify the training needs that result from performance problems, the HRM specialist must systematically collect and analyse employees' output, product quality, and attitudes. Training-needs information may be gathered using a variety of methods. Some of these methods work equally well for organisational, job and employee level assessment, and include the following (this list is adapted from Carrell et al 1989):

1.   **Attitude surveys.**
        These are useful for gathering general-level information on employee satisfaction, and other attitudes. These surveys seldom provide information in sufficient detail for the design and planning of training programs but can offer information on employee

perceptions of the work place, including current training efforts, promotion preparation, retraining programs, and the like.

2. **Advisory committees.**

An organisation may seek to establish one or more advisory committees to review job skill demands and the quality of current training and selection programs relative to those demands. These committees may be composed of management personnel and employees. The membership of these committees should be determined by who can best provide the appropriate insights.

3. **Performance appraisals.**

Depending upon the degree of detail and job relevance of the appraisal, this source of information can be very valuable. Employees who consistently fail to perform certain tasks satisfactorily may require training in order to do so. This will be discussed in more detail later in this chapter as performance discrepancy needs assessment. Time and costs are low since the data are regularly gathered. And because both the employee and supervisor are involved, an emotional commitment to training is often an additional benefit of this method.

4. **Skill tests.**

These tests provide an assessment of current employees' skill levels. A test of necessary skill, such as typing, computer programming, or driving may also be used to measure training needs. Test results are then directly compared to established skill requirements for the various positions. When using skill tests for needs assessment it is critical that the tests be job-related and measure those skills and abilities required for successful job performance.

5. **Observations of behaviour**.

HRM specialists or supervisors may directly observe employees' behaviour to identify training needs. Observations can be as technical as time-motion studies or as functionally or behaviourally specific as observing.

2.5   Challenge of developing employee expertise

In contrast to an organisation's other resources, such as equipment or cash, human competence is not tangible, but is often more central to an organisation than tangible resources. (Ronald, 2003) Training helps ensuring that the employee can do what the organisation asks of them. Training is thus, ultimately about developing high level of employee competence or expertise (Ronald, 2003).

People who possess the highest level of competence are called experts. Experts are the individuals who are the most capable in specific areas of human endeavour. History has seen a great variety of experts: nomadic hunters who fashioned hunting tools from pieces of flint; mathematicians who planned the Egyptian pyramids; Renaissance artists who represented three dimensions in their painting; managers today who devise strategic plans to guide the future of their organisations (Ronald, 2003). Expertise therefore is very important to the development of our civilisation today.

The global economy demands increased flexibility in production and service delivery, improved use of advanced technologies, and increased responsiveness to requirements of the customers, and these demands have made expertise more prized than ever before (Jacobs et al, 2001). (Kotter et al1992) suggested that the competitiveness of an organisation is determined largely by the knowledge, skills and attitudes of the people in it. Knowledge is the primary resource for organisations in the present post capitalist society (Drucker, 1993). Individual competence of employees have become crucial to the competitiveness of organisations more than ever before.

Successful organisation would depend on employees who can perform complex tasks, such as solving problems and making decisions. But employees can perform complex tasks only if they possess the necessary knowledge and skills. Thus, when individual employees possess higher levels of competence, the organisation as a whole is more able to respond to it competitive environment (Kotter et al, 1992).

Most employees are required to develop a high level of competence rapidly and continuously without undue interference in the on-going work of their organisation. All too often

competence requirements shift just as employees have become comfortable with the current way. (This table is adopted from (Ronald,p200, 2003)).

Table 2.1(adopted from Roland, 2003): Trainee levels stratum

Category	Description
Novice	Literally, one who is new to a work situation? There is often some but minimal exposure to the work beforehand. As a result the individual lacks the knowledge and skill necessary to meet the requirement set to adequately perform the work
Specialist	One who can reliably perform specific units of work unsupervised
Experienced Specialist	One who can perform specific unit of work and who has performed that work repeatedly
Expert	One who has the knowledge and experience to meet and often exceed the requirements of performing a particular unit of work?
Master	One who is regarded as the expert amongst experts?

2.6   Structured On-the-Job Training (S-OJT)

As far as can be determined, Jacobs and McGiffin (1987) made the first reference to structured On-the-Job Training (S-OJT) as a unique from of training. Many other authors before them, including Goldstein (1974) and Connor (1983), had suggested the need for more structured form of OJT, but they were the first to differentiate it clearly from unstructured OJT.

 S-OJT is defined as the planned process of developing competence on units of work by having an experienced employee train a novice employee at the work setting or a location that closely resembles the work setting. Developing high levels of employee competence is one of the most challenging issues of organisations (Ronald,p133, 2003).

(Broadwell, 1986)noted that the other forms of training that occur in the work setting are essentially unstructured. OJT is the process in which one person, most often the supervisor or leader of a work area, passes job knowledge and skills to another person (Broadwell,p68, 1986). OJT occurs at the location in which the work is done or at least closely simulating the work location as much as possible, and it is often thought of as involving both learning and doing at the same time.

The effect of the global economy has necessarily increased the importance of having training within organisations. However, while training has generally found itself in a more strategic position, this has not meant that everyone has been totally satisfied with the way it has been used. In fact both managers and HRD professionals have expressed deep concern about how training is carried out in their organisation (Sloman, 1989). To a large extent the emergence of S-OJT has been a result of these concerns.

2.6.1   Concerns of Off-the-Job Training

At first glance, most off-the-job training programs appear to be effective, of high quality, and generally well received by trainees. By virtue of its location, an off-site training program may offer some trainees a reprieve from the pressures of immediate work setting, which helps the focus more intently on the training content.

Nevertheless, many managers have come to suspect that the goals of off-the-job training programs often contradict the organisation's goals (Sloman, 1989). Increasingly training content and schedules seem unresponsive to the business needs of the sponsoring organisation, and training certificates take on more importance than job knowledge and skills. At the same time, many HRD professionals perceive that managers do not realise how much time is required to design effective off-the-job training programs. Nonetheless, off-the-job programs may cost more than the value they produce for an organisation (Ronald, 2003).

2.6.2   Concerns with On-the-Job Training

While OJT has been used more than off-the-job training, most instances of OJT are essentially informal, which means that they occur without advance planning or involvement by management. The entire training may be placed in the hands of an individual who does not know the work, has poor work habits, or considers the training an imposition on his or her working time.
Under these conditions, training takes lower priority than work, even when training might help improve the quality of the work. Most employees are forced to learn regardless of these constraints. Thus most of the OJT programs conducted in organisation can be considered unplanned or as described by (Swanson et al, 1975), unstructured in nature.

Unstructured OJT has been called many things: follow Joe (or Jane), sink-or-swim training, sit-by-Nellie training, buddy training, learning the ropes, and do-it-yourself training, to name a few (Ronald, 2003). Unstructured OJT has a number of challenges:

- The desired outcomes are rarely, if ever achieved, and when it is, all trainees rarely achieve the same outcome.
- The training content is often inaccurate or incomplete, or else it represents an accumulation of bad habits, misinformation, and possibly unsafe shortcuts on which employees have come to rely over time.
- Experienced employees are seldom able to communicate what they know in a way that others can understand.
- Experienced employees use different methods each time they conduct training, and not all the methods are equally effective.
- Employees are often unsure whether they are even allowed to train others, and they may say, "It's not my job".
- Many employees fear that sharing knowledge and skills will reduce their own status as experts and possibly even threaten their job security.

Studies have shown that unstructured OJT leads to increased error rate, lower productivity and decreased training efficiency, compared to structured OJT (Jacob et al, 1992).

2.6.3 System View of Structured OJT

The increased interest in S-OJT comes from its greater efficiency and effectiveness compared to unstructured from of OJT; S-OJT differs from unstructured OJT in making use of a planned process. Carrying out the planned process with a system view helps ensuring that the training will be efficient and effective. No other theoretical framework for instruction and performance improvement can make that promise (Jacobs et al, 1987). The system view maintains that all natural and artificial entities are systems and that the behaviour of systems is relatively predictable, which means that systems can be designed and managed with some confidence.

The system view helps us to distinguish between the means and ends of our actions. Every training approach, including S-OJT, is merely a means to an end, not an end in its self. The use of S-OJT is not the ultimate goal when using S-OJT. Rather S-OJT is one way of improving organisations performance, because it helps developing appropriate levels of employee competence. When employees have these abilities, they can increase productivity, complete projects on time, lower defect rates, or achieve other outcomes of importance. These are the outcomes that matter to the organisation and the effectiveness of S-OJT should be judged from this perspective.

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                    ┌──────────────┐
                    │ Organisational│
                    │   Context     │
                    └──────────────┘
   ┌──────────────┐                  ┌──────────────┐
   │   Training   │                  │ Training Input│
   │   Outcomes   │                  │              │
   └──────────────┘                  └──────────────┘
                    ┌──────────────┐
                    │   Training   │
                    │   Process    │
                    └──────────────┘
```
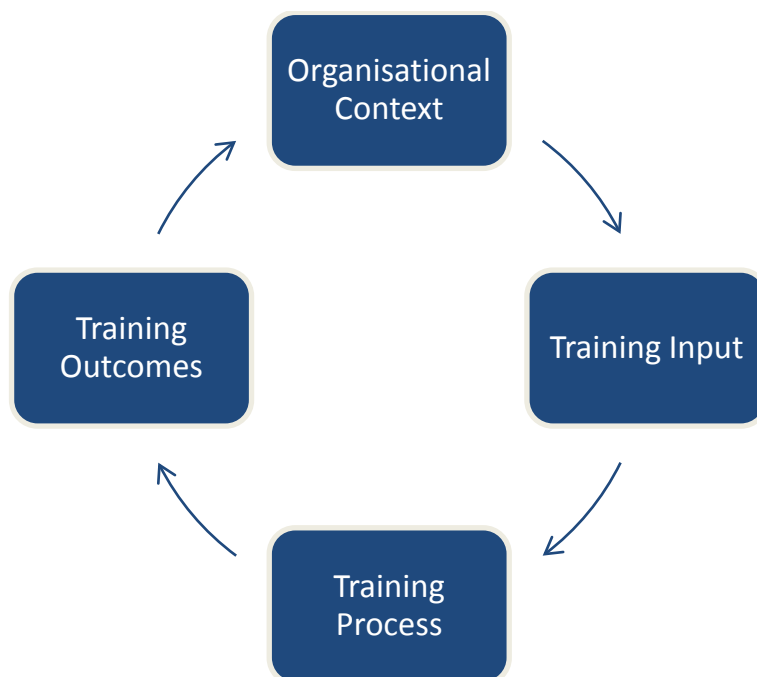
Fig 2.2: Training component interaction, Adopted from (Ronald,p67, 2003)

The system view has two basic implications for S-OJT. First, it says that S-OJT is a system composed of several interacting parts that work together to achieve common goals (Rummler & Brache, 1990).

2.6.4 The S-OJT System

Figure 2.2 shows the training input, training process and training output implied in the view of S-OJT as a system. It also shows that the system components are affected by the organisational context in which the system exists. This perspective may be puzzling to some readers who see OJT simply as a purposeful conversation between two or more employees.

The training even is more than the social interactions. In fact, S-OJT represents the interaction of several parts that are essential for ensuring the success of the system.

2.7   COMPUTER-BASED TESTING

It didn't take long for Catherine McCaslin, the evaluation and assessment specialist for the Beaufort County, S.C., public schools, to realise that moving to a computer-based testing program was going to have tremendous benefits (Russo, 2002). McCaslin saw first-hand that increased student motivation, among many other benefits, was one immediate result of mixing technology and testing. "The response of these children and some parents who were viewing the test told me then and there that this was the only way to go," McCaslin recalls. "Why not make testing fun? Whoever said that a test had to be boring and quiet and black and white to be a valid classroom assessment tool?" (Russo, 2002).

Computer-based testing can provide flexibility, instant feedback, an individualised assessment and eventually lower costs than traditional paper examinations. Computerised results create opportunities for teaching and assessment to be integrated more than ever before and allow for retesting students, measuring growth and linking assessment to instruction. So far, the experiences have been mostly positive, and proponents predict that computerised testing will be widespread within just a few years (Russo, 2002).

Like many other still-unfolding technology initiatives, computer-based testing takes several forms and falls under several different names, including online assessment, computerised testing, electronic testing and computer adaptive test (Russo, 2002). For several years now, computer testing has been creeping into other aspects of public life. Some states administer drivers' license exams electronically.

Some employers use computer testing to screen job applicants. Already millions of online tests are administered each year in the military, the private sector and post-secondary education and by professional certification groups. Computer versions of college placement tests and graduate school exams such as the GRE, GMAT and the Test of English as a Foreign Language are all available via the computer, as is the Educational Testing Service's Praxis I for new teachers. An estimated 150 companies provide

computerised testing programs of some kind, though few have a proven track record in K-12 education (Russo, 2002).

No single delivery form of computer-based testing exists. Sometimes the tests are housed on local servers or on the Internet, sometimes on diskettes or a hard drive. The source of test questions varies, too. Sometimes they consist of classroom teachers' homemade designs, while others are drawn from banks of state, national or proprietary test items. Sometimes computer tests involve written responses that require keyboard use. Some electronic tests give every student the same set of questions, while others adapt to each student's responses, giving harder or easier questions as the test proceeds.

What nearly all computer-based tests have in common is that scores and detailed reports are often available within hours or days, if not immediately at the end of the test session. This short turnaround time, perhaps more than anything else, is a compelling feature of computer testing. Nearly immediate test results allow teachers to adjust instruction and enable administrators to adjust courses and groupings of students.

Computer testing also addresses many drawbacks of current testing practices, which include scoring errors, lost mail, postage and handling expenses, diminishing classroom instruction time and the high costs of human scorers for written exams. Like a Polaroid camera whose prints develop in minutes, computer-based testing programs can provide near-instant gratification to superintendents, board members, teachers and parents who have grown increasingly frustrated at long waits for test results.

But speed is far from the only appeal. Other potential benefits include individualised reporting, flexible scheduling, shorter administration times, better student motivation and the hope of lower costs. Just imagine: No more test booklets to mail, no more mass interruptions of the school day to test whole grades at a time. No need to test students long before the end of a unit or semester.

Computer-based testing offers the promise of a highly flexible system with minimum classroom disruptions. In theory, computer tests can be administered anywhere where there is a computer, at any time of day. Special education accommodations like audio or large-type or extra time become simpler to provide.

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Once limited by cost and their cumbersome nature, digital portfolios, lab simulations and problem-solving activities become easy options. Even essays and open-ended questions can be scored by computer. A decrease in scoring errors and the increased speed of test-score reporting are two other key advantages.

2.8   EVALUATING TRAINING PROGRAMS

Every year challenges emerge in the field of training and development for example, competence development, outsourcing, e-learning, and knowledge management, to name a few. In spite of the variety and complexity of these challenges, there is a common theme: business leaders want to see value for their investment (Kirkpatrick et al, 2006). Does the initial reaction to the learning experience indicate that the learning is relevant and immediately applicable? What is being done differently as a result of the learning? What impact does this learning and development have on the business? These are questions that have been asked every year about training and development since 1959, when Don Kirkpatrick put them on the agenda of business and learning leaders.

E-learning may be less expensive then classroom learning: however, is it as effective as classroom learning? A knowledge management system may deliver the information to people; however, does it change their behaviour (Kirkpatrick et al, 2006)?

There is an old saying among training directors: When there are cutbacks in an organisation, training people are the first to go. This isn't always true. However, whenever downsizing occurs, top management looks for people and departments than can be eliminated with the fewest negative results. Early in their decision, they look at such "overhead" departments as training, commonly called corporate university and human resources.

In some organisations, top management feels that all these functions except training are necessary. From this perspective training is optional, and its value to the organisation depends on top executives' view of its effectiveness (Kirkpatrick et al, 2006). A second reason for evaluating a training program is to determine whether you should continue to offer a program. The content of some programs may become obsolete. The most common reason for evaluation is to determine the effectiveness of a program and ways in which it can be improved. Four level sequences to evaluate training programs are presented by Kirkpatrick.

Each level is important and has an impact on the next. As you move from one level to the other the evaluation process becomes more difficult and time consuming, but it provides more valuable information. The four levels include:

- Level 1-Reaction
- Level 2-Learning
- Level 3-Behaviour
- Level 4-Results

Reaction as the word implies, measures how those who participate in the program react to it. It is also called a measure of customer satisfaction. Learning can be defined as the extent to which participants change attitudes, improve knowledge, and/or decrease skills as a result of attending the training program. Behaviour can be defined as the extent to which change in behaviour has occurred because of the participant having attended the training program.

Result can be defined as the final result that occurred because of participants having attended the program. The final result can include increased production, improved quality, decreased cost, deduced frequency and/or severity of accidents, increased sales, reduced turnover and higher profit.

2.9   SUMMARY

In this chapter, the researcher highlighted the available literature on the history and evolution of training. A systematic approach was viewed as the best approach to developing effective training programs. A comparison of the advantages and disadvantages of on-site OJT and off-site OJT was previewed. The literature makes one understand why S-OJT ranks top on training methods.

The next chapter will focus on the methodology used in this research. The questionnaire data acquisition process will be discussed. A new technological approach to questionnaire distribution is applied to the primary data acquisition allowing the research to gather lots of data in a very short time and in an inexpensive manner.

CHAPTER THREE
METHODOLOGY

3.1 INTRODUCTION

The reason for evaluation is to determine the effectiveness of a training program. When evaluation is done, we can hope that the results are positive and gratifying, both for those responsible for the program and for upper level managers who will make decisions based on their evaluation of the program. Therefore much thought and planning need to be given to the program itself to make sure that it is effective.

Kirkpatrick & Kirkpatrick, 2005 stated that a four level sequence can be used to evaluate training programs for effectiveness. Each level is important and has an impact on the next level. As you move from one level to the next the process becomes more difficult and time-consuming, but more valuable information is provided. The four levels are:
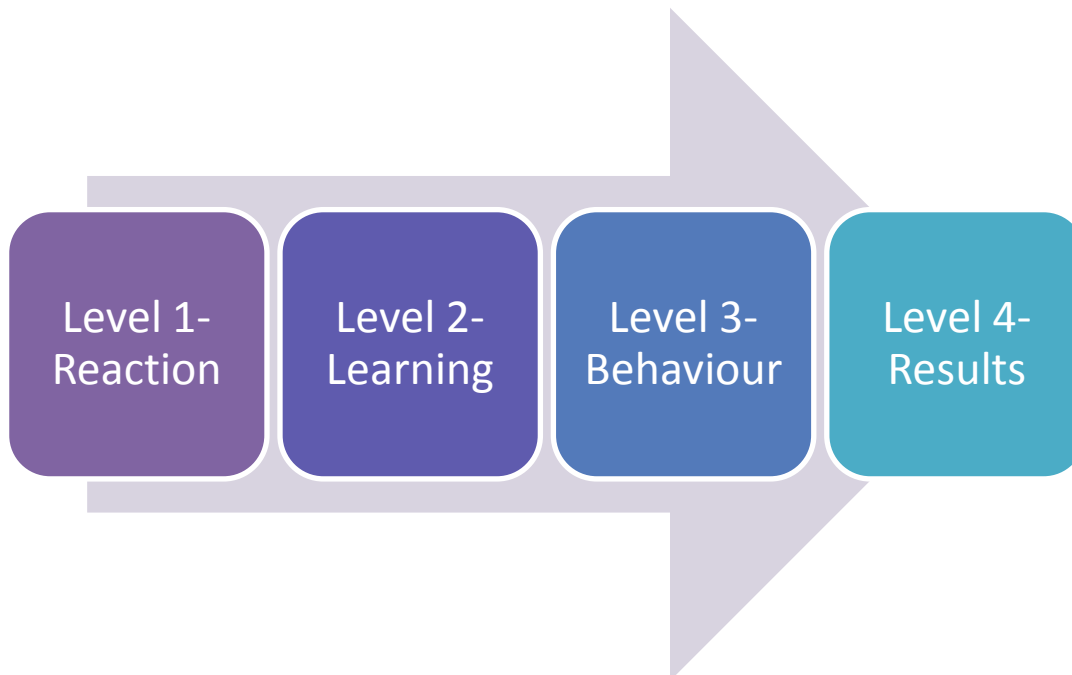
Fig 3.1: A four-level sequence for the effective evaluation of trainees, Adopted from
(Kirkpatrick & Kirkpatrick, 2005) p 21

3.1.1 Reaction

Evaluation on this level measures how those that participate in the program react to it. Kirkpatrick & Kirkpatrick, 2005 called it a measure of satisfaction. Organisations pay a fee to

train their employees . Its is obvious that the reaction of participants is a measure of customer satisfaction.

Reactions have to be favourable for these programs to be effective. It is not so obvious that reaction to in-house programs is also a measure of customer satisfaction. In many in-house programs, participants are compelled to attend whether they want to or not. However, they still are customers even if they don't pay, and their reaction can make or break a training program. What they say to their boss often gets to higher managers, who make decisions of future training programs. Positive reaction is as important for those training who run in-house programs as they are for those who run public programs. Positive reactions may not ensure learning, but negative reaction almost certainly reduces the prossibility of its occuring.

3.1.2   Learning

Learning can be defined as the context to which participants change attitude, improve knowledge, and/or increase skill as a result of attending a program (Kirkpatrick & Kirkpatrick, 2005). These are the three things that a training program can accomplish. Programs such as diversity in the work place aim at changing attitudes. Technical programs aim at improving skills. Some trainers say that no learning has taken place unless change in behaviour occurs. Learning occurs when: Attitudes are changed. Knowledge is increased. Skills are improved. One or more of these changes must take place if a change in behaviour is to occur (Kirkpatrick & Kirkpatrick, 2006).

3.1.3   Behaviour

Behaviour can be defined as the extent to which change in behaviour has occurred because the participant attended the training program (Kirkpatrick et al, 2006). In order for change to occur, four conditions are necessary:

    i)   The person must have the desire to change

    ii) The person must know what to do and how to do it

    iii) The person must work in the right climate

    iv) The person must be rewarded for changing

The training program can accomplish the first two requirements by creating a positive attitude towards the desired change and by teaching the necessary knowledge and skills. The third condition, right climate, refers to the participant's immediate supervisor. Five different

types of climate can be described: preventing, discouraging, neutral, encouraging and requiring (Kirkpatrick et al, 2005).

3.1.4   Results

Result can be defined as the final results that occurred because the participants attended the program. The final result can include increasing production, improved quality, decreased cost, reduced frequency and/or severity of accidents, increased sales and higher profit. It is important to recognise that results like these are the reasons for having some training programs. Therefore the final objective of the training program needs to be state in clear terms.

3.2   DATA COLLECTION

One of the ways in which a discipline advances is through scholarly debate (Sims, 1990). When the proponents of different sides of an issue can confront each other with proposals, critiques, and counterproposals, it is possible to highlight the distinctions among the positions and to focus on the facts and argumentation that would decide the issue one way or the other. Progress distils from such a debate.

However, not all scholarly debates are worthwhile. Occasionally, issues that should be decided on empirical grounds are debated on a priori considerations that have no bearing on the matter. Such debates, rather than advancing the field, have the opposite effect: Time and energy that should be applied to data gathering and analysis are expended instead in advancing and parrying arguments (Gass et al, 1994).

Leedy, (1974) define methodology "as an operational framework within which facts are placed so that their meaning may be seen more clearly". He further stated that methodology supplies the researcher with logical rules that guide our findings and subsequent analysis. Chlsnal, (1978) stated that "a central part of research study is to develop an effective research strategy or design"; he said that a research design forms the framework of the entire research process. There are primarily two (2) kinds of data used mostly in research. These are primary data and secondary data (Morris, 2004).

3.2.1   Primary Data

Primary data collection involves, data collected by the researcher using methods such as interviews and questionnaires. The data collected are unique until published. No one else has access to it (Morris, 2004). Primary data collection is necessary when a researcher cannot find the data needed in secondary sources (Morris, 2004). There are many methods of collecting primary data. The main methods include:

i)   Questionnaires

ii)   Interviews

iii) Focus Group Interviews

iv)   Observation

v)   Case-studies

vi)   Diaries

vii) Critical Incidents

viii)   Surveys

The choice of method is influenced by the availability of resources. The questionnaires method was used for gathering primary data.

3.2.2   Secondary Data

Secondary data are data or information obtained from already available sources. These data are collected by a third party which is a person or organisation other than the user of the data (Morris, 2004).

The advantage of using secondary data is that it is cheap and inexpensive and also easily accessible. This saves time and efforts. It also avoids data collection problems and it provides a basis for comparison. The major disadvantage relates to the credibility of the source who has published this information and the small nuances that may not fit into your research objectives.

Another disadvantage is that, the data might be out-dated. Similarly you have no control over the quality of data and you do not know how authentic the measures used for data collection have been (Morris, 2004). Sources of secondary data used in this research include, but are not

limited to: books, magazines, websites, already published reports, TV, radio, newspapers, films, journals and publications, research papers etc.

3.3 QUESTIONNAIRE DESIGN

Questionnaires are an inexpensive way of gathering data from a potentially large number of respondents. In some instances they are the only practicable approach to reach a pool of reviewers large enough to allow statistical analysis of the results. A well-designed questionnaire that is used effectively can gather information on both the overall performance of the test system as well as information on specific components of the system. If the questionnaire includes demographic questions on the participants, they can be used to correlate performance and satisfaction with the test system among different groups of users.

It is important to bring to mind that questionnaires should be viewed as a multi-stage process beginning with definition of the aspects to be examined and ending with interpretation of the results. (Dr Thomas. F. Burgess) Every step needs to be designed carefully because the final results are only as good as the weakest link in the questionnaire process. Although questionnaires may be cheap to administer compared to other data collection methods, they are every bit as expensive in terms of design time and interpretation. (Dr Thomas. F. Burgess).The steps required to design and administer a questionnaire include:

1. Defining the Objectives of the survey
2. Determining the Sampling Group
3. Designing the Questionnaire
4. Administering the Questionnaire
5. Interpretation of the Results (Morris, 2004)

A questionnaire design is a long process that demands careful attention. Questionnaires are powerful evaluation tools and should not be taken lightly. Design begins with an understanding of the capabilities of a questionnaire and how they can help your research. If it is determined that a questionnaire is to be used, then greatest care goes into the planning of the objectives. Questionnaires are like any scientific experiment. One does not collect data and then see if they found something interesting. One forms a hypothesis and an experiment that will help proving or disproving the hypothesis.

Questionnaires are versatile, allowing the collection of both subjective and objective data through the use of open or closed format questions. Modern computers have made the task of collecting and extracting valuable material more efficient. However, a questionnaire is only as good as the questions it contains.

There are many guidelines that must be met before your questionnaire can be considered a sound research tool. The majorityof these deal with making the questionnaire understandable and free of bias. Mindful review and testing are necessary to weed out minor mistakes that can cause great changes in meaning and interpretation. When these guidelines are followed, the questionnaire becomes a powerful and economical evaluation tool.

Questionnaires are measuring instruments that ask individuals to respond to a set of questions. If the questions ask for information about the individual respondents, they are called self-report questionnaires. Examples of information obtained in self-report questionnaires include biographical information, attitudes and opinions, and knowledge. Individuals may complete self-report questionnaires by responding to written questions or questions shown on a computer terminal. Self-reports may also be obtained through an interview in which another individual (the interviewer) asks the questions verbally and is responsible for recording responses. Questionnaires are also used to obtain information from individuals who serve as observers. Observers use questionnaires to record descriptions and evaluations of organisational and individual variables.

3.3.1   Questionnaire Decisions

Constructing a questionnaire is a time-consuming and challenging part of the research process. It is particularly challenging when abstract constructs must be measured. As a consequence, researchers should first consider alternatives to questionnaire construction. Two additional decisions are needed when questionnaires are used to carry out a research project.

First, a decision must be made about whether the information should be obtained using a written questionnaire or through an interview. Secondly, if the questionnaire is designed to obtain information about individuals, a decision must be made about the source of information. Should it be obtained from outside observers or from individuals reporting on themselves?

3.3.2   Alternatives to Questionnaire Construction

The choice of measurement instrument(s) depends primarily on the topic a researcher seeks to investigate. Some sorts of organisational research and some portions of specific research studies may not require that a questionnaire be constructed or may not use a questionnaire at all. Much organisational research is conducted using secondary data, data collected for some other purpose. When secondary data are available, a researcher does not need to be concerned with questionnaire construction or data collection. However, the researcher must still be concerned with the quality of the measures used to obtain the data.

Secondary data are available from many sources. They are collected by organisations for other internal purposes, such as maintaining records to monitor and improve the quality of services or products. Secondary data are also collected by organisations to meet external requirements such as safety, affirmative action, and tax regulation. Secondary data relevant to organisational research are also collected by outside organisations, such as industry trade associations and organisations that collect and sell information about other organisations and individuals who interact with. In addition, governments at all levels collect information that is of interest to organisational researchers.

3.4   METHOD OF INVESTIGATION

A case study is a method that relies on the examination of a single instance of a phenomenon to explore, often in rich detail, the hows and whys of a problem. Some of the most famous case studies in the annals of social science have been done on cities and communities, long before it was technically feasible for social scientists to examine a multitude of cities, using an array of statistics and equipped with sophisticated statistical techniques (Feagin et al, 1991).

The Lynds were the pioneers. Using both historical data and extensive interviews, the Lynds studied the development and nature of Muncie, Indiana, in two classic works, *Middletown* and *Middletown in Transition*. These books showed how industry came to Muncie, how the working class developed, and how rule was exercised over the city by a dominant family. As so often happens, these case studies became the rich and fertile source of empirical

inferences, inferences that would later be examined as well as criticized in other empirical works (Feagin et al, 1991).

A case study is a major methodological tool in social science inquiry, both as a supplement to the natural science model and as a distinctive means of providing valid social knowledge (Feagin et al, 1991).

A bid was made to gather unbiased information for the analysis of the problem addressed in the research project. The main mechanism used in gathering data relevant to determining the effectiveness of the S-OJT was the administration of personal interview and questionnaires. With this system of investigation, the researcher intends to use both the personal interview and questionnaire to arrive at detailed and reliable data.

The sampling technique used was discerning as the personal interview/questionnaire was targeted at trainees and training officers. The Air Separation Unit (ASU) case study was used for the purpose of this research. The case study involved examining the current S-OJT in place and evaluating the effectiveness of the training. This also involved deploying a computer-based learning system in place of the old paper-based S-OJT system. Trainees and trainer were handed questionnaires on the differences of the 2 (two) systems.

3.4.1   Method of Investigation Selected and Application

Efforts were made to gather unbiased information from the analysis of the problem addressed in the research project. Adobe distribution technology was integrated into the questionnaire process. This allowed the researcher to gather effective data in a cheap manner. Personal interviews were administered using Skype video conferencing technologies and face to face personal interviews.

The questionnaires were distributed using adobe email questionnaire technology. This technology allowed the personnel to complete the questionnaire in any part of the world and the data are transmitted back to the researcher.

The sampling technique used was not selective as all levels of personnel where included in the survey. Managers, supervisors, training coordinators as well as low level operational staff where included in the survey.

3.5 ANALYSIS TECHNIQUE

3.5.1 The Null Hypothesis

In statistics a **null hypothesis** (H_0) is a hypothesis set up to be nullified or refuted in order to support an alternative hypothesis. When used, the null hypothesis is presumed true until statistical evidence, in the form of a hypothesis test, indicates otherwise. This happens when the researcher has a certain degree of confidence, usually 95% to 99%, that the data do not support the null hypothesis. It is possible for an experiment to fail to reject the null hypothesis. It is also possible that both the null hypothesis and the alternate hypothesis are rejected if there are more than those two possibilities (Fisher, R.A. 1966).

The purpose of hypothesis testing is to test the viability of the null hypothesis in the light of experimental data. Depending on the data, the null hypothesis either will or will not be rejected as a viable possibility. The null hypothesis is often the reverse of what the experimenter actually believes; it is put forward to allow the data to contradict it.

In scientific and medical applications, the null hypothesis plays a major role in testing the significance of differences in treatment and control groups. The assumption at the outset of the experiment is that no difference exists between the two groups (for the variable being compared): this is the null hypothesis in this instance.

It should be stressed that researchers very frequently put forward a null hypothesis in the hope that they can discredit it. For example, consider an educational researcher who designed a new way to teach a particular concept in science, and wanted to test experimentally whether this new method worked better than the existing method. The researcher would design an experiment comparing the two methods. Since the null hypothesis would be that there is no difference between the two methods, the researcher would be hoping to reject the null hypothesis and conclude that the method he or she developed is the better of the two.

The symbol H_0 is used to indicate the null hypothesis. An example is a researcher interested in knowing the effect of time to respond to a tone is affected by the consumption of alcohol. The null hypothesis is that $\mu_1 - \mu_2 = 0$ where μ_1 is the mean time to respond after consuming alcohol and μ_2 is the mean time to respond otherwise. Thus, the null hypothesis concerns the parameter $\mu_1 - \mu_2$ and the null hypothesis is that the parameter equals zero.

H_0: $\mu_1 - \mu_2 = 0$ or

H_0: $\mu_1 = \mu_2$.

The null hypothesis is typically a hypothesis of no difference (Fisher, 1966). Despite the "null" in "null hypothesis," there are occasions when the parameter is not hypothesised to be 0.

It is possible for the null hypothesis to be that the difference between population means is a particular value. Or, the null hypothesis could be that the mean SAT score in some population is 600. The null hypothesis would then be stated as: H_0: $\mu = 600$. Although null hypotheses involve the testing of hypotheses about one or more population means, null hypotheses can involve any parameter (Fisher, 1966).

3.5.2   Significance Level

One may want to compare the test scores of two random samples of men and women, and ask whether or not one population has a mean score different from the other. A null hypothesis would be that the mean score of the male population was the same as the mean score of the female population:

H_0: $\mu_1 = \mu_2$

Where:

H_0 = the null hypothesis

μ_1 = the mean of population 1, and

μ_2 = the mean of population 2.

The null hypothesis can postulate that the two samples are drawn from the same population, so that the variance and shape of the distributions are equal, as well as the means. Formulation of the null hypothesis is a vital step in testing statistical significance. Having

formulated such a hypothesis, one can establish the probability of observing the obtained data or data more different from the prediction of the null hypothesis, if the null hypothesis is true. That probability is what is commonly called the "significance level" of the results. (Fisher, 1966).

3.5.3   Type I Error

In a hypothesis test, a type I error occurs when the null hypothesis is rejected when it is in fact true; that is, H_0 is wrongly rejected. A type I error is often considered to be serious. It is therefore important to avoid it. The hypothesis test procedure is therefore adjusted so that there is a guaranteed 'low' probability of rejecting the null hypothesis wrongly; this probability is never 0. This probability of a type I error can be precisely computed as

P (type I error) = significance level = α

The exact probability of a type II error is generally unknown. If we do not reject the null hypothesis, it may still be false (a type II error) as the sample may not be big enough to identify the falseness of the null hypothesis (especially if the truth is very close to hypothesis).

For any given set of data, type I and type II errors are inversely related; the smaller the risk of one, the higher the risk of the other. A type I error can also be referred to as an error of the first kind. (Fisher, 1966).

3.5.4 Type II Error

Type II error occurs when the null hypothesis H_0, is not rejected when it is in fact false. A type II error is frequently due to sample sizes being too small. A type II error can also be referred to as an error of the second kind. (Fisher, 1966). The probability of a type II error is generally unknown, but is symbolised by β and written

P (type II error) = β

3.5.5 Statement of the Null Hypothesis

For the purpose of this research the researcher will be using the null hypothesis in accepting or rejecting the following research questions:

The null hypotheses of the section II of the questionnaire include:

A1:   The nature of training whether structured or unstructured has no effect on job performance of trainees after they have been trained.

A2:   The nature of training whether structured or unstructured has no effect on consistency and uniformity.

A3:   The nature of training whether structured or unstructured does not influence the satisfaction of I.S.O requirements.

A4:   The nature of training whether structured or unstructured has no effect on the possibility of real time training.

A5:   The nature of training whether structured or unstructured has no effect on the level of team work and sharing of knowledge/experience between co-trainee and trainers after training.

A6:   The nature of training whether structured or unstructured has no effect on getting the desired training outcome.

A7:   The nature of training whether structured or unstructured affects the chances of a trainee getting a high grade during evaluation

A8:   The nature of training whether structured or unstructured has no effect on the ability to assess learning and performance immediately.

A9:   The nature of training whether structured or unstructured has no effect on the level of variation and defects in the final products and services.

A10:   The nature of training whether structured or unstructured has no effect on the confidence and morale of the trainees after the training.

The null hypotheses of Section III of the questionnaire include:

B1:   The method of delivery of test whether paper-based or computer-based has no effect on the frequency of test taken.

B2:   The method of delivery of test whether paper-based or computer-based has no effect on the effectiveness of the test taker on the job.

B3:   The method of delivery of test whether paper-based or computer-based does not give rise to high cost of training and assessment.

B4: The method of delivery of test whether paper-based or computer-based has no effect on the ease of scoring and assessment of performance.

B5: The method of delivery of test whether paper-based or computer-based has no effect on the ease of monitoring trainees' performance.

B6: The method of delivery of test whether paper-based or computer-based has no effect on the learning experience of the test taker.

B7: The method of delivery of test whether paper-based or computer-based has   no effect on convenience and flexibility of test taking.

B8: The method of delivery of test whether paper-based or computer-based has no effect on ease of data management.

B9: The method of delivery of test whether paper-based of computer-based has no effect on the amount of classroom time

B10: The method of delivery of test whether paper-based or computer-based has no effect on the cost of stationery of training departments

B11: The method of delivery of test whether paper-based or not has no effect on the subjective nature of marking of test scripts and hence the credibility of test scores

B12: The method of delivery whether paper-based or computer-based has no effect on the credibility of test scores

B13: The method of delivery whether paper-based or computer-based has no effect on the ease of retaking failed tests

B14: The method of delivery whether paper-based or computer-based has no effect on the ease of scheduling tests

B15: The method of delivery whether paper-based on computer-based has no effect on the ease of backup and archiving old tests scores

B16: The method of delivery whether paper-based or computer-based has no effect on the ease of test papers being destroyed by pest

B17: The method of delivery has whether paper-based or computer-based has no effect on the ease of information transfer and sharing

B18: The method of delivery whether paper-based or computer-based has no effect on the number of man-hours used in marking

B19: The method of delivery whether paper-based or computer-based has no effect on the availability of information

3.6   CHI-SQUARE

3.6.1 Chi-Square Statistics

The chi-square (chi, the Greek letter pronounced "kye") statistics is a nonparametric statistical technique used to determine if a distribution of observed frequencies differs from the theoretical expected frequencies (Hinders, 2008).Chi-square statistics use nominal (categorical) or ordinal level data, thus instead of using means and variances, this test uses frequencies (Hinders, 2008).

The value of the chi-square statistics is given by :

$$X_2 = \text{Sigma } [(O - E)^2 / E] \quad - \quad - \quad - \quad - \quad - \quad - \quad (1)$$

Where

X_2=is the chi-square parameter

O= is the observed frequency

E= is the expected frequency.

Generally the chi-square statistics summarises the discrepancies between the expected number of times each outcome occurs (assuming that the model is true) and the observed number of times each outcome occurs, by summing the squares of the discrepancies, normalised by the expected numbers, over all the categories (Hinders, 2008).

Data used in a chi-square analysis has to satisfy the following conditions
1. randomly drawn from the population,
2. reported in raw counts of frequency,
3. measured variables must be independent,
4. observed frequencies cannot be too small, and
5. values of independent and dependent variables must be mutually exclusive (Hinders, 2008).

3.6.2   Types of Chi-Square Test

There are basically two (2) types of chi-square tests

- The chi-square test for goodness of fit which compares the expected and observed values to determine how well an experimenter's predictions fit the data.
- The chi-square test for independence which compares two sets of categories to determine whether the two groups are distributed differently among the categories (Hinders, 2008).

3.6.3   Chi-Square Test for Goodness of Fit

This is a measure of how well a statistical model fits a set of observations. A measure of goodness of fit typically summarises the discrepancy between observed values and the values expected under the model in question. Such measures can be used in statistical hypothesis testing.

3.6.4   Assessing Significance Levels

Significance of the chi-square test for goodness of fit value is established by calculating the degree of freedom v (the Greek letter nu) and by using the chi-square distribution table (Hinders, 2008). The v in a chi-square goodness of fit test is equal to the number of categories, c, minus one (v= c - 1).

This is done in order to check if the null hypothesis is valid or not, by looking at the critical chi-square value from the table that corresponds to the calculated v. If the calculated Chi-square is greater than the value in the table, then the null hypothesis is rejected and it is concluded that the predictions made were incorrect (Hinders, 2008).

3.6.5   Chi-Square Test for Independence
This is used to determine the relationship between two variables of a sample (Hinders, 2008). In this context independence means that the two factors are not related.

3.6.6 Establishing a hypothesis

The null hypothesis is that the two variables are independent or in this particular case is that the likelihood of getting in trouble is the same for boys and girls. The alternative hypothesis to be tested is that the likelihood of getting in trouble is not the same for boys and girls. It is important to keep in mind that the chi-square test for independence only tests whether two variables are independent or not, it cannot address questions of which is greater or less (Hinders, 2008). Using the chi-square test for independence, it cannot be evaluated directly from the hypothesis.

3.6.7 Assessing significance levels

The degree of freedom is equal to the number of columns in the table minus one multiplied by the number of rows in the table minus one.
I.e. $dof = (r - 1)(c - 1) = 1$. Where dof means degree of freedom.

3.7   MAKING DECISIONS: THE TEST OF A HYPOTHESIS

The logic of testing a hypothesis is similar to the procedure used in court trials. The court assumes the accused innocent until proven guilty. Consider a vaccine being tested to determine its effectiveness in preventing the common cold. The statistical problem portrays the vaccine as the accused. The hypothesis to be tested, called the null hypothesis, is that the vaccine is ineffective. The evidence in the case is obtained in the sample drawn from the population of potential vaccine customers.

In making decisions, the experimenter is faced with two (2) uniquely possible errors in rejecting or accepting the null hypothesis (Mendenhall et al, 1982). Type 1 error which rejects the null hypothesis when it is true for a statistical test. Secondly, the type 2 error accepts the null hypothesis when it is false for a statistical test.

3.8   SIGNIFICANCE LEVEL

The probability of making a type 1 error is often called the significance of the statistical test, a term that originated in the probability of the observed value of the test statistic, or some

value even more contradictory to the null hypothesis, measures, in a sense, the weight of evidence favouring rejection.

The significance level represents a probability of observing a sample outcome more contradictory to H_0 than the observed sample result if, in fact, Ho is true. The smaller the value of this probability, the heavier is the weight of the sample evidence for rejecting Ho.

3.9   SUMMARY

Chapter three (3) focused on the methodology employed and statistical analysis methods. The null hypothesis was discussed; its application in the acceptance and nullification of hypothesis statement was also x-rayed. The type I and type II error types were also discussed in detail.

Chapter four (4) will attempt to present and analyse the data acquired in chapter three (3). The results of the two section questionnaire will be tested against the null hypothesis model for acceptance or rejection with the aim of evaluating the effectiveness of S-OJT against ordinary OJT.

CHAPTER FOUR
PRESENTATION AND ANALYSIS OF RESULTS

Data were acquired through the use of a questionnaire that was designed for the purpose of evaluating the effectiveness of S-OJT and studying of the effect of paper-based and computer-based training/testing on S-OJT in order to create a framework for increasing its effectiveness.

One hundred questionnaires were distributed to employees of the Air Separation Unit (ASU) unit of Sasol Synfuels (SS). In order to prevent a chance for bias in the outcome of the results; the questionnaire was designed to hide the intention of the research. The results obtained were then distributed into the categories intended for the analysis.

Out of the 100 respondents, 86 % claimed to have been trained using a structured-on-job training (S-OJT) approach. About 31 of the respondents could not distinguish between these categories of training and hence were not part of the questioning.

4.1   Results

4.1.1   Results of Section II of the Questionnaire (S-OJT versus OJT)

The complete data obtained from the experiment is shown table 4.2 and table 4.3 below while table 4.1 indicates the number trained with S-OJT and OJT. These data are required in the contingency tables and the statistical calculations that ensue.

Table 4.1: Proportion of people trained via S-OJT and OJT

Number of correspondents trained through S-OJT	84
Number of correspondents trained through OJT	16

Table 4.2: Data obtained for the workers who are trained using S-OJT

	YES		NO	
Question	Strongly Agree	Agree	Strongly Disagree	Disagree
1	61	21	1	1
2	67	3	9	5
3	55	25	2	2
4	54	23	4	3
5	51	31	2	0
6	61	23	0	0
7	55	17	7	5
8	47	35	0	2
9	54	28	1	1
10	59	25	0	0

Table 4.3: Data obtained for the workers who are trained using OJT

	YES		NO	
Question	Strongly Agree	Agree	Strongly Disagree	Disagree
1	4	3	5	4
2	4	6	3	3
3	5	9	1	1
4	1	3	7	5
5	7	5	2	2
6	6	6	1	3
7	0	4	7	5
8	1	3	4	8
9	8	6	2	0
10	5	4	3	4

4.1.2 The Sum of All Cells Model

The model required is given as:

$$X = \sum \frac{(E_{ij} - N_{ij})^2}{E_{ij}} \qquad (1)$$

where;

      X = Chi-square parameter

      E_{IJ} = Observed frequency and

      N_{IJ} = Expected frequency

It can be shown that the test statistics follows a chi-square distribution with one degree of freedom. Since the test is based on assessing how well the observed frequencies match or fit the ones expected if Ho: is true.

From the responses to the questionnaire on table 4.1, the expected frequency in (parenthesis) on the table can be calculated using this expression:

$$\text{Expected frequency, E} = \frac{\text{Sum total of row 1(CI) X Sum total of column A (A3)}}{\text{Sum total of both totals of row 3 and column C (C3)}}$$

Where; C_3 is constant.

Hence substituting values for the observed frequency, from the 2 by 2 contingency tables

Hypothesis A1: The nature of training whether structured or unstructured has no effect on job performance of trainees after they have been trained

Table 4.4: Contingency table for S-OJT and OJT's effect on job performance of trainees after they have been trained

	INFLUENCE PERFORMANCE		
	YES	NO	TOTAL
S-OJT	82 (74.76)	2 (9.24)	84
OJT	7 (14.24)	9 (1.76)	16
TOTAL	89	11	100

$$E_{11} = \frac{89 \times 84}{100} = 74.76$$

$$E_{12} = \frac{84 \times 11}{100} = 9.24$$

$$E_{21} = \frac{89 \times 16}{100} = 14.24$$

$$E_{22} = \frac{16 \times 11}{100} = 1.76$$

$$\chi2 = \frac{(82 - 74.76)^2}{74.76} + \frac{(2 - 9.24)^2}{9.24} + \frac{(7 - 14.24)^2}{14.24} + \frac{(9 - 1.76)^2}{1.76}$$

$$\chi2 = 39.84$$

Analysis: The chi-square value obtained during the test of association and significance (39.84) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

- The effect of S-OJT on job performance of trainees after they have been trained is not random.
- S-OJT affects the job performance of trainees after they have been trained.
- 97 % of those trained with S-OJT agreed that the job performance of trainees improved after they have been trained. On the other hand, only about 44 % of those whose companies use OJT agree with this.

Hypothesis A2: The nature of training whether structured or unstructured has no effect on consistency and uniformity

Table 4.5: Contingency table for S-OJT and OJT's effect on consistency and uniformity of performance after training

AFFECTS CONSISTENCY AND UNIFORMITY OF PERFORMANCE			
	YES	NO	TOTAL
S-OJT	70 (67.2)	14 (16.8)	84
OJT	10 (12.8)	6 (3.2)	16
TOTAL	80	20	100

.

$$E_{11} = \frac{80 \times 84}{100} = 67.2$$

$$E_{12} = \frac{84 \times 20}{100} = 16.8$$

$$E_{21} = \frac{80 \times 16}{100} = 12.8$$

$$E_{22} = \frac{16 \times 20}{100} = 3.2$$

$$\chi2 = \frac{(70 - 67.2)^2}{67.2} + \frac{(14 - 16.8)^2}{16.8} + \frac{(10 - 12.8)^2}{12.8} + \frac{(6 - 3.2)^2}{3.2}$$

$$\chi2 = 16.22$$

Analysis: The chi-square value obtained during the test of association and significance (16.22) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision

- The effect of S-OJT on consistency and uniformity of performance of trainees after they have been trained is not random.

- S-OJT affects the consistency and uniformity of performance of trainees after they have undergone training.

- 83 % of those trained with S-OJT agreed that the consistency and uniformity of performance of trainees improved after they have been trained. Also about 63 % of those whose companies use OJT agree with this.

Hypothesis A3: The nature of training whether structured or unstructured does not influence the satisfaction of ISO requirements

Table 4.6: Contingency table for S-OJT and OJT's effect on the satisfaction of ISO requirements

MEETING ISO STANDARD			
	YES	NO	TOTAL
S-OJT	80 (78.96)	4 (5.04)	84
OJT	14 (15.04)	2 (0.96)	16
TOTAL	94	6	100

$$E_{11} = \frac{94 \times 84}{100} = 78.96$$

$$E_{12} = \frac{84 \times 6}{100} = 5.04$$

$$E_{21} = \frac{96 \times 16}{100} = 15.04$$

$$E_{22} = \frac{16 \times 6}{100} = 0.96$$

$$\chi2 = \frac{(80 - 78.96)^2}{78.96} + \frac{(4 - 5.04)^2}{5.04} + \frac{(14 - 15.04)^2}{15.04} + \frac{(2 - 0.96)^2}{0.96}$$

$$\chi2 = 3.05$$

Analysis:

The chi-square value obtained during the test of association and significance (3.05) is less than the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. As a consequence, the null hypothesis cannot be rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision

- The effect of S-OJT on job performance of trainees after they have been trained may or may not be random, additional information is required to make a conclusion.
- S-OJT may or may not affect meeting of ISO standards after they have been trained.
- 95 % of those trained with S-OJT agreed that ISO standards were more likely to be met after training. Also, about 87 % of those whose companies use OJT agree with this.

Hypothesis A4: The nature of training whether structured or unstructured has no effect on the possibility of real time training

Table 4.7: Contingency table for S-OJT and OJT's effect on effect on the possibility of real time training

REAL TIME TRAINING			
	YES	NO	TOTAL
S-OJT	77 (68.04)	7 (15.96)	84
OJT	4 (12.96)	12 (3.04)	16
TOTAL	81	19	100

$$E_{11} = \frac{81 \times 84}{100} = 68.04$$

$$E_{12} = \frac{84 \times 19}{100} = 15.96$$

$$E_{21} = \frac{81 \times 16}{100} = 12.96$$

$$E_{22} = \frac{16 \times 19}{100} = 3.04$$

$$\chi2 = \frac{(77 - 68.04)^2}{68.04} + \frac{(7 - 15.96)^2}{15.96} + \frac{(4 - 12.96)^2}{12.96} + \frac{(12 - 3.04)^2}{3.04}$$

$$\chi2 = 45.99$$

Analysis: The chi-square value obtained during the test of association and significance (45.99) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

 Decision
- The effect of S-OJT on the possibility of real time training is not random.
- S-OJT enhances the possibility of real time training.
- 92% of those trained with S-OJT agreed with the above statement. On the other hand, only about 25 % of those whose companies use OJT agree with this.

Hypothesis A5: The nature of training whether structured or unstructured has no effect on the level of team work and sharing of knowledge/experience between co-trainees and trainers after training

Table 4.8: Contingency table for S-OJT and OJT's effect on the level of team work and sharing of knowledge/experience between co-trainees and trainers after training

TEAMWORK			
	YES	NO	TOTAL
S-OJT	82 (78.96)	2 (5.04)	84
OJT	12 (5.04)	4 (5.04)	16
TOTAL	94	6	100

$$E_{11} = \frac{94 \times 84}{100} = 78.96$$

$$E_{12} = \frac{84 \times 6}{100} = 5.04$$

$$E_{21} = \frac{94 \times 16}{100} = 15.04$$

$$E_{22} = \frac{16 \times 6}{100} = 0.96$$

$$\chi2 = \frac{(82 - 78.96)^2}{78.96} + \frac{(2 - 5.04)^2}{5.04} + \frac{(12 - 15.04)^2}{15.04} + \frac{(4 - 0.96)^2}{0.96}$$

$$\chi2 = 12.19$$

Analysis: The chi-square value obtained during the test of association and significance (12.19) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision

- The effect of S-OJT on the improvement of teamwork among trainees after they have been trained is not random.
- S-OJT affects the presence of teamwork among trainees after they have been trained.
- 92 % of those trained with S-OJT agreed with the notion above. On the other hand, only about 25 % of those whose companies use OJT concurred with this.

Hypothesis A6: The nature of training whether structured or unstructured has no effect on getting the desired training outcome

Table 4.9: Contingency table for S-OJT and OJT's effect on getting the desired training outcome

MEETING TRAINING OBJECTIVES			
	YES	NO	TOTAL
S-OJT	84 (80.64)	0 (3.36)	84
OJT	12 (15.36)	4 (0.64)	16
TOTAL	96	4	100

$$E_{11} = \frac{96 \times 84}{100} = 80.64$$

$$E_{12} = \frac{84 \times 4}{100} = 3.36$$

$$E_{21} = \frac{96 \times 16}{100} = 15.36$$

$$E_{22} = \frac{16 \times 4}{100} = 0.64$$

$$\chi2 = \frac{(82 - 80.64)^2}{80.64} + \frac{(2 - 3.36)^2}{3.36} + \frac{(12 - 15.36)^2}{15.36} + \frac{(4 - 0.64)^2}{0.64}$$
$$\chi2 = 19.07$$

Analysis: The chi-square value obtained during the test of association and significance (19.07) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision
- The effect of S-OJT on meeting training objectives is not random.
- S-OJT facilitates the accomplishment of training objectives.

- 98 % of those trained with S-OJT agreed that S-OJT facilitates the meeting of training objectives. Also, only about 75 % of those whose companies use OJT agreed with this.

Hypothesis A7: The nature of training whether structured or unstructured affects the chances of a trainee getting a high grade during evaluation

Table 4.10: Contingency table for S-OJT and OJT's effect on a gtrainee getting a high grade during evaluation

EXCELLENT RESULT DURING EVALUATION			
	YES	NO	TOTAL
S-OJT	72 (63.84)	12 (20.16)	84
OJT	4 (12.16)	12 (3.84)	16
TOTAL	76	24	100

$$E_{11} = \frac{76 \times 84}{100} = 63.84$$

$$E_{12} = \frac{84 \times 24}{100} = 20.16$$

$$E_{21} = \frac{76 \times 16}{100} = 12.16$$

$$E_{22} = \frac{16 \times 24}{100} = 3.84$$

$$\chi2 = \frac{(82 - 63.84)^2}{63.84} + \frac{(2 - 20.16)^2}{20.16} + \frac{(12 - 12.16)^2}{12.16} + \frac{(4 - 3.84)^2}{3.84}$$

$$\chi2 = 40.22$$

Analysis: The chi-square value obtained during the test of association and significance (40.22) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision

- The effect of S-OJT on the achievement of excellent results during evaluation after employees have been trained is not random.
- S-OJT affects the achievement of excellent results during evaluation after employees have been trained.
- 86 % of those trained with S-OJT agreed with the statement above. On the other hand, only about 25 % of those whose companies use OJT agree with this.

Hypothesis A8: The nature of training whether structured or unstructured has no effect on the ability to assess learning and performance immediately

Table 4.11: Contingency table for S-OJT and OJT's effect on the ability to assess learning and performance immediately

	EASE OF ASSESSING PERFORMANCE		
	YES	NO	TOTAL
S-OJT	82(72.24)	2(13.44)	84
OJT	4(13.76)	12(2.56)	16
TOTAL	86	16	100

$$E_{11} = \frac{86 \times 84}{100} = 72.24$$

$$E_{12} = \frac{84 \times 16}{100} = 13.44$$

$$E_{21} = \frac{86 \times 16}{100} = 13.76$$

$$E_{22} = \frac{16 \times 16}{100} = 2.56$$

$$\chi2 = \frac{(82 - 72.24)^2}{72.24} + \frac{(2 - 13.44)^2}{13.44} + \frac{(4 - 13.76)^2}{13.76} + \frac{(12 - 2.56)^2}{2.56}$$

$$\chi2 = 52.79$$

Analysis: The chi-square value obtained during the test of association and significance (52.79) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision

- The effect of S-OJT on the ease of assessing performance of trainees after training is not random.
- S-OJT affects the ease of assessing performance of trainees after training.
- 98 % of trainers whose companies use S-OJT agree with the statement above. On the other hand, only about 25 % of those whose companies use OJT agree with this.

Hypothesis A9: The nature of training whether structured or unstructured has no effect on the level of variation and defects in the final products and services

Table 4.12: Contingency table for S-OJT and OJT's effect on the level of variation and defects in the final products and services

	VARIATION IN FINAL PRODUCTS		
	YES	NO	TOTAL
S-OJT	82(80.64)	2(3.36)	84
OJT	14(15.36)	2(0.64)	16
TOTAL	96	4	100

$$E_{11} = \frac{96 \times 84}{100} = 80.64$$

$$E_{12} = \frac{84 \times 4}{100} = 3.36$$

$$E_{21} = \frac{96 \times 16}{100} = 15.36$$

$$E_{22} = \frac{16 \times 4}{100} = 0.64$$

$$\chi 2 = \frac{(82 - 80.64)^2}{80.64} + \frac{(2 - 3.36)^2}{3.36} + \frac{(14 - 15.36)^2}{15.36} + \frac{(2 - 0.64)^2}{0.64}$$

$$\chi 2 = 3.58$$

Analysis: The chi-square value obtained during the test of association and significance (3.58) is less the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. As a consequence, the null hypothesis cannot be rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

- The effect of S-OJT on the level of variation and defects in the final products after employees have been trained may or may not be random, additional information is required to make a conclusion.
- S-OJT may or may not affect the level of variation and defects in the final products after training.
- 98 % of those trained with S-OJT agreed that training affects the level of variation and defects in the final products. Also, about 87 % of those whose companies use OJT agree with this.

Hypothesis A10: The nature of training whether structured or unstructured has no effect on the confidence and morale of the trainees after the training

Table 4.13: Contingency table for S-OJT and OJT's effect on no effect on the confidence and morale of the trainees after the training

CONFIDENCE AND MORALE			
	YES	NO	TOTAL
S-OJT	84 (78.12)	0 (5.88)	84
OJT	9 (14.88)	7 (1.12)	16
TOTAL	93	7	100

$$E_{11} = \frac{93 \times 84}{100} = 78.12$$

$$E_{12} = \frac{84 \times 7}{100} = 5.88$$

$$E_{21} = \frac{93 \times 16}{100} = 14.88$$

$$E_{22} = \frac{16 \times 7}{100} = 1.12$$

$$\chi2 = \frac{(84 - 78.12)^2}{78.12} + \frac{(0 - 5.88)^2}{5.88} + \frac{(9 - 14.88)^2}{14.88} + \frac{(7 - 1.12)^2}{1.12}$$
$$\chi2 = 36.20$$

Analysis: The chi-square value obtained during the test of association and significance (36.20) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 at a degree of freedom of 1. The null hypothesis is rejected. Based on the foregoing and other data analysed, the following deductions can be drawn:

Decision
- The effect of S-OJT on the improvement of confidence and morale of trainees after they have been trained is not random.
- S-OJT improves the confidence and morale of trainees after they have been trained.

- 98 % of those trained with S-OJT agreed that the confidence and morale of trainees improved after they have been trained. Also, about 86 % of those whose companies use OJT agree with this.

In summary, the above analysis can be summarized as follows;

1. S-OJT improves the job performance of trainees after they have been trained.
2. S-OJT ensures the consistency and uniformity of performance of trainees after they have undergone training.
3. S-OJT may or may not affect meeting of ISO standards after employees have been trained.
4. S-OJT enhances the possibility of real time training.
5. S-OJT improves teamwork among trainees after they have been trained.
6. S-OJT facilitates the accomplishment of training objectives.
7. S-OJT increases the chances of achieving excellent results during evaluation of employees after they have been trained.
8. S-OJT aids easy assessment of the performance of trainees after training.
9. S-OJT may or may not affect the level of variation and defects in the final products after training.
10. S-OJT improves the confidence and morale of trainees after they have been trained.

4.1.3 Results of Section III of the Questionnaire (CBT versus PBT)

The complete data obtained from the experiment are shown table 4.15 and table 4.16 below while table 4.1.4 indicates the number S-OJT trainee who used computer and paper-based training/testing. These data are required in the contingency tables and the statistical calculations that ensue.

Table 4.14: Proportion of people trained by computer-based and paper-based S-OJT

Number of Structured with computer-based training	60
Number of Structured with paper-based training/testing	24

Table 4.15: Data obtained for the workers who are trained using the combination of S-OJT and computer-based training/testing

Question	YES		NO	
	Strongly Agree	Agree	Strongly Disagree	Disagree
1	30	24	4	2
2	29	24	5	2
3	16	14	19	11
4	29	25	4	2
5	40	18	1	1
6	12	16	20	12
7	40	9	4	7
8	42	16	2	0
9	22	18	12	8
10	5	8	30	17
11	18	12	22	8
12	20	15	20	5
13	14	34	5	7
14	20	26	5	9
15	23	30	3	4
16	1	5	30	24
17	20	30	7	3
18	9	11	33	7
19	22	30	7	1

Table 4.16: Data obtained for the workers who are trained using the combination of S-OJT and paper-based training/testing

Question	YES		NO	
	Strongly Agree	Agree	Strongly Disagree	Disagree
1	7	5	9	3
2	8	5	8	3
3	16	6	1	1
4	5	6	9	4
5	7	6	8	3
6	4	16	1	3
7	40	9	4	7
8	1	4	13	6
9	7	4	8	5
10	6	9	3	6
11	6	10	5	3
12	3	7	8	6
13	5	5	9	5
14	2	7	10	5
15	4	7	9	4
16	5	7	9	3
17	4	7	9	4
18	5	13	4	2
19	4	10	8	2

Hence, substituting the values of the observed frequency of each hypothesis into the 2 by 2 contingency table 4.1, we have the following computations. For example, in hypothesis B1, 54 correspondents agree that frequency of test taken in S-OJT and CPT was high while 6 disagreed (table 4.2.2). From table 4.2.3, 12 correspondents each agreed and disagreed that frequency of test taken is increased using S-OJT and PBT. These values are substituted into

the contingency table as shown below, expected frequencies are calculated and lastly, the chi-square parameter is obtained from both the experimental and expected frequencies.

Hypothesis B1: The method of delivery of test whether paper-based or computer-based has no effect on the frequency of test taken

Table 4.17: Contingency table for the CBT/PBT and S-OJT effect on frequency of test

FREQUENCY OF TEST			
	YES	NO	TOTAL
S-OJT & CBT	54 (47.14)	6 (12.86)	60
S-OJT & PBT	12 (18.86)	12 (5.14)	24
TOTAL	66	18	84

$$E_{11} = \frac{66 \times 60}{84} = 47.14$$

$$E_{12} = \frac{60 \times 18}{84} = 12.86$$

$$E_{21} = \frac{66 \times 24}{84} = 18.86$$

$$E_{22} = \frac{18 \times 24}{84} = 5.14$$

$$\chi = \frac{(47.14 - 54)^2}{47.14} + \frac{(12.86 - 6)^2}{12.86} + \frac{(18.86 - 12)^2}{18.86} + \frac{(5.14 - 12)^2}{5.14}$$

$$\chi = 16.29$$

Analysis: The chi-square value obtained during the test of association and significance exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision
- The data obtained with respect to the frequency of test are not random.

- Computer / paper-based training affects the frequency of tests conducted for trainees in a structured-On-the-Job training program.
- 88 % of those trained with computer-based in combination with S-OJT agreed that they were tested frequently; compare with 50 % that agreed in paper-based S-OJT.

Hypothesis B2: The method of delivery of test whether paper-based or computer-based has no effect on the effectiveness of the test taker on the job

Table 4.18: Contingency table for the CBT/PBT and S-OJT effect on job performance

	JOB PERFORMANCE		
	YES	NO	TOTAL
S-OJT & CBT	53 (47.14)	7 (12.85)	60
S-OJT & PBT	13 (18.86)	11 (5.14)	24
TOTAL	66	18	84

$$E_{11} = \frac{66 \times 60}{84} = 47.14$$

$$E_{12} = \frac{60 \times 18}{84} = 12.86$$

$$E_{21} = \frac{66 \times 24}{84} = 18.86$$

$$E_{22} = \frac{18 \times 24}{84} = 5.14$$

$$\chi = \frac{(47.14 - 53)^2}{47.14} + \frac{(12.86 - 7)^2}{12.86} + \frac{(18.86 - 13)^2}{18.86} + \frac{(5.14 - 11)^2}{5.14}$$

$$\chi = 11.89$$

Analysis: The chi-square value obtained during the test of association and significance (11.89) exceeds the tabulated value of 10.83 which corresponds to a level of significance of

0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision
- The data obtained with respect to the job performance are not random.
- Computer / paper-based training affects the job performance conducted for trainees in a structured-On-the-Job training program.
- Over 88 % of those trained and tested with computer-based in combination with S-OJT agreed that they were appraised high in the job performance.

Hypothesis B3: The method of delivery of test whether paper-based or computer-based does not give rise to high cost of training and assessment

Table 4.19: Contingency table for the CBT/PBT and S-OJT effect on the cost of training

COST OF TRAINING			
	YES	NO	TOTAL
S-OJT & CBT	30 (37.14)	30 (22.86)	60
S-OJT & PBT	22 (14.86)	2 (9.14)	24
TOTAL	52	32	84

$$E_{11} = \frac{66 \times 52}{84} = 37.14$$

$$E_{12} = \frac{60 \times 32}{84} = 22.86$$

$$E_{21} = \frac{52 \times 24}{84} = 14.86$$

$$E_{22} = \frac{32 \times 24}{84} = 9.14$$

$$\chi = \frac{(37.14 - 30)^2}{37.14} + \frac{(22.86 - 30)^2}{22.86} + \frac{(14.86 - 22)^2}{14.86} + \frac{(9.14 - 2)^2}{9.14}$$

$$\chi = 12.62$$

Analysis: The chi-square value obtained during the test of association and significance (12.62) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the cost of training are not random.
- Computer / paper-based training affects the cost of training conducted for trainees in a structured-On-the-Job training programs.
- 50 % of those trained with computer-based training and testing in combination with S-OJT agreed that the cost of training and test administration was expensive. On the other hand, 91 % of the rest agreed that paper-based S-OJT was expensive.

Hypothesis B4: The method of delivery of test whether paper-based or computer-based has no effect on the ease of scoring and assessment of performance

Table 4.20: Contingency table for the CBT/PBT and S-OJT effect on the ease of scoring and assessment

EASE OF SCORING AND ASSESSMENT			
	YES	NO	TOTAL
S-OJT & CBT	54 (46.43)	6 (13.57)	60
S-OJT & PBT	11 (18.57)	13 (5.43)	24
TOTAL	65	19	84

$$E_{11} = \frac{60 \times 65}{84} = 46.43$$

$$E_{12} = \frac{60 \times 19}{84} = 13.57$$

$$E_{21} = \frac{24 \times 65}{84} = 18.57$$

$$E_{22} = \frac{24 \times 19}{84} = 5.43$$

$$\chi = \frac{(46.43 - 54)^2}{46.43} + \frac{(13.57 - 6)^2}{13.57} + \frac{(18.57 - 11)^2}{18.57} + \frac{(5.43 - 13)^2}{5.43}$$

$$\chi = 19.10$$

Analysis: The chi-square value obtained during the test of association and significance (19.11) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the ease of scoring and assessments of tests are not random.
- Computer/paper-based training affects the ease of scoring and assessment of trainees in a structured-On-the-Job Training programs.
- 90 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to score and assess the test given to trainees. On the other hand, less than 46 % of the rest agreed that paper-based S-OJT was easy to score and assess.

Hypothesis B5: The method of delivery of test whether paper-based or computer-based has no effect on the ease of monitoring trainees' performance

Table 4.21: Contingency table for the effect of CBT/PBT and S-OJT on monitoring of performance of trainees

MONITORING PERFORMANCE			
	YES	NO	TOTAL
S-OJT & CBT	58 (53.57)	2 (6.43)	60

S-OJT & PBT	17 (21.43)	7 (2.57)	24
TOTAL	71	13	84

$$E_{11} = \frac{60 \times 71}{84} = 53.57$$

$$E_{12} = \frac{60 \times 13}{84} = 6.43$$

$$E_{21} = \frac{24 \times 71}{84} = 21.43$$

$$E_{22} = \frac{24 \times 13}{84} = 2.57$$

$$\chi = \frac{(50.71 - 58)^2}{50.71} + \frac{(9.29 - 2)^2}{9.29} + \frac{(20.29 - 13)^2}{20.29} + \frac{(5.43 - 11)^2}{3.71}$$

$$\chi = 11.96$$

Analysis: The chi-square value obtained during the test of association and significance (11.96) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision
- The data obtained with respect to the monitoring of performance of trainee are not random.
- Computer/paper-based training affects the ease of monitoring of performance of trainees in a structured-On-the-Job Training programs.
- 97 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to monitor the performance of the trainees. On the other hand, less than 71 % of the rest agreed that paper-based S-OJT was easy to monitor the performance.

Hypothesis B6: The method of delivery of test whether paper-based or computer-based has no effect on the learning experience of the test taker

Table 4.22: Contingency table for the CBT/PBT and S-OJT effect on learning experience

	LEARNING EXPERIENCE		
	YES	NO	TOTAL
S-OJT & CBT	28 (34.29)	32 (25.71)	60
S-OJT & PBT	20 (13.71)	4 (10.29)	24
TOTAL	48	36	84

$$E_{11} = \frac{60 \times 48}{84} = 34.29$$

$$E_{12} = \frac{60 \times 36}{84} = 25.71$$

$$E_{21} = \frac{24 \times 48}{84} = 13.71$$

$$E_{22} = \frac{24 \times 36}{84} = 10.29$$

$$\chi = \frac{(34.29 - 28)^2}{34.29} + \frac{(25.71 - 32)^2}{25.71} + \frac{(13.71 - 20)^2}{13.71} + \frac{(10.29 - 4)^2}{10.29}$$

$$\chi = 9.41$$

Analysis:

The chi-square value obtained during the test of association and significance (9.41) is below the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis cannot therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the learning experience of trainee may be random.

- Computer/paper-based training does not affect the learning experience of trainees in a structured-On-the-Job Training programs.

Hypothesis B7: The method of delivery of test whether paper-based or computer-based has no effect on convenience and flexibility of test taking

Table 4.23: Contingency table for the CBT/PBT and S-OJT effect on the convenience and flexibility in the test taken, scheduling, etc.

CONVENIENCE & FLEXIBILITY			
	YES	NO	TOTAL
S-OJT & CBT	49 (42.14)	11 (17.86)	60
S-OJT & PBT	10 (16.86)	14 (7.14)	24
TOTAL	59	25	84

$$E_{11} = \frac{60 \times 59}{84} = 42.14$$

$$E_{12} = \frac{60 \times 25}{84} = 17.86$$

$$E_{21} = \frac{24 \times 59}{84} = 16.86$$

$$E_{22} = \frac{24 \times 25}{84} = 7.14$$

$$\chi = \frac{(42.14 - 49)^2}{42.14} + \frac{(17.86 - 11)^2}{17.86} + \frac{(16.86 - 10)^2}{16.86} + \frac{(7.14 - 14)^2}{7.14}$$

$$\chi = 13.12$$

Analysis:

The chi-square value obtained during the test of association and significance (13.12) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the convenience and flexibility of trainee are not random.
- Computer / paper-based training affects the convenience and flexibility of both trainees and trainer in a structured-On-the-Job Training programs.
- 82 % of those trained with computer-based training and testing in combination with S-OJT agreed the training was convenient and flexible. On the other hand, less than 42 % of the rest agreed that paper-based S-OJT was convenient and flexible.

Hypothesis B8: The method of delivery of test whether paper-based or computer-based has no effect on ease of data management

Table 4.24: Contingency table for the CBT/PBT and S-OJT effect on ease of data management

EASE OF DATA MANAGEMENT			
	YES	NO	TOTAL
S-OJT & CBT	55 (49.28)	5 (10.71)	60
S-OJT & PBT	14 (19.71)	10 (4.28)	24
TOTAL	69	15	84

$$E_{11} = \frac{60 \times 69}{84} = 49.28$$

$$E_{12} = \frac{60 \times 15}{84} = 10.71$$

$$E_{21} = \frac{24 \times 69}{84} = 19.71$$

$$E_{22} = \frac{24 \times 15}{84} = 4.28$$

$$\chi = \frac{(49.28 - 55)^2}{49.28} + \frac{(10.71 - 5)^2}{10.71} + \frac{(19.71 - 14)^2}{19.71} + \frac{(7.14 - 10)^2}{4.28}$$

$$\chi = 12.99$$

Analysis:

The chi-square value obtained during the test of association and significance (12.99) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the ease of programs data management are not random.
- Computer/paper-based training affects the ease of data management in a structured-On-the-Job Training programs.
- 92 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to manage the data of the trainees in the course of the programs. On the other hand, less than 58 % of the rest agreed that paper-based S-OJT was easy to manage.

Hypothesis B9: The method of delivery of test whether paper-based or computer-based has no effect on the amount of classroom time

Table 4.25: Contingency table for the CBT/PBT and S-OJT effect amount of classroom time

	AMOUNT OF CLASS ROOM TIME		
	YES	NO	TOTAL
S-OJT & CBT	40 (36.43)	20 (23.57)	60
S-OJT & PBT	11 (14.57)	13 (9.43)	24
TOTAL	51	33	84

$$E_{11} = \frac{60 \times 51}{84} = 36.43$$

$$E_{12} = \frac{60 \times 33}{84} = 23.57$$

$$E_{21} = \frac{24 \times 51}{84} = 14.57$$

$$E_{22} = \frac{24 \times 33}{84} = 9.43$$

$$\chi = \frac{(36.43 - 40)^2}{36.43} + \frac{(23.57 - 20)^2}{23.57} + \frac{(14.57 - 11)^2}{14.57} + \frac{(9.43 - 13)^2}{9.43}$$

$$\chi = 3.193$$

Analysis:

The chi-square value obtained during the test of association and significance (3.193) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis may or may not be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the ease of time optimisation during training and testing may or may not be random.
- Computer/paper-based training may or may not affect the ease of time optimisation in a structured-On-the-Job Training program.
- 66.7 % of those trained with computer-based training and testing in combination with S-OJT agreed that time optimisation was feasible in the course of the program. On the other hand, less than 46 % of the rest agreed that paper-based S-OJT optimises time.

Hypothesis B10: The method of delivery of test whether paper-based or computer-based has no effect on the cost of stationery of training departments

Table 4.26: Contingency table for the CBT/PBT and S-OJT effect on the cost of stationery

COST OF STATIONERY			
	YES	NO	TOTAL
S-OJT & CBT	13 (20)	47 (40)	60
S-OJT & PBT	15 (8)	9 (16)	24
TOTAL	28	56	84

$$E_{11} = \frac{60 \times 28}{84} = 20$$

$$E_{12} = \frac{60 \times 56}{84} = 40$$

$$E_{21} = \frac{24 \times 28}{84} = 8$$

$$E_{22} = \frac{24 \times 56}{84} = 16$$

$$\chi = \frac{(20 - 13)^2}{20} + \frac{(40 - 47)^2}{40} + \frac{(8 - 15)^2}{8} + \frac{(16 - 9)^2}{16}$$

$$\chi = 12.863$$

Analysis:

The chi-square value obtained during the test of association and significance (12.863) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the cost of stationery incurred by the organisation are not random.

- Computer/paper-based training affects the cost of stationery incurred in a structured-On-the-Job Training programs.
- 21 % of those trained with computer-based training and testing in combination with S-OJT agreed that it cost of stationery is significant to the organisation in the course of the programs. On the other hand, about 63 % of the rest agreed that paper-based S-OJT gave rise to a high cost of stationery.

Hypothesis B11: The method of delivery of test whether paper-based or not has no effect on the subjective nature of marking of test scripts and hence the credibility of test scores

Table 4.27: Contingency table for the CBT/PBT and S-OJT effect on the subjectivity of grades

SUBJECTIVITY AND CREDIBILITY OF GRADES			
	YES	NO	TOTAL
S-OJT & CBT	30 (32.86)	30 (27.14)	60
S-OJT & PBT	16 (13.14)	8 (10.86)	24
TOTAL	46	38	84

$$E_{11} = \frac{60 \times 46}{84} = 32.86$$

$$E_{12} = \frac{60 \times 38}{84} = 27.14$$

$$E_{21} = \frac{24 \times 46}{84} = 13.14$$

$$E_{22} = \frac{24 \times 38}{84} = 10.86$$

$$\chi = \frac{(32.86 - 30)^2}{32.86} + \frac{(27.14 - 30)^2}{27.14} + \frac{(13.14 - 16)^2}{13.14} + \frac{(10.86 - 8)^2}{10.86}$$

$$\chi = 1.922$$

Analysis:

The chi-square value obtained during the test of association and significance (1.922) is below the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The proposed null hypothesis therefore may or may not be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the subjectivity of trainee's grade may or may not be random.
- Computer/paper-based training affects the subjectivity of trainee's grade in a structured-On-the-Job Training program.
- 50 % of those trained with computer-based training and testing in combination with S-OJT agreed that subjectivity of trainee's grade is pronounced in the course of the program. On the other hand, 67 % of the rest agreed that grades of trainees in a paper-based S-OJT is subjective.

Hypothesis B12: The method of delivery whether paper-based or computer-based has no effect on the credibility of test scores

Table 4.28: Contingency table for the CBT/PBT and S-OJT effect on the credibility of test scores

	CREDIBILITY OF TESTS SCORES		
	YES	NO	TOTAL
S-OJT & CBT	35 (32.14)	25 (27.86)	60
S-OJT & PBT	10 (12.86)	14 (11.14)	24
TOTAL	45	39	84

$$E_{11} = \frac{60 \times 45}{84} = 32.14$$

$$E_{12} = \frac{60 \times 39}{84} = 27.86$$

$$E_{21} = \frac{24 \times 45}{84} = 12.86$$

$$E_{22} = \frac{24 \times 39}{84} = 11.14$$

$$\chi = \frac{(32.14 - 35)^2}{32.14} + \frac{(27.86 - 25)^2}{27.86} + \frac{(12.86 - 10)^2}{12.86} + \frac{(11.14 - 14)^2}{11.14}$$

$$\chi = 1.915$$

Analysis:

The chi-square value obtained during the test of association and significance (1.915) is well below the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis therefore may or may not be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the credibility of results of trainees may or may not be random.
- Computer/paper-based training affects the credibility of results of trainees in a structured-On-the-Job Training program.
- 58 % of those trained with computer-based training and testing in combination with S-OJT believed the outcome of the test is credible and fair. On the other hand, 42 % of the rest agreed that paper-based S-OJT was credible and fair.

Hypothesis B13: The method of delivery whether paper-based or computer-based has no effect on the ease of retaking failed tests

Table 4.29: Contingency table for the CBT/PBT and S-OJT effect on the ease of test re-taking

EASE OF TEST RE-TAKING			
	YES	NO	TOTAL
S-OJT & CBT	48 (41.43)	12 (18.57)	60
S-OJT & PBT	10 (16.57)	14 (7.42)	24
TOTAL	58	26	84

$$E_{11} = \frac{60 \times 58}{84} = 41.43$$

$$E_{12} = \frac{60 \times 26}{84} = 18.57$$

$$E_{21} = \frac{24 \times 58}{84} = 16.57$$

$$E_{22} = \frac{24 \times 26}{84} = 7.42$$

$$\chi = \frac{(41.43 - 48)^2}{41.43} + \frac{(18.57 - 12)^2}{18.57} + \frac{(16.57 - 10)^2}{16.57} + \frac{(7.42 - 14)^2}{7.42}$$

$$\chi = 11.787$$

Analysis:

The chi-square value obtained during the test of association and significance (11.787) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the ease of re-taking test for whatever reason are not random.
- Computer/paper-based training affects the ease of test re-taking in a structured-On-the-Job Training program.
- 80 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to organise a re-take test for trainees in the course of the program. On the other hand, less than 42 % of the rest agreed that paper-based S-OJT was easy to re-organise tests.

Hypothesis B14: The method of delivery whether paper-based or computer-based has no effect on the ease of scheduling tests

Table 4.30: Contingency table for the CBT/PBT and S-OJT effect on the ease of training/test scheduling

	EASE OF TEST SCHEDULING		
	YES	NO	TOTAL
S-OJT & CBT	46 (39.29)	14 (20.71)	60
S-OJT & PBT	9 (15.71)	15 (8.28)	24
TOTAL	55	29	84

$$E_{11} = \frac{60 \times 69}{84} = 39.29$$

$$E_{12} = \frac{60 \times 15}{84} = 20.71$$

$$E_{21} = \frac{24 \times 69}{84} = 15.71$$

$$E_{22} = \frac{24 \times 15}{84} = 8.28$$

$$\chi = \frac{(39.29 - 46)^2}{39.29} + \frac{(20.71 - 14)^2}{20.71} + \frac{(15.71 - 9)^2}{15.71} + \frac{(8.28 - 15)^2}{8.28}$$

$$\chi = 11.634$$

Analysis:

The chi-square value obtained during the test of association and significance (11.634) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the ease of test rescheduling are not random.
- Computer/paper-based training affects the ease of test rescheduling in a structured-On-the-Job Training program.
- 77 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to reschedule training and test for the trainees in the course of the program. On the other hand, less than 38 % of the rest agreed that paper-based S-OJT was easy to reschedule.

Hypothesis B15: The method of delivery whether paper-based on computer-based has no effect on the ease of backup and archiving old tests scores

Table 4.31: Contingency table for the CBT/PBT and S-OJT effect on the ease backing up and archiving of files

BACK UP AND ARCHIVE OF OLD FILES			
	YES	NO	TOTAL
S-OJT & CBT	53 (45.71)	7 (14.28)	60
S-OJT & PBT	11(18.29)	13 (5.71)	24
TOTAL	64	20	84

$$E_{11} = \frac{60 \times 64}{84} = 45.71$$

$$E_{12} = \frac{60 \times 20}{84} = 14.28$$

$$E_{21} = \frac{24 \times 64}{84} = 18.29$$

$$E_{22} = \frac{24 \times 20}{84} = 4.28$$

$$\chi = \frac{(45.71 - 53)^2}{45.71} + \frac{(14.28 - 7)^2}{14.28} + \frac{(18.29 - 11)^2}{18.29} + \frac{(4.28 - 13)^2}{4.28}$$

$$\chi = 17.069$$

Analysis:

The chi-square value obtained during the test of association and significance (17.069) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to backing up/archiving of data are not random.
- Computer/paper-based training affects the backing up/archiving of data in a structured-On-the-Job Training program.
- More than 88 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to back up or archive data of the trainees in the course of the program. On the other hand, less than 46 % of the rest agreed that paper-based S-OJT was easy to back up/archive data.

Hypothesis B16: The method of delivery whether paper-based or computer-based has no effect on the ease of test papers being destroyed by pests

Table 4.32: Contingency table for the CBT/PBT and S-OJT effect on the ease of test paper being gutted by fire

EASE OF TEST PAPER BEING GUTTED BY FIRE			
	YES	NO	TOTAL
S-OJT & CBT	6 (12.85)	54 (47.14)	60
S-OJT & PBT	12 (5.14)	12 (18.86)	24
TOTAL	18	66	84

$$E_{11} = \frac{60 \times 69}{84} = 12.85$$

$$E_{12} = \frac{60 \times 15}{84} = 47.14$$

$$E_{21} = \frac{24 \times 69}{84} = 5.14$$

$$E_{22} = \frac{24 \times 15}{84} = 18.86$$

$$\chi = \frac{(12.85 - 6)^2}{12.85} + \frac{(47.14 - 54)^2}{47.14} + \frac{(5.14 - 12)^2}{5.14} + \frac{(18.86 - 12)^2}{18.86}$$

$$\chi = 16.291$$

Analysis:

The chi-square value obtained during the test of association and significance (16.291) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the effect of inferno on storage media (paper or hard drives, DVD) are not random.
- Computer/paper-based training affects the loss of data to inferno in a structured-On-the-Job Training program.
- 10 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy for the data of the trainees in the course of the program to be lost through conflagration. On the other hand, less than 50 % of the rest agreed that paper-based S-OJT was prone to this phenomenon.

Hypothesis B17: The method of delivery has whether paper-based or computer-based has no effect on the ease of information transfer and sharing

Table 4.33: Contingency table for the CBT/PBT and S-OJT effect on the ease of information transfer and sharing

EASE OF INFORMATION TRANSFER AND SHARING			
	YES	NO	TOTAL
S-OJT & CBT	50 (43.57)	10 (16.42)	60
S-OJT & PBT	11 (17.43)	13 (6.57)	24
TOTAL	61	23	84

$$E_{11} = \frac{60 \times 69}{84} = 43.57$$

$$E_{12} = \frac{60 \times 15}{84} = 16.42$$

$$E_{21} = \frac{24 \times 69}{84} = 17.43$$

$$E_{22} = \frac{24 \times 15}{84} = 6.57$$

$$\chi = \frac{(43.57 - 50)^2}{43.57} + \frac{(16.42 - 10)^2}{16.42} + \frac{(17.43 - 11)^2}{17.43} + \frac{(6.57 - 13)^2}{6.57}$$
$$\chi = 12.124$$

Analysis:

The chi-square value obtained during the test of association and significance (12.124) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision:
- The data obtained with respect to the ease of sharing and transfer of information are not random.
- Computer/paper-based training affects the ease of sharing and transfer of information in an S-OJT program.

- 83 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was easy to share and transfer information during the course of the program. On the other hand, less than 46 % of the rest agreed that paper-based S-OJT was easy to share and transfer.

Hypothesis B18: The method of delivery whether paper-based or computer-based has no effect on the number of man-hours used in marking

Table 4.34: Contingency table for the CBT/PBT and S-OJT effect on wastage of man-hours

WASTAGE OF MAN-HOURS			
	YES	NO	TOTAL
S-OJT & CBT	20 (27.14)	40 (32.85)	60
S-OJT & PBT	18 (10.86)	6 (13.14)	24
TOTAL	38	46	84

$$E_{11} = \frac{60 \times 69}{84} = 27.14$$

$$E_{12} = \frac{60 \times 15}{84} = 32.85$$

$$E_{21} = \frac{24 \times 69}{84} = 10.86$$

$$E_{22} = \frac{24 \times 15}{84} = 13.14$$

$$\chi = \frac{(27.14 - 20)^2}{27.14} + \frac{(32.85 - 40)^2}{32.85} + \frac{(10.86 - 18)^2}{10.86} + \frac{(13.14 - 6)^2}{13.14}$$

$$\chi = 12.013$$

Analysis:

The chi-square value obtained during the test of association and significance (12.013) exceeds the tabulated value of 10.83 which corresponds to a level of significance of 0.001

and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision
- The data obtained with respect to wastage of man-hours are not random.
- Computer/paper-based training affects wastage of man-hours in an S-OJT program.
- Slightly below 34 % of those trained with computer-based training and testing in combination with S-OJT agreed that wastage of man-hour is prevalent during marking in the course of the program. On the other hand, 75 % of the rest agreed that paper-based S-OJT leads to unnecessary wastage of man-hours.

Hypothesis B19: The method of delivery whether paper-based or computer-based has no effect on the availability of information

Table 4.35: Contingency table for the CBT/PBT and S-OJT effect on the availability of data

AVAILABILTY OF INFORMATION			
	YES	NO	TOTAL
S-OJT & CBT	52 (47.14)	8 (12.85)	60
S-OJT & PBT	14 (18.86)	10 (5.14)	24
TOTAL	66	18	84

$$E_{11} = \frac{60 \times 69}{84} = 47.14$$

$$E_{12} = \frac{60 \times 15}{84} = 12.85$$

$$E_{21} = \frac{24 \times 69}{84} = 18.86$$

$$E_{22} = \frac{24 \times 15}{84} = 4.28$$

$$\chi = \frac{(47.14 - 52)^2}{47.14} + \frac{(12.85 - 8)^2}{12.85} + \frac{(18.86 - 14)^2}{18.86} + \frac{(5.14 - 10)^2}{5.14}$$

$$\chi = 8.174$$

Analysis:

The chi-square value obtained during the test of association and significance (8.174) is lower than the tabulated value of 10.83 which corresponds to a level of significance of 0.001 and a degree of freedom of 1. The null hypothesis can therefore be rejected; leading to the following deductions:

Decision

- The data obtained with respect to the availability of information may or may not be random.
- Computer/paper-based training may or may not affect the availability of information in an S-OJT program.
- 87 % of those trained with computer-based training and testing in combination with S-OJT agreed that it was relatively easy for information about the trainees to be available in the course of the program. On the other hand, less than 58 % of the rest agreed that paper-based S-OJT made information to be readily available.

4.2 Summary

Chapter four (4) analysed and interpreted the data and the following high level findings can be documented:

i) S-OJT is a more effective form of OJT.
ii) Performance evaluation is one of the critical components of S-OJT that is absent in OJT.
iii) S-OJT is more effective when integrated with computer-based training and testing.
iv) Job performance is enhanced when S-OJT is employed.
v) Learning is more consistent in S-OJT programs than ordinary OJT.

Chapter five (5) will discuss the findings from the analysis and interpretation of the data from chapter four (4). The next chapter will also describe a framework for the integration of computer-based testing and training into S-OJT programs.

CHAPTER FIVE
DISCUSSION OF FINDINGS/FRAMEWORK FOR INTEGRATION OF COMPUTER-BASED TRAINING/TESTING INTO STRUCTURED-ON-THE-JOB TRAINING PROGRAMS

5.1 Discussion of findings on the use of Structured On-The-Job Training and On-the-Job Training in a chemical industry

It has been shown experimentally that structured-On-the-Job Training (S-OJT) is the better of the two widely used forms of training. The following are the criteria used for the discrimination between the two methods. Some of these criteria were found in the work of (Denton, 1998) while others were developed.

5.1.1 Job Performance

S-OJT was found to increase the performance of workers. 97 % of the correspondents trained via S-OJT believed their job performance had increased while 44 % of those trained via OJT agreed their job performance increased substantially. This trend may be explained as follows: S-OJT form of training allows for trainees to be constantly assessed and monitored, hence, they are always at their best of attitude towards learning and retention of skills acquired.

5.1.2 Consistency and Uniformity

From the result of the data analysis, there are consistency and uniformity in the quality of goods and/or services being rendered by the trainees trained with S-OJT program by the time they are incorporated into the work force. This may largely be as a result of similar training manuals and learning environment the trainees are subjected to and also that they are trained by the same trainer or training team.

5.1.3 International Standard Organisation Requirements

Although consistency and uniformity of products and/or services may or may not affect ISO requirements, the results of the experiments have shown that workers trained using S-OJT largely produce products that are world class. This may be as a result of the standardised

training manual, constant assessment and monitoring that are prevalent in this form of training.

5.1.4 Real-Time Training

As proved by the data obtained and its statistics, S-OJT has the benefit of immediacy in the training of trainees. This is simply because the training exercise does not depend on the entire work force of the company; hence, delays that may be caused by factors affecting the trainers are not imminent. Specialised trainers ensure all the trainees are well trained during the specified period of time without encumbrance. Consequently, the trainees will in no time be joined with the company's work force.

5.1.5 Team Work and Sharing of Knowledge/Experience between Co-Trainees and Trainers

92 % of correspondents who are trained using S-OJT agreed that teamwork and knowledge sharing are fostered while 25 % of those who are trained using OJT concurred.
S-OJT allows for accountability because the trainers and trainees follow checklists and sign for completed training within a given period of time (usually short because of downtime usually experienced during this form of training). This thereby necessitates the collaborative efforts of trainees and/or trainers (Denton, 1998).

5.1.6 Desirable Training Outcome

From the data analysis, 98 % and 75 % of correspondents who are trained in S-OJT and OJT respectively believed the training outcome was desirable. Although a desirable outcome is relative, the results above intimates why OJT will continue to exist.
The accountability ensured by the evaluation of trainees after training sessions has an influence on the desirability of the performance of trainees after training.

5.1.7 High Grade of Trainees during Evaluation

Evaluation is one of the 3 fundamental components of S-OJT (others include: standardised training materials and selected and trained trainer (Kirkpatrick et al, 2005). In S-OJT, both the trainees and trainers know well enough that evaluation at regular interval is inevitable; hence, necessary steps are taken by both parties to ensure a high success rate, this is supported by the data analysis (86 % agreed that high grade were obtained during evaluation). On the other hand, OJT recorded a lower high grade outcome (25 % agreed it leads to high grades) if at all evaluations were carried out in the first place.

5.1.8 Assessment of Learning and Performance Promptly

The experiment also shows that the alacrity of assessment of learning and performance is to a large extent greater in S-OJT. This observation may be the result of the time limit usually placed on this form of training. Compare 98 % and 25 % of the correspondents agreeing to the promptness in assessment of learning and performance in S-OJT and OJT respectively.

5.1.9 Level of Variation and Defects in the Final Product

The low level variation and defects in the final product is not unexpected as the same group of trainers is responsible for the training of all the trainees. Compare 98 % and 87 % of correspondents who believed there was a low level of defects and variation in products for S-OJT and OJT respectively.

5.1.10 Confidence and Morale of Trainees

The confidence and morale level were found to be very high in S-OJT. This may be due to the intensity of training and evaluation delivered by the trained trainers. Compare 98 % of the correspondents in S-OJT agreeing to a high confidence and morale level to 86 % in OJT.
The incorporation of computer-based testing and training into S-OJT programs was intended to be used as an approach that would position a big and growing chemical company in a way to treat effectively the ever increasing need for skilful and well-trained employees. The aim is to help employees to attain the level of expert within the shortest possible time, promoting the profitability of the company and the safety of the work environment for the employees.

5.2   Discussion of findings on the integration of computer-based or paper-based training/testing with structured On-the-Job Training in a chemical industry

In order to maximise the utilisation of this concept of training S-OJT, the imminent advantages of computer-based training/testing in conjunction with S-OJT were investigated using factors or parameters obtained from the work of Kirkpatrick & Kirkpatrick, (2006). The following outcomes were obtained after the experiment and the ensuing analysis:

5.2.1   Frequency of Tests Taken

The experimentation process found that the frequency of the evaluation in CBT and S-OJT is greater than that of PBT and S-OJT programs. This is due to the fact that the time for collation of scripts, marking, recording, categorisation, etc. has been partially or totally eliminated based on the depth of computer application utilisation. This implies that more tests can actually be conducted to the benefit of the training objectives.

5.2.2   Effectiveness of the test taker on the Job:

This is a corollary of the frequency of test taken. The result of the experiment showed that over 88 % of those trained with computer-based S-OJT agreed that they were appraised high in the job performance. Compare with 54 % in paper-based S-OJT.

5.2.3   Relative Cost of Training and Assessment

The cost incurred during the training and evaluation exercise has been found to lower as compared with paper-based testing/training in combination with S-OJT. This result however did not reflect the initial cost of installation of computer, database management facilities and man-power.

5.2.4   Ease of Scoring and Assessment of Performance

In CBT and S-OJT, scoring and assessment of trainees becomes extremely easy and the result may be available as the final question is being answered by the test taker. This eliminates waiting time for trainees and re-testing can be conducted almost immediately. The experiment revealed that 90 % and 46 % of the correspondents in CBT and PBT respectively attested that scoring and assessment of performance was easy.

5.2.5   Ease of Monitoring Trainee's Performance

The monitoring of the trainee's performance was found to be easier in CBT approach. Since information about a trainee is readily available, information sharing was enhanced with the CBT approach. The experiment revealed that 97 % and 71 % of the correspondents in CBT and PBT respectively attested that monitoring trainee's performance was easy.

5.2.6   Learning Experience of the Test Taker

This is also a corollary of the possibility of many tests to be taken by the trainees. This affords the trainers the opportunity to evaluate the trainees on virtually all the knowledge associated with the standardised training manual and may even be extended to deductive knowledge.

5.2.7   Convenience and Flexibility of Test Taking

Administering tests using computer-based training/ testing in combination with S-OJT allows for flexibility and comfort of both the test taker and giver.

5.2.8   Ease of Data Management

The form of the data makes it possible for it to be easily analysed and managed to suit all purposes required by the decision makers. Data can easily be exported to spread sheet programs for analysis. This analysis could be a source of vital information for decision making.

5.2.9   Amount of Class Room Time

The majority of the respondents agreed that computer-based S-OJT made time optimisation possible. This implies that time gained from test taking, marking and evaluation can be invested in the trainees in one way or the other.

5.2.10   Cost of Stationery

The use of computer-based testing and marking renders the use of stationery to the minimum and hence the cost. The experimental result affirms this. The exact amount of cost saving on stationery is beyond the scope of this work and forms a good area for further studies.

5.2.11   The Subjectivity Nature of Marking of Test Scripts

The use of computer-based S-OJT limits the advent of corruption and influence at the level of the test markers. Veracity of the test result is more assured than in paper-based S-OJT. The result of the experiment confirms this hypothesis.

5.2.12   Credibility of Test Results

As expected, the uninterrupted result from the computer on the evaluation of the trainees is more credible than that of the manual marking. Human errors are averted in this form of S-OJT.

5.2.13   Ease of Test Retaking

The experimental work shows that it is very easy for the trainees who failed to pass the evaluation test at the end of training at each stage to use the opportunity of easily re-taking the test. This is because not much manpower need to be available before the test is being re-written.

5.2.14   Ease of Test Scheduling

The trainers enjoy the facility of easily scheduling and re-scheduling tests for the trainees. Since the trainer is not required to be physically present at the time of training or testing. The trainee can always schedule assessments at their own convenience.

5.2.15   Backup and Archiving of Old Tests Scores

Electronic data require 1/1000th volume of space required to store the same data in the paper-based form. The experimental result is in support of the statement above as 88% of the respondents agreed that computer-based S-OJT makes backing up and archiving easy.

5.2.16 Loss of Data

The issue of missing reports becomes vague. It is well known that electronic data are much easier to safe-keep than paper-based data. The latter is prone to bug attacks, fire outbreaks, and sabotage. The data in the former are retrievable in the events of the aforementioned. The experimental results are in support of the observation.

5.2.17 Ease of Information Transfer and Sharing

Trainees' data (including evaluation results) are readily available to all departments as the need arises. There may even be inter-transfer of information when safety and health regulatory bodies come in request.

5.2.18 Man-Hour Requirements

The time required by the trainers in the conduct of the training is shown to be drastically reduced. This is as a result of the fact that computer systems have taken over some time consuming and repetitive tasks and/or routines.

5.2.19 Availability of Information

Computer-based S-OJT makes it possible for the storage of all kinds of data about the trainees (relevant or irrelevant) since it requires no extra resources to do so as in paper-based. The aforementioned has proven beyond doubt that synergistic capability of S-OJT with computer-based training and testing will not only reduce cost of training and evaluation, reduce time of training and evaluation, but also improve the learning capacity of the trainee and hence his effectiveness on the job after the training exercise. It is therefore a requisite to consider the framework with which this integration could be undertaken for optimal performance. Other frameworks may exist, but one would be considered in this work that would ensure a world class training of employees to a level that would be beneficial to both the company and the employee on job satisfaction, health and safety.

5.3 Framework for integration of computer-based testing and training into structured On-the-Job Training program

The effectiveness of Structured-OJT over Unstructured-OJT has been confirmed independently in this research work. Similar work also substantiates this observation (Levine, 1995). Performance evaluation is one of the critical components of S-OJT that is absent in OJT. This requires the use of either paper-based or computer-based implementation of this key component (Trainees performance evaluation). Computer-based S-OJT was found to be the best form of training that will meet this requirement (Performance Evaluation) better.

Now that the most desirable form of training has been identified through research conducted extensively among trained workers in the chemical industry, it is of the utmost importance

that the framework for the integration of computer-based training/testing into S-OJT be designed. Companies can utilise this synergy for the training of their workers in the face of ever increasing technicalities involved in chemical equipment and processes.

The stratification of employees into four groups (novice, specialist, expert and master) in the work of Roland (2003) is adopted as a workable format in the framework developed, figure 5.1.

The computer system design required for this work may either be centralised or decentralised. The choice to be taken is a function of the company's structure, capital, and technical know-how. Regardless of the computer network architecture, no much difference will be observable. The the same objective can be achieved by different optimized network configurations.

For the purpose of this work, decentralised system architecture is utilised. Figure 5.1 below was designed for the purpose of this work to incorporate the employee stratification as reported by Roland (2003) and computer components.

5.3.1 Component of the Framework

1. Stratification of the level of trainee: As illustrated in the literature, Ronald (2003) categorised the level of trainees into any of the following:

    i. Novice: One who is new to the work situation and environment and hence lacks the basic knowledge to perform.
    ii. Specialist: One who can perform a specific unit of work unsupervised.
    iii. Expert: One who has the knowledge and experience to meet and often exceed the requirements of performing a particular unit of work
    iv. Master: One who is regarded as the expert amongst experts

Other complex stratifications may exist but the above categorisation was used due to its simplicity and cogency.

2. Test taking and marking computer systems: These are computer systems that are well equipped with accessories such as earphones, mouthpieces, picture capturing devices etc.

The hardware is installed with specialised software that will allow for the administering of tests, simulation of the plant/machineries and marking of tests.

3.   Decision Support System (DSS): This involves data storage, data management and information sharing system. This is the component of the framework that determines whether a trainee can move to the next level or repeat the level based on the benchmark set by the personnel manager(s) or management.
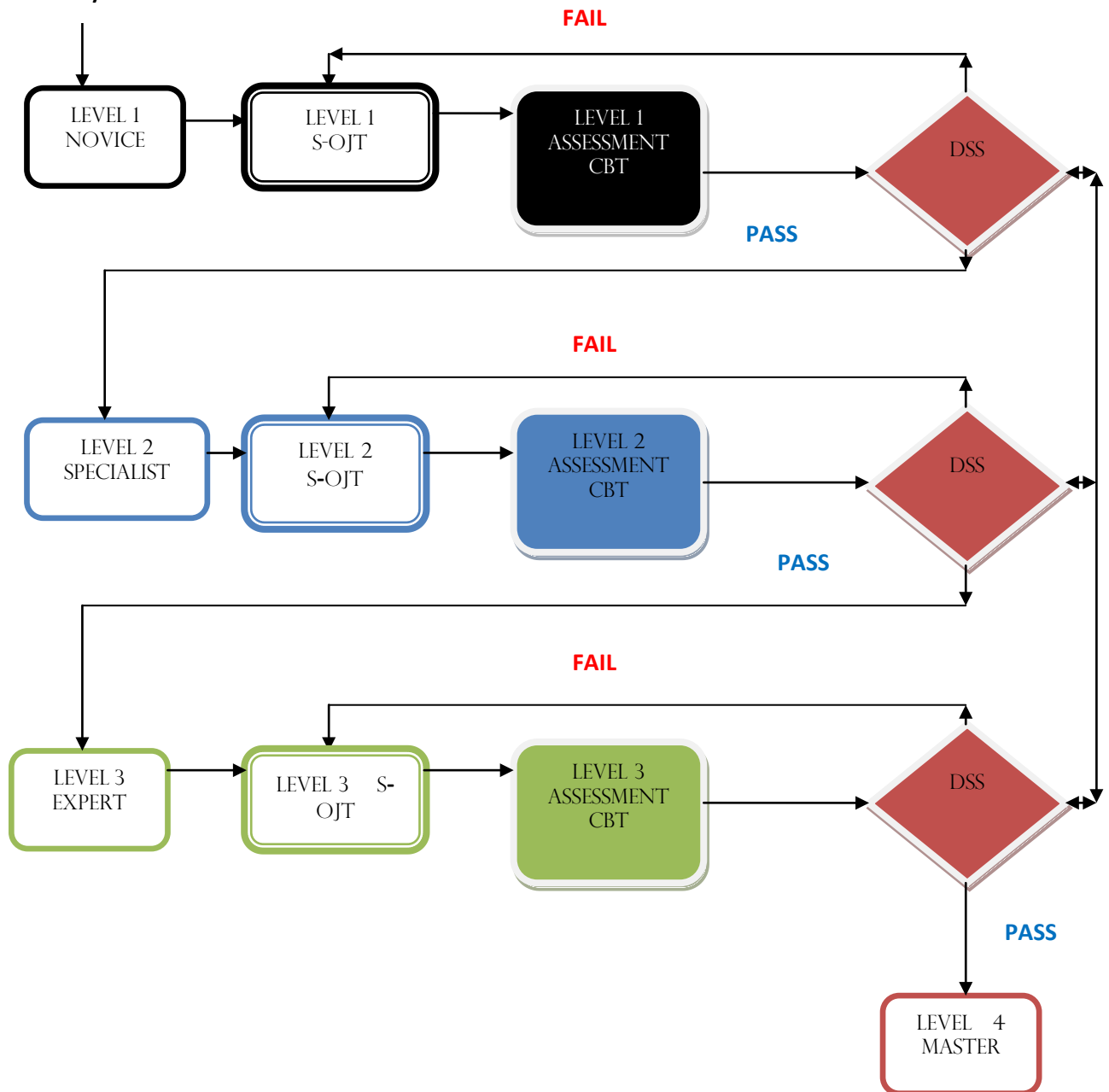
RECRUIT/TRANSFER

Figure 5.1: Framework for the synchronisation of S-OJT and computer-based training/testing (Own Research)

5.3.2 The inter-relationship of the component of the computer-based and structured on-the-job-training framework

According to the proposed framework, there are three entry levels for trainees in this framework, these include: Novice, Specialist and Expert. One who has achieved the status of a master may not necessarily be trained (the trainees usually consist of these category of people).

New recruits into the company and transfers from another department or unit enter at the novice level (level 1 as shown in the figure 5.1 above); they are subjected to a standardised training by trained trainers on the job and sometimes on a simulated version of the plant/facility in a virtual reality setting, for a specific period of time which is usually short. After the training session is the computer-based testing. The marking and assessment of the test are done in real-time.

As such, the test results are quickly collated, analysed and presented in the desire form ready to be used by the trainers and/or decision makers. These results are transferred to the database management systems; it is at this point in time that a decision is made to ascertain whether the trainee is qualified for the next level of training or for the next job position. Usually, this decision can also be automated, by setting a baseline performance against which the decision is based. It can be seen from the figure 5.1 above that there is interconnectivity between the Decision Support Systems (DSS), this makes data sharing at a different level of training feasible in real-time.

Consider a recruit to a department, he or she is admitted on level 1 (novice). The trainee is subjected to a well-organised and standardised level 1 S-OJT usually for a short period of time. Following the training is the level 1 computer-based assessment; the outcome of the assessment is sent to the decision support system (DSS) which will determine whether the trainee has passed and hence deserves to advance to the next level of the training Level 2 (specialist). On the other hand, if the trainee failed, he or she is returned to the level 1 S-OJT and the process is repeated again or in an extreme case, the trainee is being laid off.

If the trainee scaled the hurdle of level-1 training and assessment, he or she becomes a specialist. The trainee proceeds to level 2 S-OJT for a short period of time. This is followed by a level 2 computer-based assessments. Once again the decision support system (DSS) determines the procession of the trainee based on the performance benchmark. If the trainee failed, this level of training and assessment is retaken otherwise the trainee becomes a level 3 trainee (an expert in that unit or department).

On becoming an expert, the trainee is subjected to level 3 S-OJT which is followed by a computer-based assessment. The DSS will once again determine whether this level 3 trainee will retake the training and assessment or becomes a master.

At this stage the trainee has completed the training cycle for that particular unit or department and hence is ready to man effectively and professionally the assigned task or job.

CHAPTER SIX
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In this work, the features of both structured and unstructured job training were understudied and compared. In addition, the study was also aimed at comparing the effectiveness of S-OJT with computer-based test over S-OJT with paper-based testing. As a means of facilitating practical implementation of an S-OJT system with computer-based testing and assessment a framework for such a system was designed.

In order to quantify the qualitative studies, questionnaires were developed .The design of the questionnaire was such that it captured two kinds of data, the first being about the effectiveness of structured on the job training over unstructured on the job training, and the second type being the observable advantages of computer-based testing compared to paper-based testing (both under within the structured on the job training).

The results obtained from the data were analysed statistically using the chi-square technique. Analysis obtained from the first part of the questionnaire (which compared the effectiveness of structured on the job training against unstructured on the job training) indicates that relative to unstructured job training (OJT), structured on the job training (S-OJT):

   I.   Improves the job performance of trainees after they have been trained.

  II.   Enhances the possibility of real time training.

 III.   Improves teamwork among trainees after they have been trained.

 IV.   Facilitates the accomplishment of training objectives.

  V.   Increases the chances of achieving excellent results during evaluation of employees after they have been trained.

 VI.   Aids easy assessment of the performance of trainees after training, and

VII.   Improves the confidence and morale of trainees after they have been trained.

Analysis of the data obtained from the second part of the questionnaire (which captured data on the benefits of computer-based testing with structured on the job training over paper-based

testing with structured on-the-job training) using the Chi-square techniques confirms the following about the relative advantages of the computer-based test over paper-based tests;

I. Employees are tested more frequently when computer-based testing is integrated into S-OJT programs as compared to paper-based testing integration into S-OJT.

II. Employee performance is enhanced when computer-based testing is integrated into S-OJT

III. Computer-based testing integration into S-OJT is a cost effective way of training and test administration.

IV. It is easier to score and access employees using computer-based testing and training integrated into S-OJT

V. Computer-based testing and training integrated with S-OJT is an effective way to monitor employee performance.

VI. Computer-based testing and training integrated into S-OJT affects the learning experience of the employee.

VII. S-OJT programs are more convenient and flexible when integrated into computer-based training and testing.

VIII. Employee data and course programs are better managed when computer-based training and testing is integrated into an S-OJT program.

IX. Time optimisation is more flexible when computer-based training and testing is integrated into an S-OJT program.

X. Computer-based testing and training integration into S-OJT programs is cost effective compared to paper-based testing.

XI. Grades of test in paper-based S-OJT programs are not subjective, and hence more credible.

Finally, a framework for the implementation of an S-OJT with computer-based testing was designed. This framework was designed based on the categorisation of the level of trainee's expertise into four (4) training levels (novice, specialist, expert and master).

The actual implementation of this system will consist of computer systems installed with the required software (the software ideally will be developed using an object oriented language like Java), also, these computers will be networked to share a database which has a decision support system (DSS) embedded in it.

6.2 Recommendation for further studies

This research determined the effectiveness of S-OJT compared to unstructured OJT. The research also identified the need for a framework for integration of computer-based testing and training into S-OJT programs, which was developed. The study of user experience and exact cost savings on the integration of computer-based training and testing into S-OJT programs is beyond the scope of this research work and is an area for further research.

APPENDICES

APPENDIX 1 (HYPOTHESIS)
Hypothesis of the Questionnaire Developed for the Comparison of Structured on the Job Training (S-OJT) and Unstructured on the Job Training (OJT)

A1. The nature of training whether structured or unstructured has no effect on job performance of trainees after they have been trained.

A2. The nature of training whether structured or unstructured has no effect on consistency and uniformity.

A3. The nature of training whether structured or unstructured does not influence the satisfaction of I.S.O requirements.

A4. The nature of training whether structured or unstructured has no effect on the possibility of real time training.

A5. The nature of training whether structured or unstructured has no effect on the level of team work and sharing of knowledge/experience between co-trainee and trainers after training.

A6. The nature of training whether structured or unstructured has no effect on getting the desired training outcome.

A7. The nature of training whether structured or unstructured affects the chances of a trainee getting a high grade during evaluation

A8. The nature of training whether structured or unstructured has no effect on the ability to assess learning and performance immediately.

A9. The nature of training whether structured or unstructured has no effect on the level of variation and defects in the final products and services.

A10. The nature of training whether structured or unstructured has no effect on the confidence and morale of the trainees after the training.

Hypotheses of the Questionnaire Developed for the Comparison of S-OJT in conjunction with Computer-based Testing (CBT) and Paper-based Testing (PBT)

B1. The method of delivery of test whether paper-based or computer-based has no effect on the frequency of test taken.

B2. The method of delivery of test whether paper-based or computer-based has no effect on the effectiveness of the test taker on the job.

B3. The method of delivery of test whether paper-based or computer-based does not give rise to high cost of training and assessment.

B4. The method of delivery of test whether paper-based or computer-based has no effect on the ease of scoring and assessment of performance.

B5. The method of delivery of test whether paper-based or computer-based has no effect on the ease of monitoring trainees' performance.

B6. The method of delivery of test whether paper-based or computer-based has no effect on the learning experience of the test taker.

B7. The method of delivery of test whether paper-based or computer-based has no effect on convenience and flexibility of test taking.

B8. The method of delivery of test whether paper-based or computer-based has no effect on ease of data management.

B9. The method of delivery of test whether paper-based of computer-based has no effect on the amount of classroom time

B10. The method of delivery of test whether paper-based or computer-based has no effect on the cost of stationery of training departments

B11. The method of delivery of test whether paper-based or not has no effect on the subjective nature of marking of test scripts and hence the credibility of test scores

B12. The method of delivery whether paper-based or computer-based has no effect on the credibility of test scores

B13. The method of delivery whether paper-based or computer-based has no effect on the ease of retaking failed tests

B14. The method of delivery whether paper-based or computer-based has no effect on the ease of scheduling tests

B15. The method of delivery whether paper-based on computer-based has no effect on the ease of backup and archiving old tests scores

B16. The method of delivery whether paper-based or computer-based has no effect on the ease of test papers being destroyed by pest

B17. The method of delivery whether paper-based or computer-based has no effect on the ease of information transfer and sharing

B18. The method of delivery whether paper-based or computer-based has no effect on the number of man-hours used in marking

B19. The method of delivery whether paper-based or computer-based has no effect on the availability of information

APPENDIX 2 (QUESTIONNAIRE)
Part I (Personal Information)

1. What is your gender?

   □ Male   □ Female

2. What is your position in the air separation unit of your company?

   □ Manager   □ Supervisor   □ Worker

3. How long have you worked in the Air separation unit?

   □ 0-6 month's   □6-12 months   □ over 1 year

4. What is your educational level?

   □ Less than High School   □ College/University □ High School

   □ Vocational/Technical School   □ Graduate School or Higher

5. Do you have any training program in your company?

   □ Yes   □No

6. Do you know what structured and unstructured On-the-Job training are?

   □ Yes   □No

7. Does your organisation use structured On-the-Job Training?

   □ Yes   □ No

Part II (S-OJT versus OJT)
1. Do you agree that new employee service performance (e.g. professional skills, knowledge, service attitudes, service behaviours, service consistency, etc.) has become more satisfying to the management through structured On-the-Job Trainingin your unit?

   □ Strongly Agree □ Agree □ Strongly Disagree   □ Disagree

2. Are the performances of trainees on similar tasks comparable despite being trained at different sessions and/or by different trainers?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

3. Do you agree that proper tracking and recording system in the training help in meeting International Standard Organisation standard?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

4. Do you agree that the training administered made it possible for real time training to be done by trainees?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

5. Do you agree that the training has helped to build team work and develop cohesiveness in the company between employees and the managers?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

6. During training, are the original training objectives achieved?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

7. Do you agree that the training has helped to build team work and develop cohesiveness in the company between employees and the managers?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

8. Have you ever had an evaluation/grade equal or greater than 90%?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

9. Do you agree that the training administered made it possible for immediate assessment of trainees after each or regular training sessions?

   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

10. Do you agree that the training administered has improved the competence of the workers capacity of existing employees to contribute to the organisation?

    □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

Part III (Paper-based versus Computer-based Training/Testing)

1. Do you test trainees frequently?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

2. Are the tests taken effective in terms of correlation with job performance?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

3. Do you think the cost of assessing the tests is expensive?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

4. Do you agree that the type of training administered made it easy to score and assess the test taken by trainees?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

5. Can the performance of trainees be monitored within a short period of time after the test?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

6. Can the learning rate of trainees be followed easily?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

7. Is there flexibility in administration of tests to trainees?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

8. Is it easy to manage the database of trainee's test performance?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

9. Do you think that the classroom time is optimised?
   □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

10. Do you think that the cost of stationery expended is significant to the management?
    □ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

11. Can the grade of the trainees be tampered with easily at different stages of the assessment?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

12. Do you think the result obtained is credible and fair?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

13. Do you think it is easy for a trainee who failed a test to re-take it?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

14. Can the rescheduling of tests for the trainees easily be effected if the need arises?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

15. Does your training delivery have a way of backing up or archiving of test results of trainees for futuristic purpose?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

16. Can the occurrence of an inferno inflict irreparable damage to the storage media in use in your organisation?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

17. Is the transfer and sharing of information about the trainees within the organisation easy to carry out?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

18. Is unnecessary man-hours of the company's labour force utilised in marking of test scripts?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

19. Do you agree that your method of test delivery effects the availability of information?

□ Strongly Agree   □ Agree   □ Strongly Disagree   □ Disagree

APPENDIX 3 (DATA OBTAINED VIA THE QUESTIONNAIRE)

Table A3.1: Data obtained for the workers who are trained using S-OJT

Question	YES		NO	
	Strongly Agree	Agree	Strongly Disagree	Disagree
1	61	21	1	1
2	67	3	9	5
3	55	25	2	2
4	54	23	4	3
5	51	31	2	0
6	61	23	0	0
7	55	17	7	5
8	47	35	0	2
9	54	28	1	1
10	59	25	0	0

Table A3.2: Data obtained for the workers who are trained using OJT

Question	YES		NO	
	Strongly Agree	Agree	Strongly Disagree	Disagree
1	4	3	5	4
2	4	6	3	3
3	5	9	1	1
4	1	3	7	5
5	7	5	2	2
6	6	6	1	3
7	0	4	7	5
8	1	3	4	8
9	8	6	2	0
10	5	4	3	4

Table A3.3: Data obtained for the workers who are trained using the combination of S-OJT and computer-based training

Question	YES		NO	
	strongly Agree	Agree	Strongly Disagree	Disagree
1	30	24	4	2
2	29	24	5	2
3	16	14	19	11
4	29	25	4	2
5	40	18	1	1
6	12	16	20	12
7	40	9	4	7
8	42	16	2	0
9	22	18	12	8
10	5	8	30	17
11	18	12	22	8
12	20	15	20	5
13	14	34	5	7
14	20	26	5	9
15	23	30	3	4
16	1	5	30	24
17	20	30	7	3
18	9	11	33	7
19	22	30	7	1

Table A3.4: Data obtained for the workers who are trained using the combination of S-OJT and Paper-based training?

Question	YES		NO	
	strongly Agree	Agree	Strongly Disagree	Disagree
1	7	5	9	3
2	8	5	8	3
3	16	6	1	1
4	5	6	9	4
5	7	6	8	3
6	4	16	1	3
7	40	9	4	7
8	1	4	13	6
9	7	4	8	5
10	6	9	3	6
11	6	10	5	3
12	3	7	8	6
13	5	5	9	5
14	2	7	10	5
15	4	7	9	4
16	5	7	9	3
17	4	7	9	4
18	5	13	4	2
19	4	10	8	2

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