The Effectiveness of the Spatial Playmaker Method of Creative Problem-solving: A pilot Evaluation Study

By
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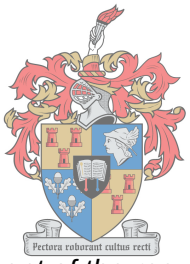

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DECLARATION

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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ABSTRACT

Creativity is of paramount importance to organisations. It is the essential building block of not only the competitive advantage of organisations but of their continued survival. Organisations often opt to implement training programmes based on group-based creative problem-solving. However, for various reasons, such group-based methods may be ineffective and logistically difficult to implement. Hence, a method used by individuals may hold significant promise for organisations. Using an individual-driven problem-solving method, employees can act as *multiple problem-solving engines working in parallel* instead of as a single session-based problem-solving engine as is the case with group problem-solving.

The purpose of this study was to develop and test the effectiveness of a creative problem-solving method called the Spatial Playmaker. After a review of the existing psychological literature on creativity, diverse streams of research were utilized to build rationales for each tool (both existing and newly created by the current investigator) that became part of the Spatial Playmaker method. In order to evaluate the effectiveness of Spatial Playmaker empirically, the significance of the effects of the use of the Spatial Playmaker on (1) Originality, (2) Acceptability, (3) Implementability, (4) Effectiveness, and (5) Completeness of solutions produced had to be determined.

This pilot study utilized a Pretest Posttest Control Group research design. A total of 60 Small Medium Micro Enterprise (SMME) owners participated voluntarily, either as intervention group participants or comparison group participants. All participants resided in the Cape Winelands region of the Western Cape province of South Africa. Differences in pre- and post-test scores of the intervention group (n_i=30), who participated in a half-day training intervention detailing how to use the Spatial Playmaker, were compared with differences in scores of the comparison group (n_c=30). The five dependent variables in question (i.e. Originality, Acceptability, Implementability, Effectiveness, and Completeness) were measured by using the rating scales developed by Dean, Hender, Rodgers, and Santanen (2006).

The results show that there was a significant group/time interaction effect on four of the five dependent variables, namely originality, acceptability, effectiveness, and completeness ($p < .01$ for all four variables). Furthermore, post hoc comparisons using the LSD test revealed that the intervention group significantly outperformed the comparison group on the post-test in terms of these four dependent variables. There was a group/time interaction effect on the fifth dependent variable implementability, but it failed to reach significance ($p > .05$). However, contrary to research expectations, post hoc comparisons using the LSD test revealed that the comparison group significantly outperformed intervention group on the post-test in terms of implementability. Taken together, these findings suggest

that the Spatial Playmaker holds significant benefits as a creative problem-solving method for individuals. It is therefore concluded that the intervention (i.e. How to use the Spatial Playmaker method) had a positive impact on the originality, acceptability, effectiveness, and completeness of the solutions generated by the intervention group. This study contributes to a body of previous research supporting the training individuals in the use of creative problem-solving methods.

OPSOMMING

Kreatiwiteit is uiters belangrik vir organisasies. Dit is ‘n noodsaaklike bousteen vir beide innovasie en die voortgesette oorlewing van organisasies. Organisasies verkies dikwels om opleidingsprogramme wat op kreatiewe groepsprobleemoplossing gebaseer is, te implementeer. Ongelukkig, kan sulke groepsmetodes vir verskeie redes oneffektief en logisties moeilik wees om te implementeer. Dus kan ‘n metode wat deur individue gebruik word baie waarde vir organisasies inhou. ‘n Individu-gedrewe metode kan werknemers as meervoudige probleem-oplossende enjins wat parallel aan mekaar werk, in plaas van as ‘n enkele sessie-gebaseerde probleem-oplossende enjin, soos in die geval van groepsmetodes, laat optree.

Die doel van hierdie studie was om ‘n kreatiewe probleemoplossingsmetode, genaamd die Ruimtelike Spelskepper (*Spatial Playmaker*) te ontwikkel en die effektiwiteit daarvan te toets. Na ‘n oorsig van relevante literatuur oor kreatiwiteit is diverse navorsingsstrome gebruik om ‘n rasionaal vir die gebruik van elke tegniek (beide bestaande en die wat geskep is deur die huidige navorser) wat deel vorm van die Ruimtelike Spelskepper, te ontwikkel. Om die effektiwiteit van die Ruimtelike Spelskepper empiries te evalueer, moes die beduidenheid van die effek van die gebruik van die Ruimtelike Spelskepper op (1) Oorspronklikheid, (2) Aanvaarbaarheid, (3) Implementeerbaarheid, (4) Effektiwiteit, en (5) Volledigheid van geproduseerde oplossings bepaal word.

Hierdie loodsstudie het van ‘n Voortoets-Natoets-Kontrolegroep navorsingsontwerp gebruik gemaak. Altesaam 60 Klein-Medium Mikro-onderneming (KMMO) eienaars het vrywilling aan die studie as intervensie- of vergelykingsgroepdeelnemers deelgeneem. Alle deelnemers was woonagtig in die Kaapse Wynlande streek van die Wes-kaap provinsie en was kliënte van verskeie klein besigheidsontwikkelingorganisasies. Verskille in voor- en natoetstellings van ‘n intervensiegroep (n_i=30), wat ‘n halfdag opleidingsintervensie bygewoon het, is vergelyk met die tellings van die vergelykingsgroep (n_c=30). Die vyf afhanklike veranderlikes (d.w.s. Oorspronklikheid, Aanvaarbaarheid, Implementeerbaarheid, Effektiwiteit, en Volledigheid) is gemeet deur gebruik te maak van evalueringskale wat deur Dean, Hender, Rodgers, en Santanen (2006) ontwikkel is.

Die resultate toon dat daar ‘n beduidende groep/tyd interaksie-effek op vier uit die vyf afhanklike veranderlikes, naamlik oorspronklikheid, aanvaarbaarheid, effektiwiteit, en volledigheid, was ($p < .01$ vir al vier veranderlikes). Verder het post hoc vergelykings getoon dat die intervensiegroep beduidend beter as die vergelykingsgroep ten opsigte van hierdie vier veranderlikes op die na-toets presteer het ($p < .01$ vir al vier veranderlikes). Daar is ook ‘n groep/tyd interaksie-effek op die vyfde veranderlike (d.w.s.

implementeerbaarheid) gevind, maar die effek was nie beduidend nie ($p > .05$). In teenstelling met die verwagtinge is bevind dat die vergelykingsgroep beter as die intervensiegroep ten opsigte van implementeerbaarheid op die na-toets presteer het. Gesamentlik suggereer hierdie bevindinge dat die Ruimtelike Spelskepper beduidende voordele as kreatiewe probleem-oplossingsmetode vir individue inhou. Gevolglik word die afleiding gemaak dat die gebruik van die Ruimtelike Spelskepper ‘n positiewe impak op die oorspronklikheid, aanvaarbaarheid, effektiwiteit, en volledigheid van die oplossings wat deur die intervensiegroep gegenereer is, gemaak het. Hierdie studie dra by tot vorige navorsing wat die opleiding van individue in die gebruik van kreatiewe probleem-oplossingsmetodes ondersteun.

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"Almost all creativity involves purposeful play."

- Abraham Maslow

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CHAPTER 1

INTRODUCTION

1.1 Background to the Research Challenge

Problems are a pervasive part of human life and the world of work. There is no profession that is problem-free and all occupations, as well as the sciences occupied with the improvement of practice (such as Industrial Psychology), owe their existence to the human endeavour to solve problems. Progress made on an individual, group, team, organisational and societal level can invariably be traced back to attempts to either solve the same problems in better ways or solve new problems brought into focus by previous solutions.

Currently, many organisations have a strong focus on innovation. This view is backed by research findings linking innovation to positive organisational outcomes such as organisational resilience (Mafabi, & Munene, 2015), organisational performance (Bowen, Rostami, & Steel, 2010), profitability (Geroski, Machin, & Van Reenen, 1993), and ultimately organisational survival (Cefis & Marsili, 2006). Innovation has also been found to be a mechanism by which intellectual capital (i.e. the intangible resources, capabilities, and competencies that results in value creation) is transformed into competitive advantage (Chahal & Bakshi, 2015). Innovation can occur at many levels within an organisation. At a broader level, organisations may innovate to create *blue oceans*, referring to markets that do not currently exist and are therefore uncontested by competitors (Kim & Mauborgne, 2004; Wubben, Düsseldorf, & Batterink, 2012). Organisations may innovate at the product level through new product development (Chang, Wei, & Lin, 2008; Kurkkio, 2011; Martinsuo, 2009). At the job or functional levels, innovations in work practices or processes may be introduced (Crossan & Apaydin, 2010; Wang & Ahmed, 2004).

However, innovation cannot be accomplished by rehashing previous solutions to problems. For innovation to occur, a creative act must be undertaken. Researchers have largely conceptualised creativity as either a component or an antecedent of innovation (Ford, 1996; Gilson, 2008; McFadzean, O'Loughlin, & Shaw, 2005; West, 2002; Woodman, Sawyer, & Griffin, 1993). Both of these conceptualisations support the importance of the link between creativity and innovation. Beyond preceding innovation or being one of its building blocks, creativity has been linked to desirable outcomes that do not necessarily result in a formalised adopted innovation such as sales performance (Bodla &

Naeem, 2014; Martinaityte & Sacramento, 2013) and advertising recall (Lehnert, Till, & Carlson, 2011; Till & Baack, 2005). Using the sales example, Wang and Netemeyer (2004) suggested that creativity helps salespersons to identify future sales prospects, understand customer problems, and tailor desirable solutions.

Yet creative problem-solving skills are not specifically addressed in schools' or many universities' curricula to prepare students for the challenges in the workplace. In an attempt to overcome this shortcoming, several researchers have developed practical methods and models to guide creative problem-solving.

1.2 Statement of the Research Challenge

Most practical creative problem-solving and idea generation methods are, however, group-based and collaborative. Runco (1999) suggested, in comparing social and individual variables cited as important to creativity, that the social factors may not be requisites for creativity to occur and that intra-individual factors may represent the real dynamic of creativity. The pre-occupation with group-based methods ignores the complexity that interpersonal relations bring into the creative problem-solving situations, as well as several problems that plague group-based methods namely social loafing, evaluation apprehension, production blocking, groupthink, the Abilene paradox, downward performance matching, the common knowledge effect, relational loss, and cognitive narrowing.

Social loafing occurs when individuals withhold their inputs or reduce their efforts within groups when they perceive their individual inputs cannot be identified (Van Dick, Tissington, & Hertel, 2009). According to Asmus and James (2005), this phenomenon is important for creative group processes, as efforts need to be elicited and coordinated to be effective. When all group members do not contribute to the best of their ability, the quality of the group product will suffer.

Evaluation apprehension refers to unease over being judged or evaluated by others, causing one to act in a manner that will likely result in a positive evaluation or avoid a negative one (Bui, 2007). Diehl and Stroebe (1987) contended that even under a 'do not criticize' brainstorming instruction, the problem of evaluation apprehension remains. For example, participants may rate others' ideas more positively so that their own ideas are evaluated positively by others. Evaluation apprehension is also related to psychological safety. In a psychologically safe environment, members share a general sense that others

will not punish them for their mistakes (Gu, Wang, & Wang, 2013). Therefore, in a psychologically unsafe environment, higher levels of evaluation apprehension are likely to occur.

Production blocking arises when people have to wait to express their ideas in a group and this, in turn, causes interference in cognitive processes that limits productivity (Nijstad, Stroebe, & Lodewijk, 2003). Interference occurs in two different ways. In cases where delays are unpredictable, individuals are required to monitor these delays using cognitive capacity that could have been used for a controlled search through memory, resulting in difficulties starting a new train of thought (Nijstad & et al., 2003). In instances where delays are long, the generation of semantically related ideas within a category is disrupted, resulting in fewer ideas within a category.

Groupthink is a type of thinking that occurs when a highly cohesive in-group's drive to attain unanimity prevents a realistic evaluation of other options resulting in those options being ignored (Janis, 1982; Koerber & Neck, 2003). According to Janis (1982), the symptoms of groupthink include three broad types. Firstly, there is an over-estimation of the group, which is characterised by the belief of the invulnerability and innate morality of the group (Eaton, 2001). Secondly, it is typified by closed-mindedness that encompasses stereotyping of out-groups and group rationalization. Lastly, groupthink presents pressures toward conformity, which include self-censorship, the illusion of unanimity, and direct policing of individual dissenting opinions (Eaton, 2001).

Another problem, which is often mistaken for groupthink, is called *the Abilene paradox* (Kim, 2001). The Abilene paradox differs from groupthink as cohesiveness, in-group versus out-group thinking, and policing of dissension plays less of a role. The Abilene paradox occurs when a group makes a decision or choice which is contrary to individual preferences of each individual within the group (Harvey, 1996). There is public mutual agreement on the course of action among group, because each individual erroneously assumes that it is the preference of the other group members (Harvey, Novicevic, Buckley, & Halbesleben, 2004). Individuals often misread 'signals' in support of such assumptions, fear being the 'spoiler' in the group, and subsequently go along with what they think is the group's preference. In essence, the Abilene paradox stems from the mismanagement of agreement (Rubin & Dierdorff, 2011). McAvoy and Butler (2009) noted that collective decisions may run contrary to constituent individual views, because group members do not voice their reservations on agreed options. The Abilene paradox may be particularly relevant during the idea selection phases of various group-based creative problem-solving methods.

Downward performance matching (also known as downward comparisons) occurs when group members conform to low performance norms (Pertula, Krause, & Sipila, 2006). In other words, while operating within a group context (such as when using a group problem-solving method) individuals may conform to the low level of performance that others within the group are maintaining. It should be noted that upward performance matching is also possible. However, a sense of competition or fears that lower performance may affect personal self-esteem must be present for upward performance matching to occur (Paulus, Dugosh, Dzindolet, Coskun, & Putman, 2002). Paulus and Dzindolet (1993) identified a variation of downward performance matching called 'the sucker effect', in which group members are afraid that social loafing will occur and they will be stuck doing most of the work. Consequently, these potential 'suckers' match their performance to the rest of the group.

The common knowledge effect occurs when the minority within a group who possess knowledge or information relevant to the problem fail to introduce this knowledge into the group discussion and, when it is discussed, it is undervalued by the group at large (Gigone & Hastie, 1993; Straus, Parker, & Bruce, 2011). In other words, this unique and potentially valuable information tends to be under-discussed and given low importance by the rest of the group (Baumann & Bonner, 2013). Reasons for the common knowledge effect are numerous (Kerr & Tindale, 2004). Firstly, the more widely information is known among a group, the more likely this information will be mentioned relative to less widely known information (Stasser & Titus, 1985). Secondly, individuals often enter group discussions with preferences strengthened by information widely known within the group. Thirdly, the more widely information is known within a group, the more likely it is to be repeated. The undervaluation of unique or less widely held information stems from the tendency of people to resist altering initial opinions even when disconfirming information is received (Bamber, Ramsay, & Tubbs, 1997; Betsch, Haberstroh, Glockner, Haar, & Fiedler, 2001; Hogarth & Einhorn, 1992).

According to Mueller (2012), *relational loss* is a process loss at the individual level whereby an individual team member perceives that assistance and support within the team are less available as team size increases. This is particularly important for group problem-solving methods that advocate larger group sizes, because Mueller (2012) found that individual performance decreases as the team size increases. This decrease in individual performance is due to the perception that their teammates are less likely to help or support them in larger teams. House (1981) identified four types of support required by team members, including informational support (i.e. information that team members require to solve problems), instrumental support (i.e. assistance requested from teammates), appraisal support (i.e. advice regarding setbacks), and emotional support (i.e. displays of positive emotions and trust towards teammates when they are struggling). The current researcher is of the opinion that if teammates

themselves are unfamiliar with or inexperienced regarding a group problem-solving method, relational loss may be magnified, as these team members may be too busy dealing with their own struggles with the method to assist others.

Cognitive narrowing involves group discussion focusing ideas in a single direction and limiting the number of alternate directions that are acceptable (Wood & Pickerd, 2011). This narrowing reduces the number of semantic categories in which ideas can be grouped, but not the number of ideas (Goldenberg & Wiley, 2011). In other words, if ideas from only two categories have been produced by group members, the rest of the group may tend to generate ideas in the same categories. Having access to other's ideas while coming up with one's own ideas, which is typical of open group discussion, produces ideas from fewer categories as individuals become fixated on previously salient categories (Kohn & Smith, 2010; Larey & Paulus, 1999).

In addition to these nine problems, group-based methods are often based on a single theoretic perspective and ignore multiple psychological perspectives that might enhance creativity. There is also a tendency for these methods to exclude steps or stages that could help the human mind prepare to be creative before working on the problem. Furthermore, very few of these methods capitalize on meta-cognitive mechanisms and, thus, do not address *thinking about your creative thinking.* Lastly, there appears to be a trend among both the practitioners and developers of some group-based methods to use an ever-expanding and non-compulsory set of creativity tools during some of the steps of these methodologies. Although, this does introduce flexibility in practice, it also causes definition problems as researchers might each be referring to slight variations of the same method. This has also led to the elaboration of these methods and consequently the hiring of specialist consultants to lead these creativity interventions at a premium, which has cost implications for the client organisation.

1.3 The Ineffectiveness of Group-based Idea Generation

Numerous studies have compared the performance of traditional interactive (i.e. face-to-face) brainstorming groups and nominal groups (i.e. individuals who generate ideas on their own and then pool these ideas). A key perceived benefit of brainstorming and other group-based methods is the number of ideas that are expected to be generated. However, when Mullen, Johnson, and Salas (1991) performed a meta-analysis, they found that groups generated fewer or at best the same number of ideas when compared to the summed efforts of several individuals. Several brainstorming studies have found that these nominal groups generated a greater number of ideas than traditional face-to-face

brainstorming groups (Hunton & Gold, 2010; Paulus, Dzindolet, Poletes, & Camacho, 1993; Paulus, Larey, & Ortega, 1995; Rietzschel, Nijstad, & Stroebe, 2006). Diehl and Stroebe (1987) reviewed 22 studies that compared the performance of traditional face-to-face brainstorming groups with that of nominal groups. The majority of these studies, 18 to be precise, found that nominal groups produced more ideas than traditional brainstorming groups. Another review of brainstorming versus nominal group studies conducted by Mongeau and Morr (1999) illuminated a similar pattern of results. In addition, studies have also found that nominal groups generated a greater number of original ideas than traditional brainstorming groups (Diehl & Stroebe, 1987; Rietzschel, Nijstad, & Stroebe, 2006). Still other studies indicated that nominal groups generated ideas from more semantic categories than did brainstorming groups (Larey & Paulus, 1999). In other words, nominal groups produced a greater variety of ideas.

These findings are not only a modern occurrence. Even during the early years of brainstorming, Taylor, Berry and Block (1958) found that nominal groups outperformed brainstorming groups in terms of quantity of ideas as well as quality of ideas. Subsequently, in a move that is relatively rare in social science, several researchers have strongly discouraged the use of traditional face-to-face brainstorming (Diehl & Stroebe, 1991; Mullen et al., 1991).

However, there have been some positive findings regarding practices and procedures that may improve group creativity. Studies have indicated that the use of a trained facilitator (i.e. a nongroup member who ensures that time is used efficiently while remaining impartial) can improve performance of interactive brainstorming groups to levels that at least match the performance of nominal groups (Kramer, Fleming, & Mannis, 2001; Offner, Kramer, & Winter, 1996; Oxley, Dzindolet, & Paulus, 1996). Kramer et al. (2001) suggested that the encouragement to produce additional ideas that facilitators provide to group members may reduce social loafing and downward performance matching. In another study by Paulus, Nakui, Putman, and Brown (2006), groups with facilitators actively enforcing additional rules (e.g. do not explain ideas; do not tell stories) used fewer words to express their ideas than groups adhering to traditional brainstorming rules. This may reduce production blocking to degree as shorter ideas result in participants spending less time waiting for their turn. However, it is the opinion of the current researcher that active facilitation cannot totally eliminate production blocking, because ideas from multiple members cannot be heard simultaneously. In addition, although a trained facilitator may create a psychologically *safer* brainstorming environment through reassurances, the fact that traditional brainstorming is a group activity means it can never be completely psychologically safe and thus leaves participants susceptible to evaluation apprehension.

Choi and Thompson (2005) found that changing group membership between sessions by adding a new member from another idea generating group increased the number of ideas as well as the diversity of ideas as compared to closed groups (i.e. groups with unchanged membership). Beyond the group performance improvement, after membership change, the creative performance of existing group members also improved. However, the current researcher suspects that this result will not hold when existing group members possess a high degree of cohesiveness prior to the addition of the new member. Therefore, this may leave such a membership change procedure vulnerable to groupthink. The common knowledge effect and cognitive narrowing may also be threats, especially if all the existing group members are given the opportunity to offer ideas before the new member has the chance to speak.

Another route to overcoming the limitations of brainstorming is to change the medium from traditional face-to-face to electronic brainstorming. In their meta-analytic study, DeRosa, Smith, and Hantula (2007) found that electronic brainstorming produced more unique ideas than face-to-face brainstorming. In addition, the study found electronic brainstorming outperformed face-to-face brainstorming in terms of idea quality. In another study involving auditors brainstorming fraud risks, electronic brainstorming groups identified more relevant fraud risks than face-to-face brainstorming groups (Lynch, Murthy, & Engle, 2009). However, electronic brainstorming may be susceptible to cognitive narrowing. In other words, participants tend to offer similar or related ideas in the same category to those previously submitted (Dennis et al., 1997). Furthermore, electronic brainstorm participants may get distracted when they read the off-topic comments and ideas that other participants make (Pinsonneault, Barki, Gallupe, & Hoppen, 1999; Potter & Balthazard, 2004). Such distraction can be detrimental to the generation of relevant ideas.

1.4 Reasons for the Popularity of Group-based Creative Problem-solving Methods

This section details with some of the reasons why group-based creative problem-solving methods are so popular within organizations.

1.4.1 The romance of teams

The romance of teams is defined as a belief in the effectiveness of the team-based arrangement of work that is not supported by empirical research evidence (Allen & Hecht, 2004; Paulus & Van der Zee, 2004).

The previous section described the ineffectiveness of group-based work compared to individuals working alone (i.e. nominal groups). Allen and Hecht (2004) suggest that the romance of teams persist for a variety of reasons. Participating in groups and teams may satisfy social needs, reduce uncertainty, lead to greater enjoyment, and allow individuals to deflect failures away from the self to the rest of the group to maintain feelings of self-efficacy. There are also illusory beliefs regarding group productivity that may contribute to the romance of teams. In a survey, Paulus et al. (1993) found that most participants believed that they would produce a greater number of ideas working in groups than they would individually. In a second experiment, group brainstorming participants rated their own performance higher than nominal group participants did their own performance. Nominal group participants also expressed the opinion that they could have produced superior quality ideas if they had participated in brainstorming groups. This phenomenon is known as the illusion of group productivity.

1.4.2 Perceptions surrounding the quantity and quality of ideas produced by groups

Group-based methods are often aimed at increasing the quantity of ideas, instead of developing a single creative idea to its full potential. However, the reader will recall from a previous section of this chapter that most evidence disconfirmed the widely held notion that groups generate more ideas compared to an equal number of individuals (i.e. nominal groups). In fact, groups tend to produce fewer ideas than the summed efforts of several individuals. This preference for quantity is based on the assumption that a larger set of ideas is more likely to contain a quality idea. However, research support has been mixed, with some studies reporting a positive correlation between idea quantity and idea quality (Diehl & Stroebe, 1987; Gallupe et al., 1992) while others have alluded to a negative correlation (Connolly, Jessup, & Valacich, 1990; Graham, 1977).

1.5 The Importance of Developing Individual Creativity

As mentioned in the background of the problem section, creativity is a prerequisite for innovation and innovation, in turn, is essential to stay competitive in today's globalised environment. It should be recognized that individual creativity is not relatively fixed like a personality trait, but can be developed. Thus, an organisation's workforce can improve their capacity for producing creative ideas and these ideas may lead to radical innovations (e.g. truly creative solutions such as new product breakthroughs). Developing individual creativity is important as group-based creativity, hampered by problems outlined in previous sections, may only lead to incremental innovation characterised by minor changes to

products or processes that may lead to minor organisational performance improvements. Individual creativity may be able to bypass the 'cut and paste' natures of many popular group, organisation-wide, and even industry-wide approaches to performance improvement. It may be that these performance improvement initiatives are symptomatic of organizations running out of ideas and lacking the know-how to elicit individual creativity.

One such popular approach to performance improvement, benchmarking, is defined as the search for the best practices within an industry that will result in greater performance (Adebanjo, Abbas, & Mann, 2010). However, even if processes from the benchmarked organisation are successfully replicated, the benchmarking organisation can at best be the second best at implementing those processes, because the benchmarked organization has more experience with these processes. This might be acceptable if the benchmarking exercise conforms to generic benchmarking; the type of benchmarking aimed at comparing operations from unrelated industries (Galletti, Lee, & Kozman, 2010). However, if the benchmarking exercise constitutes competitive benchmarking and is aimed at comparing the operation with that of a direct competitor, then its output will have to be accompanied by innovation to improve the benchmarked process to gain competitive advantage. There is also the risk that the benchmarked organisation is itself continuously improving, causing any benchmarked processes to be outdated by the time the benchmarking organisation implements these processes. Clearly, benchmarking is no substitute for innovation or creativity.

1.6 The Research Question

It is important not to confuse the focus on individual creativity as a focus on creative individuals. In other words, the study of the lone creative genius will not be central to the current study, nor will the trait approaches to creativity.

The preceding sections have led to the following central research-initiating questions:

- *Is it possible to develop a creative problem-solving method for use by individuals, based on multiple theoretic perspectives, and which consists of sequential stages that contain specific thinking tools?*
- *If it is possible, will such a method be effective?*

In answering the first question, it is the position of the current researcher that individual creativity can be developed, and that this development can be aided by an individual method that sidesteps the

problems inherent in group-based methods. Therefore, the focus of this research study shall be the development of the method and then answering the second question.

1.7 The Research Goal

Flowing from the preceding sections of this chapter, the current study aims to fulfil the following specific research objectives:

1. Develop a creative problem-solving method based on psychological research for use by individuals;
2. Implement the new creative problem-solving method in a preliminary trail run; and
3. Evaluate the effectiveness of the new creative problem-solving method;

It is hoped that this method will significantly improve individual creative problem-solving output while eliminating training delays of more elaborate methods, the scheduling delays related to group methods and the costs associated with more commercial, consultant-driven methods.

1.8 Overview of the Thesis

Chapter 2 introduces the literature concerning the psychological study of creativity. It provides an in-depth review of literature through the lens of the four Ps of creativity (i.e. process, person, press, and product). It concludes with the review of existing creative problem-solving methods. Chapter 3 provides details on the development of the Spatial Playmaker method of creative problem-solving and its related training intervention. Chapter 4 presents the methodology used in the research study. Finally, Chapter 5 reports the results of the study and presents a discussion of these results. Limitations of the study and possible avenues for further research are also addressed.

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to provide a critical overview of creativity research. An explanation of the construct of creativity and related concepts are presented. Thereafter Rhodes' (1961) 4-P framework of creativity research is utilised by reviewing theories of the creative process, creative product, creative person, and the creative press. Creative process theories answer the question: How does creativity work in the mind of the individual? Creative product theories answer the question: What makes a product creative? In addition, intrapersonal factors that affect individual creativity are discussed. Creative person theories answer the question: What makes a person creative? Creative press theories answer the question: How does the environment affect creativity? Subsequent sections discuss theoretical perspectives and empirical research on the deliberate development of creativity. Finally, thirteen of the most well-known creative problem-solving methods are discussed and critiqued.

2.2 Definition of Creativity

Creativity refers to the goal-oriented mental process that results in a product (i.e. an idea or solution) that, once perceived as suitable and novel, stimulates people's intention to use, appreciate, or buy it (Zeng, Proctor, & Salvendy, 2011).

According to Feist and Barron (2003, p. 63), "creativity is a specific capacity to not only solve problems, but to solve them originally and adaptively."

Sternberg and Lubart (1999, p. 3) proposed that "creativity is the ability to produce work that is both novel (i.e. original, unexpected) and appropriate (i.e. useful, adaptive concerning task constraints)."

It is evident from the above definitions that there is general consensus that creativity involves the production of ideas that are both novel and useful.

2.3 Clarification of a Related Concept: Innovation

Creativity has often been confused with the related construct of innovation. This section attempts to highlight the differences between creativity and innovation by defining the latter.

Martins and Terblanche (2003, p.67) define innovation as "the implementation of a new and possibly problem-solving idea, practice or material artefact (e.g. a product) which is regarded as new by the relevant unit of adoption and through which change is brought about."

Baregheh, Rowley, and Sambrook (2009, p.1334) view innovation as "the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace."

The innovation process has been conceptualised as consisting of stages. Some scholars favour an innovation process consisting of two stages. One such model presented by Mumford, Scott, Gaddis, and Strange (2002) includes a first phase of *idea generation* and a second phase of *idea implementation*.

Others propose a three-stage model. For example, McFadzean, O'Loughlin, and Shaw (2005) presented innovation as consisting of three stages labelled idea generation, problem solving, and implementation and diffusion. The first stage, *idea generation*, consists of two chronological sub-processes entailing the identification of a need followed by idea formulation. The second stage, *problem solving*, involves firstly a sub-process of design and evaluation, then prototyping a solution. The final stage, *implementation and diffusion*, encompasses a first sub-process of commercial development and subsequently manufacturing and marketing.

Majaro (as cited in McAdam & McClelland, 2002) proposed innovation as a four-stage process. *Idea generation* is once again the first stage. Next, the *screening* stage entails checking whether generated ideas are compatible with the organisation's objectives and rejecting non-compatible ideas. The third stage involves determining the *feasibility* of the remaining ideas, both from a technical and commercial standpoint. The final stage, *implementation*, is where the new idea is commercialised.

There are many typologies of innovation used in innovation research literature. One common typology used by researchers (Garcia & Calantone, 2002; Gatignon, Tushman, Smith, & Anderson, 2002) focuses on the degree to which innovations are revolutionary in order to delineate incremental and radical innovation. *Incremental innovations* refer to the gradual improvement of existing products or solutions as seen from the perspective of the organisation or end customer (Partanen, Chetty, & Rajala, 2011). *Radical innovations* have a major impact on the field, possess significant advantages when compared to competing solutions, and are seen as revolutionary.

Another categorization of innovation popularized by Christensen's (1997) book, *The innovator's dilemma: When new technologies cause great firms to fail*, is the distinction between sustained and disruptive innovations. Sustained innovations are incremental or radical improvements of existing products in terms of attributes of performance traditionally valued by mainstream customers in major markets (Corsi & Di Minin, 2014). Disruptive innovations are also improvements of existing products, but relating to performance dimensions that differ from those valued by mainstream customers. These innovations initially underperform, but become disruptive when they reach the same performance level of market leaders in terms of mainstream attributes, while maintaining their performance level relating non-mainstream performance attributes. For example, mainstream customers in the hard disk drive market during the 1980s valued improvements in the attribute of storage capacity, while a smaller segment valued physical hard disk size. By the 1990s the performance of smaller firms, who initially catered only for the smaller segment by concentrating on physical hard disk size, improved on the mainstream attribute of storage capacity and displaced previous market leaders (Corsi & Di Minin, 2014).

It is evident from the definition, the various process models, and innovation typologies presented that creativity is inextricably part of the innovation process. No type of innovation can be realised without creativity being utilised first. Specifically, creativity is clearly located within the idea generation stage of the innovation process, regardless of which model is selected. Thus, this is also the stage of the innovation process where the current study is situated.

2.4 Creative Process Theories

As alluded to in this chapter's introduction, creative process theories attempt to describe the creative process at work in the mind of the individual. This section outlines the most prominent among the creative process theories.

2.4.1 Wallas' Creative process

The earliest cited attempt to decompose the creative act as a process was the four-stage model developed by Wallas in 1926. Wallas based his model on self-reports such as Poincaré's discovery of the existence of presumed impossible mathematical functions called *fuschian functions* (Weisberg, 2006). One night, after toiling for fifteen unsuccessful days, the mathematician had trouble sleeping. It was then, while still awake, that many of his ideas on the subject combined within his mind to form the proof he required. Poincaré felt that he was only an observer during this insight and did not direct these thoughts in any way (Weisberg, 2006).

According to Wallas, the process begins with a stage called *preparation*, where the problem-solver senses the problem, focuses the mind on the problem, and senses its dimensions. During this stage, problem-solvers consciously and deliberately draw on their education, problem-relevant knowledge and skills (Lubart, 2001).

Next, the *incubation* stage occurs, where the problem-solver does not consciously work on the problem (Lubart, 2001). However, during this stage it is believed that the thinking about the problem continues unconsciously. It is argued that a period of distraction away from the problem produces superior problem-solving compared to working on a problem continuously (Ellwood, Paller, Snyder, & Gallate, 2009; Penaloza & Calvillo, 2012). Research support for incubation has been mixed, with some studies showing a strong incubation effect, while other research efforts found no such effect. In a recent study, Gallate, Wong, Ellwood, Roring, and Snyder (2012) found support for Wallas' incubation stage, suggesting that creative people should be exposed to a problem well in advance and that this gives them greater benefit in terms of their creative output than creative people who are exposed shortly before ideas are solicited. However, it is noteworthy that proponents of incubation disagree on how incubation works. According to Kohn and Smith (2009), one explanation is the *forgetting-fixation account,* which posits that a break or period of distraction allows problem solvers to forget initial incorrect strategies or solution paths on which the problem-solvers may have been fixated. Another possibility is

that incubation provides rest and recovery after a problem-solver becomes mentally exhausted from thinking about the problem (Sawyer, 2012).

The third stage is *illumination*, in which new ideas and relationships present themselves in the form of sudden insights. Continuing the analogy from the previous stage, Weisberg (2006) refers to the illumination stage as where the incubated solution hatches. Alberti, Dejean, and Cayol (2007) argued that the existence of the incubation and illumination stages suggest that, in Wallas' conception, creativity is partly unconscious and therefore uncontrollable. The authors also proposed that this reveals that Wallas advocates the lone genius view of creativity. Holm-Hadulla (2013) casted doubt over the sudden nature of illumination, suggesting that this is an artifact preserved from the term's mythical and religious origins where divine enlightenment is the source of all creative inspiration.

Verification is the last stage where the idea is consciously elaborated and tried in the real world. According Holm-Hadulla (2013), this stage determines whether the final creative product is creative in an everyday sense, meaning only creative to the problem solver, or whether it is viewed as novel and useful by society at large.

It should be noted that Wallas intended for it to be possible for the problem-solver to return in earlier stages in the process. Lubart (2001) noted that if a solution is judged as incorrect during verification, the creator could incubate on how to fix this state. Alternatively, reactions from the wider community could spark and shape motivation for new creations (Holm-Hadulla, 2013). In addition, if a problem can be broken into sub-problems, it is possible for phases to occur simultaneously for various sub-problems (Lubart, 2001).

Although Wallas' conceptualization is one of the oldest, theorising and research focusing on much of its elements is still being undertaken. Furthermore, despite countless other models of the creative process that have been proposed and criticism against the Wallas model, his stage process is still frequently quoted in creativity literature. Ambuster (1989) suggested that this is due to:

(i) the inability of scholars to produce a superior model;

(ii) the perception that the model broadly matches many self-reports; and

(iii) the perception that the model is implicit in the work of many creativity scholars.

The strength of the Wallas model is its accessibility due to its simplicity and small number of stages. Stated differently, it is easy to teach it to those not immersed in psychological creativity research.

One major drawback of this model alluded to earlier is that little detail is provided of how stages such as incubation and illumination occur. This compounds the popular belief that creativity is a mystical and mysterious phenomenon. Perhaps the most serious limitation of Wallas' creative process model is the fact that it was based on self-report data from eminently creative individuals (Weisberg, 2006). Regardless of the fame or eminence of a creator, self-reports are subject to various limitations such as embellishment, self-deception, and recall problems when self-reports occur years or decades after the creative act. Self-reports of creative discoveries may represent positive flashbulb memories. These memories are highly vivid and enduring memories of events that are emotionally significant at a personal level (Lanciano & Curci, 2012). Although people have a high degree of confidence in the accuracy of these memories and the detail of recollection, flashbulb memories are not superior to everyday memories in the manner that they are recalled and can therefore be just as inaccurate (Kraha & Boals, 2014). These limitations call into question the validity of a model, derived solely from self-report data.

2.4.2 Campbell's Blind Variation and Selective Retention (BVSR) theory

According to Campbell's 1960 Blind Variation and Selective Retention (BVSR) theory, a person alters a specific idea in a variety of ways to produce several variants, selects the fittest variant(s), then repeats the process until an acceptably creative idea is produced. The essence of the theory is that to produce anything truly creative one must use a trial-and-error or generate-and-test procedure (Simonton, 2013). Although steeped in evolutionary terminology, this view of creativity has fallen out of favour in modern times and has its critics. However, this theory is still being promoted by researchers, such as Simonton, who support the theory's naturalistic trial-and-error basis of creativity.

Blind variation is the generative component of the theory, initially referring to variations occurring *randomly,* independently of environmental conditions (Simonton, 2011). However, Simonton has since abandoned the requirement of *randomness* within the theory. Currently, *blindness* refers to the individual not knowing the effectiveness or value of the variations he/she produces in advance (Simonton, 2013). He cited four processes that should produce blindness:

1. *Associative richness.* Once the mind is stimulated, individual or collective associative processes can be initiated that display a degree of blindness.

2. *Defocused attention.* At times, individuals will respond to stimuli that have been proven to be irrelevant to the problem and the resultant ideas tend to be more unpredictable. In a related manner, after repeated failures to solve a problem, a creative person may then divert attention

to unrelated (and sometimes everyday) tasks. These unrelated tasks may produce a greater variety of association.

3. *Behavioural tinkering*. At times, creators may opt to make ideational trials take an external form. In other words, they may take their initial ideas out of their heads and give those ideas physical or observable form. For example, a musician playing a few note combinations aloud or a painter doing a few sketches to discern what is most interesting to them or potentially fruitful going forward.

4. *Heuristic search.* This refers to the use of rules of thumb that may or may not lead to a solution. These heuristic methods are in contrast to algorithmic methods that are step-by-step protocols that *guarantee* a solution.

Weisberg and Hass (2007) criticised Simonton's BVSR theory's dependence on special cognitive processes, such as the four cited above, to produce novel ideas. A second criticism lodged against BVSR by these authors is that Simonton views the creative process as operating without planning or foresight. In their view, an individual can still have a broad plan for a solution but still be 'blind' as to whether the specifics will work. Therefore, blindness does not equal a complete lack of foresight.

Selective retention is the second phase of the theory, wherein criteria are developed from the initial problem situation to determine the utility of the generated ideas or variations (Simonton, 2010a). These criteria are then used in a selection process that facilitates the pruning down of variants until one variant meets all the criteria (Dasgupta, 2011).

At a broader level, Dasgupta (2011) criticised Simonton's claim that BVSR is a universal explanation of the creative process, while simultaneously asserting that different domains require different levels of blindness. For example, Simonton (2010b) stated that scientific creativity generally requires less blindness than artistic creativity and that in the sciences alternative variants are often limited to just two via a previously unmentioned process called pre-selection. Further eroding the BVSR universality claims, Dasgupta (2011) also highlighted Simonton's claim that more blind variation will be required for big C or eminent creativity than for everyday creativity. Another blotch on BVSR is Simonton's use of self-reports of the creative processes by eminent creators, such as Poincaré, as evidence for BSVR. The limitations of such an approach have been discussed under other creative process theories in this section.

Gabora (2010; 2011) cites more conceptual criticism against BVSR as a theory of creativity. Simonton highlighted Picasso's use of multiple numbered sketches (showing a deviation from gradual improvement), while creating the painting called Guernica, as evidence supporting BVSR. The main evidence of this deviation was backtracking, meaning experiments that were initiated, not developed further, and which did not make it into the final painting. However, Gabora (2011) noted that what appears to be backtracking at the external behavioural level does not necessary reflect backtracking at a cognitive level and may actually be forward progress. In addition, switching between sketches of different parts of an overall vision may falsely appear to be backtracking. The BVSR theory's use of the evolutionary term *variants* (and by implication variation) implies that two or more entities have a common ancestor. However, in the study of creativity, unlike biology, there is no way to objectively determine which ideas are or are not variations of other ideas (Gabora, 2010).

Gabora (2010) argued that it is not immediately apparent what advantages a variation-selection theory, such as BVSR, offers over more conventional two-stage theories such as *geneplore* (discussed in the next sub-section). Runco (2010a) took this criticism a step further by questioning BVSR's strict two-stage sequential nature with *blind variation* focused on originality and *selective retention* aimed at utility. According to Runco (2010a), human minds are adapted for simultaneous processing and it is possible for the effectiveness of ideas to be considered at the time of ideation and not necessarily during a second stage.

It is the opinion of the current researcher that the Blind Variation and Selective Retention theory suffers from an attempt to cling to evolutionary terminology and shoehorn the creative process into an evolutionary framework. However, in response to criticism, Simonton (2012) has reformulated the BVSR theory to address some of the highlighted shortcomings in several ways. One, the term 'variants' has been replaced by 'potential solutions' to unchain the theory from Darwinian connotations. Two, instead of focusing on the blindness of potential solution sets, the reformulated BVSR theory uses sightedness of solution sets, because critics such as Kronfeldner (2010) have suggested that sightedness is more easily quantifiable, while blindness is qualitative in nature. Essentially, the newly reformulated theory posits that highly creative solutions will tend to be less sighted. Three, a solution creativity index has been developed for assessing single solutions, conceptualising the creativity of a solution as its usefulness multiplied by its originality (i.e. improbability). Finally, to address Runco's (2010a) criticism, the reformulated BVSR's two phases, *blind variation* and *selective retention*, may take place either sequentially or simultaneously.

Time will tell whether these changes will be well received by its critics and whether the newly evolved, yet less evolutionary, BVSR theory will add value to the study of creativity.

2.4.3 Finke, Ward, and Smith's Geneplore model

A relatively new approach to studying the creative process is called the creative cognition approach, which posits that (i) people are naturally creative and creativity is a feature of normal cognition; (ii) the psychological processes resulting in creative products can be studied via experiments; and (iii) these processes are observable (Ward, Smith, & Finke, 1999). In addition, the originators of this approach, Finke, Ward and Smith also theorised that these cognitive processes are organized in a bottom-up fashion (Weisberg, 2006). In other words, input from the environment is analysed via the senses, then the resultant sensory information is processed via perception, and finally relevant information in memory is sought that matches processed information before creative problem solving can begin (Weisberg, 2006). Much of the creative cognition approach is built upon experimental research that other cognitive psychologists have undertaken in areas such as mental imagery, combinatorial creativity, mental blocks, novel tasks, etcetera (Piirto, 2004).

Out of the creative cognition approach, they have developed a model of the creative process called the *geneplore model*. According to the geneplore model, creative thinking encompasses two processing stages. First, there is a *generation stage* in which generative processes such as association, memory retrieval, transformation, synthesis, categorical reduction and analogical transfer are used to create mental representations called pre-inventive structures (Finke, Ward, & Smith, 1992). *Memory retrieval* and *association* are the generative processes that produce the most simplistic pre-inventive structures as they happen rapidly, but suffer from fixation effects (i.e. being unable to view an idea outside of its original context or use). *Mental transformation* and *synthesis* produce a wider variety and more intricate pre-inventive structures. *Analogical transfer*, in which relationships are transferred to another context, is another common generative process. *Categorical reduction* refers to mentally reducing concepts or objects to more basic descriptions such as viewing a cup as a container for hot liquid allowing for consumption (Finke et al., 1992).

This process is repeated until several pre-inventive structures, which are not creative products in themselves, exist (Finke et al., 1992). *Visual patterns* and *object forms* are two pre-inventive structures that are primarily visual and spatial images that may eventually lead to new designs. *Mental blends* are pre-inventive structures that include metaphors, merged images, and conceptual combinations. Pre-

inventive structures may also take the form of *category exemplars*, which are hypothetical categories that resemble existing categories in some respects but differ in terms of others (Finke et al., 1992). *Mental models* are pre-inventive structures that mentally depict physical or conceptual systems. *Verbal combinations* are interesting arrangements of words or phrases that are not blended like mental blends and that may be used for poetic or literary creativity. Some musical forms may also represent pre-inventive structures.

These pre-inventive structures are then mentally visualised and manipulated to test them in usage situations. For more complex problems with many parts, the geneplore model suggests that great creators often physically externalize these pre-inventive structures or take these pre-inventive structures outside of their heads during the generation stage or later exploration stage (Sawyer, 2012). This externalization can occur verbally, visually and even mathematically, depending on the problem faced and modifications can be made afterwards. Day (as cited in Sawyer, 2012) found that when progress is stifled during problem-solving, it is because inappropriate external representations not matching the type of problem are being used. For example, when faced with certain classes of design problems, written language is only suited for conveying classes of objects (e.g. boxes) rather than specific objects (e.g. shapes with no known names). Therefore, visual representations or externalizations are superior for specific objects as this allows designers to see consequences of using specific objects (Nijstad, De Dreu, Rietzschel, & Baas, 2010). According to the geneplore model, creative thinking attempts to capitalise on properties of pre-inventive structures (outlined in Table 2.1) so that final creative products possess most of these properties.

Table 2.1

Pre-inventive Structures and Properties according to the Geneplore model

Pre-inventive Structures	Pre-inventive properties
Visual patterns	Novelty
Object forms	Ambiguity
Mental blends	Meaningfulness
Category exemplars	Emergence
Mental models	Incongruity
Verbal combinations	Divergence

Note. Adapted from “Explaining creativity: The science of human innovation (2nd edn.),” by R.K. Sawyer, 2012, p. 137. Copyright 2012 by Oxford University Press.

However, it should be emphasised that no single property is essential. *Novelty* is a desired property, because the chances of a creative product are increased if the pre-inventive structure itself is uncommon (Finke et al., 1992). *Ambiguity* creates greater opportunity for exploration and interpretation, especially where concepts are involved. *Meaningfulness* refers to a pre-inventive structure's sense of meaning and potential for inspiring new interpretations. *Emergence* is the degree to which unanticipated features manifest in a pre-inventive structure, especially in those structures that form via mental synthesis (Finke et al., 1992). *Incongruity* is the conflict inherent in the elements of a pre-inventive structure and motivates further exploration. *Divergence* is existence of multiple (non-conflicting or non-mutually exclusive) meanings or uses within the same pre-inventive structure.

Then, the exploration stage starts in which exploration processes such as conceptual interpretation, contextual shifting, attribute finding, functional inference, hypothesis testing and limitations search are used to organise, interpret the meanings of and evaluate these pre-inventive structures (Finke et al., 1992). *Conceptual interpretation* involves finding a theoretical, metaphorical, or abstract interpretation of a pre-inventive structure. *Contextual shifting* refers to imagining the pre-inventive structure in a different context. *Attribute finding* is the mental scanning of the pre-inventive structures for unknown or unexpected features. *Functional inference* involves imagining uses for a pre-inventive structure. *Hypothesis testing* refers to mentally testing pre-inventive structures as possible solutions to problems. *Limitations search* entails attempts to discover for which problems pre-inventive structures will not work and which solutions are not feasible, which makes future searches easier. The resultant interpretations produce insights that either focus on specific issues or modify pre-inventive structures in an expansive manner (Van der Lugt, 2002). It should be noted that constraints on the creative product can be set during either stage of the model (Van der Lugt, 2002). According to Finke et al. (1992), the creative problem-solving process ends when one or a combination of these structures meet all the constraints and is therefore sufficient to solve the problem.

This geneplore model rejects the *abrupt insight* view of creativity, but proffers a more incremental process. If a creator undertakes the two-phase geneplore process and is unsuccessful in creating a creative product, he/she may return to generative phase, abandon the initial pre-inventive structure and generate another such structure. Alternatively, he/she may modify the pre-inventive structure and repeat the exploratory phase. Depending on the level of refinement required by the creator, the geneplore model may operate in a cyclical fashion. Another important aspect to note is that the geneplore model views intrinsic motivation, especially the joy of creative discovery, as important for creativity and that intrinsic motivation can be activated before the generation phase or once pre-inventive structures have been formulated (Finke et al., 1992).

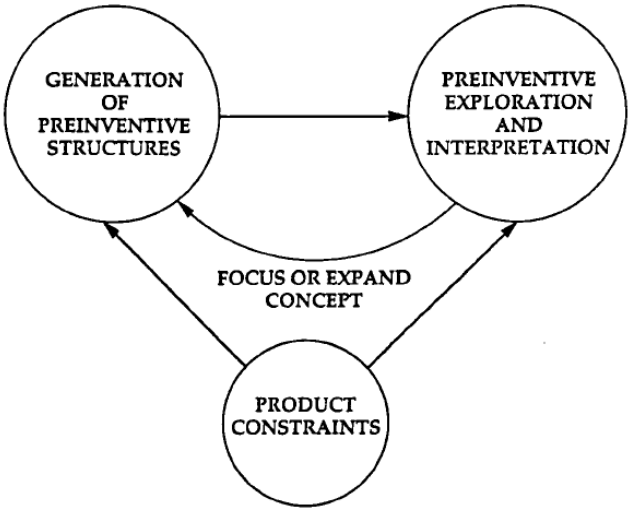

Figure 2.1. The basic structure of the geneplore model. Reprinted from "Brainsketching and how it differs from brainstorming," by R. Van der Lugt, 2002, Creativity and Innovation Management, 11, p.49. Copyright 2002 by Blackwell Publishing Limited.

An example of the geneplore model in action is the 1940s saxophonist, Charlie Parker, who is considered to be an all-time great of the Jazz genre in the main because of his improvisations that were both novel and appropriate (Cropley & Cropley, 2009). It appeared as if his improvisations arose from nothing each time. In reality, Parker had developed an extensive collection of 100 musical sequences or 'licks' (pre-inventive structures) varying between 4 and 10 notes in length, which he combined and recombined to produce novel performances (Cropley & Cropley, 2009). It could be theorized that Parker retrieved some of these licks from memory, combined several in a new synthesis such as a melody line, sound-tested it mentally, and then arranged it with other newly created pre-inventive structures to create a Jazz performance. Parker's initial problem may have been 'How do I express my current feelings musically?'

Another, far less famous, but no less creative, example comes from a chance encounter the current researcher had one afternoon upon entering an unusual sushi bar in a town in the Karoo, a region in the Western Cape known for its lamb. Upon scanning the menu, it was evident that most of sushi items contained biltong (i.e. South African spiced and dried meat) instead of fish. It can be theorised that the entrepreneur-owner of the sushi bar had engaged in a *mental transformation* or a *synthesis* (generative processes) that produced a *mental blend* of 'biltong sushi' (pre-inventive structure). This pre-inventive structure possessed *novelty* (pre-inventive property) and subsequently the entrepreneur explored this further, possibly via *limitations search* (explorative process) by determining whether all regular sushi items (Ngiri, Fashion sandwiches, California rolls, etcetera) would work with biltong in it instead of the more traditional fish or prawns. This was accomplished by *externalisation* or crafting sample biltong

sushi and taste-testing. This lead to expanding the pre-inventive structure into a final creative product: a full biltong sushi menu.

One of the strengths of the geneplore model is that it allows for some people to be more skilled in the generative phase, while others may excel at the explorative phase without either being less creative than the other (Finke et al., 1992). For example, Mozart created complete compositions in single attempts, while Beethoven constantly revised his initial compositions, exploring new possibilities.

While contributing in outlining various generative and exploration processes that may play a role in creative thinking, Weisberg (2006) contended that the bottom-up geneplore model contradicts the evidence for top-down processing that places greater emphasis on the role of knowledge and expectations about the world. The top-down approach expands the role of memory to beyond just a mechanism for recognition to the seat of knowledge, concepts and expectations, which is viewed as the starting point for processing. However, the current researcher is of the opinion that the geneplore model does not minimise the role of knowledge and expectations. It merely views generative processes that rely heavily on prior knowledge, such as memory retrieval and association, as fairly common, but likely to create less creative pre-inventive structures.

Weisberg (2006) suggested that there was no pre-inventive structure when Picasso painted his anti-war painting, Guernica. However, Weisberg (2006) also admits that Picasso sketched the structure of Guernica before painting it. These pre-painting sketches could be considered to be externalisations of *object forms* or *visual patterns*, both examples of pre-inventive structures.

2.4.4 Koestler's Bisociation

Koestler (1964) conceptualised bisociation as a thinking process in which one combines two habitually unrelated matrices of thought. A matrix refers to any ability, skill, or any pattern of activity governed by a code or a set of rules. According to this theory, routine thinking operates on a single matrix while the creative process of bisociation always operates on multiple matrices. Bisociation is therefore double-minded and follows more than one set of rules. FIgure 2.2 is a depiction of two matices of thought being combined through bisociation.

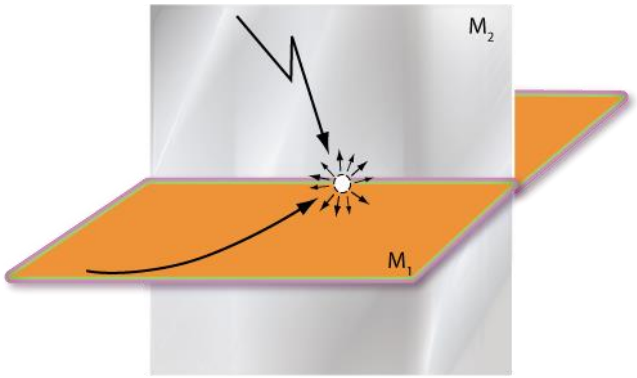

Figure 2.2. Two matrices of thought being combined via bisociation. Reprinted from "Generative creativity – lecture 15: Analogies," by C. Thornton, 2009, Retrieved September 1, 2014, from http://users.sussex.ac.uk/~christ/crs/gc/lec15.html. Copyright 2009 by Chris Thornton.

Routine thinking can be thought of as associative thinking, which according to Jabri (as cited in Ko, 2004) is based on habit or a set of routines expressible in words or symbols. Sill (1996) emphasizes that bisociative thought occurs at the intersection of separate unrelated matrices and these respective matrices may be simple or complex. Furthermore, Koestler (1964) suggested that although associative thinking may be complex at times, this complexity only occurs within a single matrix of thought and does not produce novelty. Table 2.2 contrasts associative and bisociative thought.

Table 2.2

Comparison of Associative and Bisociative thought

Associative Thought	Bisociative Thought
Association within the confines of a single matrix	Bisociation of independent matrices
Guidance by preconscious or extraconscious processes	Guidance by subconscious processes normally under restraint
Dynamic equilibrium	Activation of regenerative potentials
Rigid to flexible variations on a theme	Superflexibility
Repetitiveness	Novelty
Conservative	Destructive-Constructive

Note. Adapted from "The act of creation," by A. Koestler, 1964, p. 659-660. Copyright 1964 by Hutchinson.

Bisociation involves various levels of consciousness (from completely conscious to completely unconscious) and encourages receptivity, which refers to preparing the mind to benefit from any chance casual hint of a new idea. This implies that the unconscious keeps the mind thinking about the problem at hand even if the conscious mind's full attention is elsewhere. Koestler (2009) viewed the creative act as *do-it-yourself psychotherapy* that resolves an intellectual conflict instead of one of an emotional variety.

Partington (2011) noted that there are three ways in which bisociation works:

1. If the independent matrices *collide*, then humour is the product. According to Koestler (1964), this is a release of cognitive tension;
2. If the independent matrices *fuse into a new synthesis*, then intellectual understanding (scientific discovery) is the product. This is an Aha moment;
3. If the independent matrices *confront* one another, then an aesthetic experience (in the arts or rituals) is the product. This may coincide with an illumination of incompatibilities or symmetries or a catharsis of sorts (Koestler, 1964).

Koestler (1964) cited joke humour as a perfect example of bisociated logic, because humourous anecdotes (specifically jokes using punch-lines) often work by applying one set of logical rules to a different matrix in order to surprise the audience with a punch-line. Jokes are often used to alleviate tension or disarm a potentially hostile audience. An example taken from a White House press briefing (Partington, 2011, p.375) demonstrates bisociation resulting in humour, as follows:

> "Q: Can you assure us - just to wind this up, can you assure us that -
> MR. LOCKHART: You are winding me up. (laughter)"

The humour stems from the questioner's matrix of thought (M_1) where *wind up* means *to conclude* colliding with Mr. Lockhart's matrix of thought (M_2) where *wind up* means *to anger or tease.*

An example from the social sciences may help illuminate bisociation in a more explicit fashion. While visiting Japan, an American ethnologist named Edward T. Hall found his luggage moved from his original hotel room to another room in the hotel without any explanation by the hotel management (Sclavi, 2008). Curiously, all of his belongings were carefully placed into position in the new room as he had placed them in his old room. Initially, using his American matrix of thought (M_1), Hall interpreted this as an insult or a form of discrimination towards foreigners. It was only when a Japanese friend explained the

Japanese hotel matrix of thought (M_2), that he gained insight. In smaller Japanese hotels, guests are viewed as family members and older guests receive the best accommodation (Sclavi, 2008). Therefore, the hotel had in truth bestowed a great honour on Hall by moving him to another room. The fusion of these two matrices contributed to Hall's seminal work on *high context cultures* (where little verbal information is transmitted, and much information is assumed) and *low context cultures* (where a large amount verbal information is transmitted and little information is assumed).

Bisociation resulting in an aesthetic experience can be found in the use of imagery and metaphor in fine art, poetry, as well as literary works. Certain genres of fiction such as Science Fiction may go beyond the level of applying bisociation for creating metaphors to using it to devise a story's entire plot. For example, in 1954, writer Alfred Bester (2000) used his science fiction writer's matrix of thought filled with distant futures, androids, and interplanetary travel to *confront* a matrix of thought composed of psychological research on synaesthesia and projection he had been exposed to, to craft a short story entitled *Fondly Fahrenheit*.

Santanen, Briggs and De Vrede (2004) noted that this theory does not provide guidance on how to practically use bisociation to improve creative output. However, the current researcher would suggest that although some creative process theories provide such guidance, it is not an essential requisite of a creative process theory. Klausen (2014) questioned whether bisociation of disparate matrices can be found in all examples of scientific creativity. Throughout scientific history, there have been many breakthroughs produced from working within a single matrix or that have been incremental in nature. Weisberg (2006) highlighted scepticism about bisociation as an explanation of creativity, because the theory was inspired by self-reports by eminent creators such as Albert Einstein. As previously discussed, self-reports may suffer from the creator's self-deception, embellishment, and problems of recall when these anecdotal accounts are elicited long after the creative breakthrough.

2.4.5 Perkins' Klondike space theory

'Gold is where you find it' is the central principle in the theory of creativity developed by Perkins (1995). In this theory, creativity is viewed as a search through a space of possibilities to find resolutions (or gold). Perkins (1995) posited two extreme types of topography possessed by possibility spaces. The first is a *homing space* that is rich in clues and thereby enabling easy resolution of problems by experts who know what to look for. The second, *Klondike space*, is a space comprised of relatively clueless

regions in the midst of which exist small clue-rich pockets where rapid progress can be made. True creative solutions are often reached by searching through Klondike space.

The process involves *hill-climbing*, which Perkins (1995) defined as starting at a particular point, testing points around that point and then heading of in the direction of highest probable payoff. Dunbar (as cited in Matlin, 2009) maintained that hill-climbing is of particular utility in cases where information about alternatives is not available and only your immediate next step is evident.

According to Perkins (1995, 2000), there are four regions in problem space where creative solutions may be discovered. The current researcher is of the opinion that a practical strength of the Klondike space theory is that each of the four problems or regions in problem space can be matched to existing creative problem-solving tools and methods:

1. The *rarity problem* emerges in areas of problem space where resolutions are very rare among the possibilities (Perkins, 1995, 2000). This problem can be solved through automated search, teamwork, use of heuristics and searching more abstractly. Therefore, when faced with the rarity problem, using an electronic solution database or a tool such as *collective notebook* (where ideas are stored for later use) is consistent with Perkins' recommendations. A heuristic method such as the Theory of Inventive Problem Solving (an approach better known as TRIZ that will be discussed in a later section) may also be of use. In general, other examples are group-based problem-solving methods. One such group-based method is called the *Gordon-Little variation*, where the presentation of the precise problem is initially delayed and detailed information about the problem is gradually revealed as the group comes up with ideas in response to the more abstract or general versions of the problem (Proctor, 2010).

2. The *isolation problem* is encountered if resolutions lie in another part of possibilities space that is not accessible to the search mechanism except by changing its rules in some manner (Perkins, 1995). This problem can be solved by searching through merely interesting forms. Truly isolated resolutions can be reached via chance (e.g. exposure to a variety of previously unknown information or temporarily switching to hill-descending strategy). Therefore, to tackle the isolation problem, one could use short 10-minute breaks during which a different, unrelated problem can be solved (Gilhooly, Georgiou, & Devery, 2013) or a tool such as *cool sites* (Clegg & Birch, 2007), where websites unrelated to the problem are explored. Tools such as *random picture* and *random word* (Clegg & Birch, 2007), where the pictures or words are chosen at random to stimulate associations, can also be used.

3. The *oasis problem* arises in an area of problem space where the search lingers close to success, but frustratingly does not quite reach the resolution (Perkins, 1995, 2000). This problem can be solved by becoming aware of this problem and then changing the point of entry. The oasis problem can be solved by applying tools such as a *provocation* or *random entry* contained within *Lateral thinking* (an approach that will be discussed in a later section).
4. The *plateau problem* arises in large regions of possibilities space where there is no indication of what represents promising directions (Perkins, 1995, 2000). This problem can be solved by randomly jumping to other areas of search space or working on identifying the plateau's boundaries or using some form of systematized chance. Following this logic, the plateau problem can be solved by applying a tool called *boundary analysis* (Calwell, n.d.), which entails identifying boundaries of the problem and then determining whether boundaries are truly relevant.

The main limitation of this theory is that it relies on the person trusting notions or directions that *appear* to be promising. For example, using hill-climbing as a strategy, one must choose the idea or direction that appears to lead most directly to the solution. However, as Matlin (2009) pointed out, a more indirect option may produce greater long-term benefits. Another problem with this approach is that the type of problem (or region in problem space) may be difficult to recognise and distinguish from other types of problems.

Overall, there are limits to how far this theory of creativity can be taken as an explanation of the creative process. By boiling down creativity as search in a problem space of possibilities, the theory does not consider the use of 'impossibilities' such as fantasy and other imagination-based strategies. Weisberg (2006) cited using one's imagination to implement the solution mentally to determine the outcome in advance as an example of such a strategy.

2.4.6 Santanen, Briggs, and De Vrede's Cognitive network model

A relatively new process theory of creativity is the *cognitive network model* developed by Santanen et al. (2004). This model posits that knowledge takes the form of bundles of information called frames. Frames that are strongly associated with one another are proximally closer while frames that are weakly associated with or related to one another are more distantly positioned in the knowledge network. Exploring links between frames activated during problem-solving activates other frames in memory and yet further frames become candidates for activation (Santanen et al., 2004). The cognitive network

model holds that creative solutions are generally produced by combining frames that are more distantly located in the knowledge network. The major caveat of the model is that due to working memory limitations and the tendency for people to revert to routine frames, problem-solvers often require assistance or stimuli from the outside environment to solve problems. This assistance may take the form of exposure to multiple ideas while participating in group problem-solving methods such as brainstorming (Ray & Romano, 2013). This could lead to a greater likelihood of more diverse associations among frames suggested by the group. External prompts contained within individual problem-solving methods or feedback from a facilitator during a group activity, such as brainstorming, may also serve as the required external assistance.

However, Bose, Garretson Fose, and Burton (2013) noted that the cognitive network model also posits that if cognitive load increases (such as when a great number of ideas suggested by a group, forces individuals in that group to consider each idea), the processing of information is inhibited. Cognitive load is defined as the cognitive effort made by a person to accomplish a task (Kolfschoten & Brazier, 2013). Any novel information must first be processed by working memory before it can be stored in long-term memory, but working memory can only handle up to three unfamiliar elements of information concurrently (Paas, Renkl, & Sweller, 2004). Therefore, novel information increases cognitive load (Hsiao, Brouns, Kester, & Sloep, 2013). This, in turn, reduces the number of associations made and consequently decreases creative output.

According to the cognitive network model, cognitive load increases as the distance between or diversity among activated frames increases and as the number of external stimuli increase per unit of time (Santanen et al., 2004). When frames are activated simultaneously, the more similar or frequently related frames may become chunked into larger frames that will decrease cognitive load. Chunking may also reduce the diversity (disparity) among activated frames. It should also be noted that if the diversity of external stimuli increases (e.g. more prompts, feedback, facilitation), the likelihood of new associations being made between active frames increases, but so too does the cognitive load. This is because the problem solver uses more cognitive resources to process the variety of external stimuli (Santanen et al., 2004).

The strength of the cognitive network model is that it may aid in the development of a new and improved use of existing creative problem-solving methods, specifically where balancing factors affecting cognitive load are concerned.

The cognitive network model views creativity as associative in nature. Therefore, the theory's major weakness is that it does not consider *incremental creativity,* such as when an existing idea within a single matrix is improved slightly without combining it with another distant idea.

2.4.7 Weisberg's CHOICES model of creativity

CHOICES is an acronym that is short for 'Creative thinking is Habitual, Ordinary, Incremental, Evolutionary, and Sensitive to external events'. Weisberg (2010) presented the view that even if the product of thinking is extraordinary, we cannot assume that the thinking itself is extraordinary. In other words, when it is said that someone is thinking creatively, the comment more accurately relates to the outcome of thinking and not the process of thinking itself (Weisberg, 2006). He theorised that creativity is the product of ordinary thinking. It is for this reason that some have labelled Weisberg as an anti-theorist (Piirto, 2004). However, suggesting that a process underlying a phenomenon is not as extraordinary as the majority of researchers believe, is also a theory. According to Weisberg (2006), ordinary thinking is marked by the following characteristics:

- Ordinary thinking has structure. In other words, thoughts are related and follow on from one another.
- Events in our environment can influence ordinary thinking.
- Ordinary thinking displays continuity with the past. Our thoughts are built on the past.
- Our knowledge and the concepts in our minds are the primary drivers of our thoughts. In other words, top-down processing (as discussed in the section on the geneplore model) underlies ordinary thinking.

The CHOICES model is a summary of the creativity as ordinary process perspective and is outlined in Table 2.3 (Weisberg, 2010):

Table 2.3

The CHOICES model of creativity

Creative Thinking Component	Implications
Habitual: 'within the box'	It takes time to gain expertise in any given domain. There is general agreement that a decade of practice is required to achieve highly in a domain (Glãvenau, 2012). Studying the career development of poets, composers and painters, Hayes (1989) found that creative achievement came after a long period of immersion in a particular domain. The so-called 10-year rule is also consistent with Gruber's concept of constructive repetition, whereby creativity is only achieved by those individuals that are passionate about their craft and engage in extended practice (Brower, 2003).
Ordinary: everyone is capable of creativity	Creative products come about via the operation of ordinary cognitive components. Weisberg (2006) includes the following often interrelated activities as cognitive components: remembering, imagining, planning, anticipating (consequences of actions), judging, deciding, determining (consequences via deductive reasoning), perceiving (a pattern in specific experiences via inductive reasoning), comprehending, recognizing, and interpreting (a diagram or picture).
Incremental: small steps	The great creative leap is a myth. Instead, creative results are the product of small (incremental) steps over an extended period (Weisberg, 2011). Sawyer (2012) noted that significant creative breakthroughs tend to require many small insights embedded in a longer period, perhaps even a lifetime.
Conscious: conscious work	The CHOICES model views creativity as a conscious process and rejects the unconscious view held by many theorists. Sawyer (2012) noted that creativity is predominantly conscious, hard work.

Table 2.3 (continued)

The CHOICES model of creativity

Creative Thinking Component	Implications
Evolutionary: builds on what is available	Even the most radically new creative product has its roots in some pre-existing antecedent. Breakthroughs are often combinations of strands of existing domain-specific knowledge that the creator has learnt and/or prior experiences that he/she has had (Sawyer, 2012).
Sensitive to external events: influenced by context	Creative products are at times responses to or shaped by events in the creator's external environment. For example, Picasso's creation of the anti-war painting, Guernica, was a response to the bombing of the town by the same name during the Spanish civil war in 1937 (Weisberg, 2010).

Note. Adapted from "The study of creativity: From genius to cognitive science," by R.W. Weisberg, 2010, *International Journal of Cultural Policy, 16,* p. 247. Copyright 2010 by Routledge.

An example of supposed creative insight raised by Weisberg (2013) is the case of R. Wagner Dodge, who was a smoke-jumping foreman in the American state of Montana in the 1940s. Smokejumpers are forestry firemen who parachute into inaccessible mountainous areas to extinguish fires. On 5 August 1949, Dodge and his crew of 15 men were ordered to extinguish a small, routine fire in the Mann Gulch area. However, due to changing conditions including intensifying winds, the strength and speed of the fire rapidly increased to the point where Dodge's crew had to flee the area. Soon, the fire picked up even more speed as it moved over dry grass and Dodge realised that they would not be able to outrun the blaze (Weisberg, 2013). Foreman Dodge and his team were facing certain death.

It was then that Dodge came up with a creative idea up until that time unheard of in the US Forestry Service (Weisberg, 2013). With the raging blaze catching up behind the team, Dodge set a smaller fire ahead of them that moved up the terrain in front of them. This smaller fire burned the grass that would have served as fuel for the main fire, leaving a charred area behind. He lay down in this charred ground with a wet cloth over his face and asked his men to do the same. The larger inferno moved around him, leaving him essentially unharmed. This idea later became known as an *escape fire*. Asked how he thought of this idea, Dodge stated that it seemed logical at the time (Weisberg, 2013). Dodge's escape fire idea has been described as "Eureka!" moment or an insight experience. According to Ohlsson (1992), insight experiences are marked by (a) impasse, (b) restructuring of the situation or problem, (c)

the “aha” moment, and (d) the subjective sense of certainty. It is possible that Dodge’s escape fire idea could be the result of an insight experience. However, it is also possible to illustrate how Dodge’s creative process is consistent with the CHOICES model as can be seen in Table 2.4.

Table 2.4

The CHOICES model of creativity: The example of the Escape Fire

Creative Thinking Component	Application to Wagner Dodge’s invention of the escape fire
Habitual: ‘within the box’	Wagner Dodge was an experienced smokejumper who had risen to the position of foreman; knew the standard operating procedures for many forest fire situations, and was known as a cool head under pressure (Weisberg, 2013). It may have been that when all the usual options (standard operating procedures) were closed to him, Dodge asked himself: What is the next logical thing I can try?
Ordinary: everyone is capable of creativity	Wagner Dodge: • *determined* that the fire would accelerate as it moved into the dry grass area; • *anticipated* that his team would not outrun the fire; • *recalled* the three methods that he was trained to use in their situation; • *determined* the consequences of all three methods given their situation (See Evolutionary row below); • *judged* that none of the three actions would save their lives (See Evolutionary row below); • *planned* how to create a new type of method: an escape fire.
Incremental: small steps	If one examines the options available to the team (see Evolutionary row below), then Dodge’s escape fire idea does not seem like he created something out of nothing as many reports of creative insights are described. The escape fire is merely two small steps (changes) from standard operating procedures, specifically options 1 and 3 as outlined in the Evolutionary section below.

Table 2.4 (Continued)

The CHOICES model of creativity: The example of the Escape Fire

Creative Thinking Component	Application to Wagner Dodge's invention of the escape fire
Conscious: conscious work	All of Dodge's thinking during the incident (from the instant he determined that dry grass would accelerate the fire's progress to Dodge's invention of the escape fire) took place while he was actively thinking about the situation.
Evolutionary: builds on what is available	As mentioned above, there were three existing options that smokejumpers were trained to use in such situations. Maclean (1992) outlined these options as follows: 1. Create a backfire, meaning a fire that would move back towards the main fire, consuming the fuel before the main fire arrived; 2. Escape to a nearby rocky ridge, where the fuel for the fire was minimal (less dry grass) and the winds were different to the ones driving the fire; 3. If the front wall of the fire is not too intense or large, it might be possible to run into the fire and find burned-out spot in which to wait out the fire. Option one (starting backfire) was not possible due to their position and the wind conditions. Option two was also impossible due to the terrain – no ridge was available. The fire was too intense to attempt option three. However, Dodge's *escape fire* idea appears to be a creative combination of option one (starting a backfire) and option three (running into the main fire to find a burned-out spot).
Sensitive to external events: influenced by context	Dodge's actions were influenced by the changing wind conditions, his team's position, and the change in the fuel load available to the fire (from slower-burning trees to faster-burning dry grass).

Note. Adapted from "On the "demystification" of insight: A critique of neuroimaging studies of insight," by R.W. Weisberg, 2013, *Creativity Research Journal, 25,* p. 10-11. Copyright 2013 by Routledge.

The CHOICES model is a robust explanation of the creative process as all of its components have been established as accepted elements of cognition. There is no special kind of thinking or processes within the CHOICES model as it consists of thinking undertaken in non-creative, everyday cognition.

A limitation of the CHOICES model is that one requires a mass of contextual and biographical information to explain an instance of creativity, which is not always available. However, this criticism is aimed at the requirements to use the CHOICES model in research and not content of the model, which appears logical.

2.5 Creative Product Theories

As briefly mentioned in this chapter's introduction, creative product theories attempt to describe what constitutes a creative product. This section outlines the most prominent among the creative product theories.

2.5.1 Besemer's Creative Product Analysis Matrix

Besemer and her colleagues developed the *Creative Product Analysis Matrix* to aid judgment of creative products for evaluative or improvement purposes (Besemer & O'Quin, 1999). The model consists of three dimensions, which Besemer regards as the most vital indicators of the creativity of products (O'Quin & Besemer, 2006).

The first dimension is called *novelty*. Novelty considers elements of newness regarding materials, concepts, and processes within the creative product (O'Quin & Besemer, 2006). It also looks at the product's capacity to inspire further creative products (Fryer, 2012). Although widely cited as a dimension of creativity, focusing solely on novelty or originality might result in a merely weird or bizarre product being considered creative.

This is why the second dimension named *resolution* is vital. Resolution refers to how well the product accomplishes the purpose for which it was created. Generally, a product that is logical, understandable, and useful is regarded as high in resolution (O'Quin & Besemer, 2006).

The first two dimensions reflect the common agreement in creativity literature, as evidenced in various definitions of creativity itself, that for a product to be creative it must be both novel and useful. However, Besemer and her fellow researchers have also added a third dimension, labelled *elaboration and synthesis*. This dimension is also known as *style*, but should not be understood as meaning stylistic appearance or fashion-related stylishness (O'Quin & Besemer, 2006). Instead it refers to how the product presents itself to judges or customers. This dimension considers aspects of the product such as expressiveness, attractiveness, complexity, and the extent to which disparate elements form a coherent whole (Fryer, 2012). Of the three dimensions, *style* is the least cited within the literature as a criterion of creativity and is mostly proffered in artistic domains (visual or performing arts) and to a lesser degree within mathematics or physics where instead the *elegance* of a solution or how it is presented is often praised.

A key strength of the *creative product analysis matrix* is that it can be applied to a variety of creative products ranging from consumer products to works of art (Besemer, 1998). However, a limitation of the model is that it does not consider feasibility of creative products. Products may be original, may work, and even look good to observers, but the feasibility must at least be considered to improve the chances of future acceptance by a wider audience.

2.5.2 Sternberg's Propulsion Theory of Creative Contributions

Sternberg and his colleagues devised the *Propulsion Theory of Creative Contributions* to delineate the types of creative products a person can create in terms of how it is judged in its context or field (Sternberg, 2006). Creative products, termed creative contributions in this theory, are viewed as attempts to propel a field to where a creator believes it should go. In this way, the theory uses a 'space' metaphor similar to the one employed in Perkins' Klondike space theory (Sawyer, 2012). Sternberg holds the view that creativity is a form of propulsion and as such also represents an attempt at leadership (Sternberg, 2006). Therefore, a creative contribution is a creator's way of saying, *'This is the future of our field. Follow me, if you agree.'*

Eight types of creative contributions that fit into three broad categories are described within the propulsion theory (Sternberg, 2006). The three categories describe how contributions relate to existing paradigms.

A] Types of creative contributions that accept current paradigms and attempt to extend them:

1. *Replication.* This type of contribution attempts to make the case that the field is in the right place (Sternberg & Kaufman, 2010). It keeps the field where it is, in stationary motion, like a wheel turning in place, but not moving forward.

2. *Redefinition.* This type of contribution tries to see the current status quo from a different point of view (Sternberg & Kaufman, 2010). This represents a circular motion, because the creative product leads back to where the field is at present.

3. *Forward Incrementation.* In this instance, the contribution attempts to propel the field forward in the direction it is already moving, leading to forward motion (Sternberg, 2006). This type of contribution is the most widely accepted as it does not defy the crowd and threatens virtually no one (Sternberg & Kaufman, 2010).

4. *Advance Forward Incrementation.* This type of contribution is almost identical to Forward Incrementation. The only difference is that it moves the field to a place beyond where others are ready for it, leading to accelerated forward motion (Sternberg, 2006).

B] Types of creative contributions that reject current paradigms and attempt to replace them:

5. *Redirection.* Contributions or products of this variety attempt to divert the field from where it is into a new direction (Sternberg, 2006).

6. *Reconstruction/Redirection.* Here, an attempt is made to move the field back to where it was in the past and then move it in a direction different from the one it originally took from that point onwards (Sternberg & Kaufman, 2010). The motion is thus backwards at first, then in a new direction.

7. *Reinitiation.* In this case, a contribution attempts to move the field to new, as-yet-unreached starting point and then move it in a new direction from that position (Sternberg, 2006).

C] A Type of creative contribution that synthesizes current paradigms:

8. *Synthesis* (also known as Integration). The product or contribution attempts to merge diverse ways of viewing phenomena or paradigms into a new paradigm (Sternberg & Kaufman, 2010).

It should be noted that the type of creative contribution is not indicative of the *amount of creativity* inherent in such a contribution. As we have seen from definitions of creativity, there is general agreement that there is both a novelty and usefulness component within creativity. Therefore, one cannot evaluate two contributions and come to the conclusion that because *synthesis* is more novel than *forward*

incrementation, the synthesized contribution is more creative. This is because contribution type makes no prediction regarding usefulness.

Although widely applicable to various domains, a minor limitation of the Propulsion theory of creative contributions is that it is conceptualised from a scientific creativity viewpoint. Serving an illustration, contribution types such as *reconstruction/redirection* and *reinitiation* are more common in scientific fields. This is perhaps the case due to the fact that progress within a scientific field is documented within journal articles and scholarly textbooks. This meticulous record of literature makes it easier to pinpoint a previous state of the field to use as a starting point for a *reconstruction/redirection*.

2.6 Creative Press Theories

As briefly mentioned in this chapter's introduction, creative press theories attempt to describe how the environment affects creativity. This section outlines the most prominent among the creative press theories.

2.6.1 Ekvall's Creative Organisational Climate Model

Organisational climate refers to the aggregated perceptions of recurring behavioural, attitudinal, and feeling patterns that characterize life within an organisation (Isaksen, Lauer, Ekvall, & Britz, 2001). Organisational climate refers to that which organisational members experience and is distinct from organisational culture, which is what members of the organisation value (Puccio & Cabra, 2010). Organisational climate is also more directly observable than organisational culture, as the latter refers to values, norms, and beliefs within the organisation that often need to be elicited via interviews before it can be recorded (Isaksen et al., 2001).

While working for several large Swedish organisations during the 1950s, 1960s, and 1970s, an industrial psychologist named Göran Ekvall observed how differences in organisational atmosphere affected participation in innovation schemes. Ekvall and his colleagues have continually studied and refined the original observations to synthesize nine dimensions of creative organisational climate (Isaksen et al., 2001):

1. *Challenge and involvement.* This refers to the degree that employees are involved in the organisation's vision, long-term objectives, and day-to-day operations. When challenge and

involvement are high, people find their work meaningful and feel motivated to contribute the organisation's goals.

2. *Freedom.* This refers to the degree that people are provided with autonomy and resources to plan their work. In a climate marked by a high degree of freedom, employees exercise discretion in their day-to-day tasks and may take initiative to gather and share information concerning their work.

3. *Trust/Openness.* This dimension refers to the degree of emotional safety in interpersonal relationships. In a climate where trust is high, people feel free to be genuinely open with each other and depend on their colleagues for both personal and professional support. Recognition is given where it is due.

4. *Idea Time.* Idea time refers to the amount of time employees are permitted to and do use to develop new ideas. In a high idea-time climate, time is given to discuss, explore, develop, and experiment with ideas not delineated by an assignment. In such a climate, flexible timelines are utilised.

5. *Playfulness/Humour.* This dimension is defined as the spontaneity and ease permeating the workplace. Climates high in playfulness are professional yet easy-going where employees laugh and have fun. This is in line with West's (2014) contention that play must be viewed as a behavioural approach to one's work and that any task can become a playful one if a person can develop such a state of mind.

6. *Idea Support.* This dimension deals with how new ideas are treated. Idea-supportive climates are marked by constructive atmospheres, where ideas are received in an attentive manner by supervisors, peers, and subordinates. In such climates, opportunities to field-test ideas are also created.

7. *Debate.* This dimension refers to the degree differences in ideas, experiences, and viewpoints are considered. Debate is conceptually similar to what Jehn (1995) calls *cognitive conflict*, defined as differences regarding task-related aspects, expressed as disagreements. If foreseen and managed carefully, debates or cognitive conflicts elicit a larger number of ideas and anticipation of such conflict may increase flexible thinking patterns (Carnevale & Probst, as cited in Badke-Schaub, Goldschmidt, & Meijer, 2010). In debating climates, many voices are welcome, people discuss opposing positions, and are unafraid to offer their ideas for consideration.

8. *Risk-taking.* Risk-taking is the degree to which ambiguity and uncertainty are tolerated within the organisation. In high risk-taking climates, organisational members can take a gamble on their

ideas, even if outcomes are unknown. There is no need to play it safe (e.g. set up committees to consider the ideas).

9. *Conflict.* This dimension should not be confused with the dimension called debate. Debate is a productive, idea-focused phenomenon required for creativity to occur in organisations, while conflict is the counter-productive, person-focused face of disagreement (Isaksen & Ekvall, 2010). Ekvall's conflict dimension is conceptually similar to Jehn's (1995) construct of *affective conflict,* which involves negative emotions connected to interpersonal issues and dysfunctional relationships among team members. According to Ekvall's model, creative climates possess low levels of conflict, where organisational members behave maturely and tolerate diversity. If a contrary situation of high conflict exists, then employees may engage in interpersonal warfare, power struggles, and allow personal differences to lead to counter-productive personal attacks, gossip, and even slander.

Numerous studies have validated Ekvall's model of creative organisational climate (Ekvall, 1997; Ekvall & Ryhammar, 1999; Isaksen et al., 2001). This research agenda has yielded a valid instrument to measure creative organisational climate called the Situational Outlook Questionnaire. This instrument has been validated over time and fruitfully applied to various contexts, such as within teams (Isaksen & Lauer, 2002).

The current researcher is of the opinion that Ekvall's model may dovetail quite well with other organisational research streams. For example, if one uses the Ekvall's model as a lens to look at Mayfield and Mayfield's (2008) work on leadership behaviours (based upon goal-setting, motivation, coaching, feedback, and securing resources) that promote creativity, then leaders may be in a position to enhance the *challenge and involvement*, *freedom*, and *risk-taking* dimensions.

Another area of inquiry that could have an impact on creative organisational climate may be Job design research. The *challenge and involvement* dimension may be greatly helped by recent research on *problem-solving demand*, defined as the degree to which a job requires workers to actively use their skills and knowledge for diagnosing and solving problems in their workplace (Zhou, Hirst, & Shipton, 2012). Furthermore, to increase the *idea time* dimension, organisations may have to consider designing jobs on the basis of *work days* (i.e. how a workday is structured) not merely tasks.

At a more strategic level, it occurs to the current researcher that to build a creative organisational climate, an organisation must possess or consciously decide to develop a high degree of *organisational*

ambidexterity, which is defined as being efficient in managing today's demands, while also being adaptive to tomorrow's changing environment (Gibson & Birkenshaw, 2004). Although the directionality of the relationships can be debated, it would seem logical that dimensions such as *challenge and involvement*, *freedom, idea time, idea support, debate* and *risk-taking* are linked to organisational ambidexterity.

Theoretically and empirically, Ekvall's creative organisational climate model is a robust and widely applicable contribution to creativity research. The sole limitation, when considering the preceding few paragraphs, is that the practical implementation of the model requires both multi-level and multi-target interventions. As such, there may be resistance from organisational members, especially within an existing organisation. Alternatively, full implementation may only be realised in the longer term, if leadership chooses to ease the organisation into such a climate.

2.6.2 Amabile's Climate for Creativity Model

Another creative climate model was developed by Teresa Amabile, a researcher best known for approaching creativity from a social psychological perspective. Amabile and her colleagues used employee motivation as a theoretical frame to review organisational creativity literature and synthesize eight dimensions of creative organisational climate (Amabile, Conti, Coon, Lazenby, & Herron, 1996):

1. *Organisational encouragement.* This refers to an organisational culture that encourages risk-taking, idea generation, idea development, valuing of innovation at all management levels, fair judgement of ideas, recognition and reward for creativity, and a free flow of ideas across the organisation.

2. *Supervisory encouragement.* This dimension refers to a supervisor who sets and clarifies appropriate goals, supports the team's ideas, has open interactions with subordinates, values contributions of individuals, displays trust and confidence in the group's abilities. A study conducted by Amabile, Shatzel, Moneta, and Kramer (2004) yielded the finding that leaders should engage in these behaviours on a *daily basis* to positively influence creativity.

3. *Work group encouragement.* This factor refers to a work group with diverse individual backgrounds with regard to skills, possesses a mutual openness to new ideas, trust each other enough to communicate well, constructively challenge each other's work, help when needed, and are committed to the group's work.

4. *Resources.* Resources refer to the appropriate allocation of resources to projects to enable people to do the work and display creativity in doing so. Such resources include information, funds, facilities, and materials. Beyond practicality of the resources needed for a given project, the allocation of resources influence beliefs about the intrinsic value of work.

5. *Challenge.* This dimension refers to the felt sense that one is working hard on important and challenging projects. Challenge in work is positively correlated with intrinsic motivation and creativity.

6. *Freedom/Autonomy.* This refers to having the discretion to decide what work to do when and how to do it on a day-to-day basis and having a sense of ownership of the work.

7. *Workload pressures.* This factor, when undesirably high, has a negative effect on creativity. Workload pressures include unrealistic expectations for productivity, unwanted interruptions or distractions from creative work, and severe time pressures. Amabile, Hadley, and Kramer (2002) found that the more time pressure employees experience on a given day, the less probable they were to engage in creative thinking.

8. *Organisational impediments.* This dimension is negatively correlated with creativity. Organisational impediments include internal political strife, rigid management structures, destructive internal competition, high levels of criticism of new ideas, and conservatism.

This research agenda has yielded an instrument named KEYS to measure these eight dimensions (Amabile & Conti, 1999; Amabile et al., 1996). The KEYS instrument assesses employees' perceptions of these factors, as well as perceptions of the creativity and productivity of work being performed in the organisation or team under study.

Readers may notice that Amabile's model has major similarities with the model proffered by Ekvall and colleagues (Isaksen et al., 2001) as discussed in the previous subsection. Ekvall's *playfulness* dimension is the only dimension that doesn't have an analogue in Amabile's model. Although, some might argue that it is implied within the *organisational impediments* dimension, where rigidity and conservatism are discussed.

2.6.3 West's Climate for Work Group Innovativeness

Still another model is presented by West and is specifically focused on the creative climate within teams. West and his colleagues have synthesized research findings to form a four-dimensional model (Anderson & West, 1998):

1. *Work group vision.* This dimension refers a higher order goal that motivates the team and makes it more likely that team members develop new goal-appropriate work methods. Work group visions must possess clarity, attainability, sharedness, and a visionary nature.

2. *Task orientation.* Task orientation denotes a shared priority of excellence and quality of task performance. In climates where task orientation is high, there is an emphasis on reflection on team performance and work methods, individual and team accountability, mutual monitoring, evaluation and modification of performance, exploration of opposing opinions, and intra-team advice.

3. *Participative safety.* This dimension refers a non-threatening atmosphere characterised by interpersonal support and trust where all work group members feel that they can actively propose problem solutions and ideas without fear of punishment. Furthermore, people will be more invested or committed in decision outcomes, if they can participate in decision-making via interaction, sharing information, or having an influence over decisions.

4. *Support for innovation.* In this model, this factor denotes the practical support, approval, and expectations of attempts to introduce improvements in work method. Such support may be articulated (i.e. communicated via policies, human resources documents, and word of mouth) or enacted (i.e. resources made available for innovation and top management support).

Significantly, this research agenda has produced the Team Climate Inventory (TCI), a self-report measure for assessing climate for work group innovativeness.

It is the opinion of the current researcher that all three creative climate models presented (i.e. those developed by Ekvall, Amabile, and West respectively) emphasize the removal of obstacles to creativity from the paths of employees. As such, House's (1996) path-goal theory of leadership seems to be particularly suitable for such a purpose as its focus is the removal of obstacles to performance.

2.6.4 Bhorgini's Circular Model of Creativity in Multicultural Organisations

Borghini approaches organisational creativity from the viewpoint that multiple sub-cultures enhance organisational creativity (Klijn & Tomic, 2010). This organisational model assumes that technological, social, and cultural factors are not limited to being input to individual learning but are integral parts of it (Borghini, 2005). Organisational settings are also marked by situated and distributed cognition.

Situated cognition refers to thinking that is embedded within an interaction between schemas of the mind and the environment (Elsbach, Barr, & Hargadon, 2005). Distributed cognition holds that cognition is not limited to the mind of an individual but distributed in wider system of multiple individuals and teams in the form of multimodal representations, such as jargon they use and information communicated via technology (Pimmer, Pachler, & Genewein, 2013; Stanton, 2013).

This model posits that creativity within organisations can only lead to innovation when organisational sub-systems interact in a constructive manner that leads to sense making. Sense making can be achieved if there is unlearning and learning by sub-systems and an integration of sub-cultures, albeit temporarily, moving towards a shared goal (Borghini, 2005). Such integration may occur spontaneously. However, if not, leadership practices or organizational mechanisms or other mediating structures should be enacted to promote such integration. Mediating structures are sets of tools that influence both collective and individual learning (Borghini, 2005). These mediating structures include language that is shared by all sub-cultures within the organisation that can be used for learning; sub-cultural social rules and values that influence the change of shared mental models and creation of knowledge; and formal division of labour that leads to the development of fixed procedures. The physical work environment and instruments also represent mediating structures that affect cognition and learning.

Bhorgini's Circular Model of Creativity in Multicultural Organisations is depicted in Figure 2.3 below.

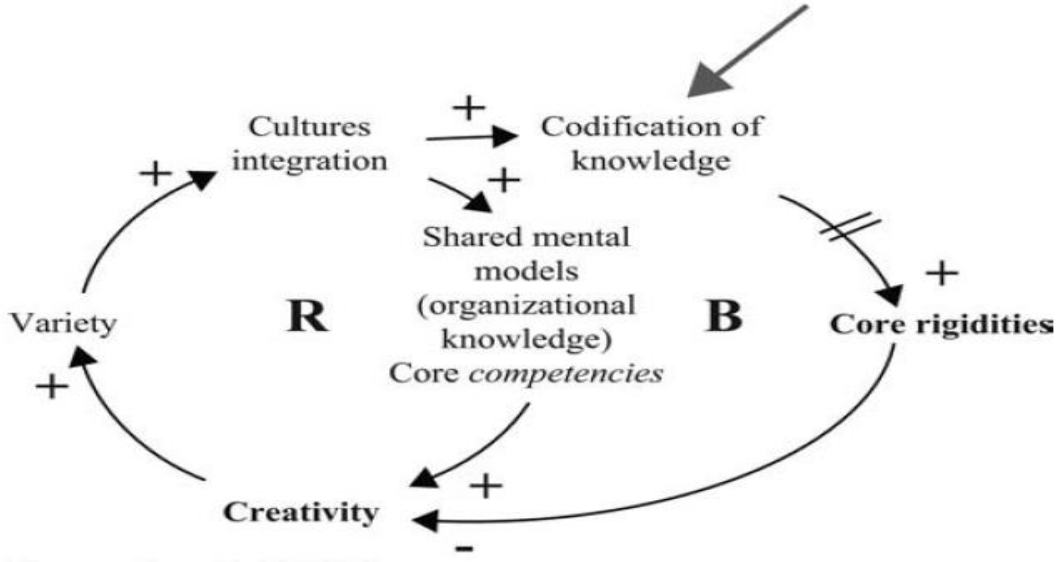

Figure 2.3. Circular model of creativity in multicultural organisations. Reprinted from "Organizational creativity: Breaking equilibrium and order to innovate," by S. Borghini, 2005, Journal of Knowledge Management, 9, p. 27. Copyright 2005 by Emerald Group Publishing Limited.

Following from the assumption discussed above, variety is defined as the proffering of a potentially creative solution to an issue that affects the entire organisation, typically in the form of a new idea or strategy originating from individual or group creativity (Borghini, 2005). This variety should include a learning process that generates new knowledge and develops new competencies. This, in turn, promotes the integration of the various sub-cultures within the organisation (Klijn & Tomic, 2010).

According to Borghini (2005), the integration of cultures increases the shared mental models (organisational knowledge), which is comprised of procedures, rules, methods, systems of knowledge, and models of behaviour. Cultural integration also increases the core competences, referring to the patterns by which sub-culture or domain-specific technical knowledge is preserved. This increases creativity by way of facilitating original and useful output as the cross-fertilization among integrated sub-cultures stimulates more variety and completes the first loop in the Figure 2.3.

Simultaneously, the integration of cultures also causes knowledge to be codified, meaning that it is represented in instruction, procedures, scientific laws, software, patents and models showing how new knowledge is to be applied (Borghini, 2005). Codification allows the transfer of skills and therefore a greater number of people who are able to participate creatively.

However, as time lapses, limits to the organisational creativity appear in the form of core rigidities. Core rigidities refer to the inability to break free from the successful rules and knowledge created out of the

knowledge codification (Klijn & Tomic, 2010). Organisations may be tempted to think along the lines of '*If our last change effort or creative rule change worked, why should we change or create newer rules once more?'* The limitation on creativity that the core rigidities in the second loop provides balances the self-reinforcing first loop of the model. A real-world example of core rigidities was when knowledge management systems were developed for the global consultancy McKinsey. These systems initially took the form of databases of reports, PowerPoint presentations, and best practices (Hargadon, 2008). However, McKinsey did not find these databases as useful as developers had anticipated and developed its own *rapid response team* to rather link people to other people (previous problem-solvers) instead of to stored information (Hargadon, 2008). It had become clear to McKinsey that the databases were creating core rigidities. The rationale behind the formation of the rapid response team was that previous problem-solvers were not just experts on their ideas, *as stored* in a database, but were generally thinking of new applications for these old ideas.

It is evident that Borghini's model takes a *knowledge management* perspective on organisational creativity. The model dovetails well with knowledge management's ethos that thinking, creativity, learning, and retention are part of the same process (Kaufmann & Runco, 2009). However, there is a criticism against knowledge management that can also be levelled against Borghini's model. Schulze and Stabell (2004) maintained that once implicit knowledge is transformed into explicit knowledge, such as happens at the knowledge codification stage in Borghini's model, it can be easily copied by competing organisations. Implicit (also known as tacit knowledge) is non-verbalised, unarticulated and thus not easily transferable by those employees leaving the organisation or imitated by other firms (Kaufmann & Runco, 2009).

2.7 Creative Person Theories

As alluded to in this chapter's introduction, creative person theories attempt to describe what makes a person creative. This section outlines the most prominent among the creative person theories.

2.7.1 Dabrowski's Theory of Positive Disintegration

The theory of positive disintegration is a developmental theory of personality developed by psychiatrist Kazimierz Dabrowski. This theory details the contributing factors and different stages of the process of development (Ackerman, 2009). Positive disintegration refers to the process by which a lower-level

personality structure breaks apart and a higher-level structure is installed in its position and promotes development in a positive sense (Ackerman, 2009).

According to the theory, there are three sets of factors influencing the development of humans. The first two are hereditary and environmental (social) factors. The third and most important set, which the theory posits that most people do not possess, are called the autonomous factors that consists of inner conflict, self-awareness, choice and self-transformation (Ackerman, 2009).

Flowing from the hereditary factor is the developmental potential, which is a person's an inborn propensity or set range for growth (Piirto, 2004). Developmental dynamisms, on the other hand, are intellectual processes and drives combined with emotions that operate within one or more levels of development (Ackerman, 2009). Development is viewed as unrelated to age or physical maturation. All people do not necessarily start at the lowest level and people will not necessarily develop past their original level.

Dabrowski outlined five levels of personality development as follows:

1. *Level I (primary integration)* is the lowest level, characterised by fully formed personality without self-reflection and consequently without inner conflicts (Ackerman, 2009). Self-interest and basic needs drive behaviour at this level.

2. *Level II (unilevel disintegration)* is marked by the awareness of various value systems but no selection of values based on judgement is possible (Ackerman, 2009). Doubt, ambivalence, and changing opinions lead to behaviour based on social pressures.

3. *Level III (spontaneous multilevel disintegration)* is where a hierarchy of values starts to take shape, often due to a significant life event that forces the individual to engage in self-evaluation and reflection (Ackerman, 2009). At this level, individuals experience anxiety and internal conflicts. This is where the third autonomous factor starts to exert greater influence on personality development.

4. *Level IV (organised or directed multilevel disintegration)* is the level where the individual consciously and deliberate chases growth, because internal conflicts have subsided and levels I to III have been disintegrated, making regression impossible (Ackerman, 2009). The person is no longer a prisoner of hereditary and environmental factors that reign at lower levels, but is making autonomous choices.

5. *Level V (secondary integration)* is a new fully integrated personality structure (Ackerman, 2009). Curiously, this highest level of development is also devoid of inner conflicts like the primitive,

self-interested level I (primary integration). However, unlike the primary integration, the secondary integration does not lack internal conflicts due to the inability to reflect, but rather there is no difference between the personality and ideal personality the individual chased during level IV. At the fifth level, individuals are often driven by helping the world at large.

Dabrowski found that the gifted and creative individuals were both intense and emotionally sensitive. He described five dimensions called overexcitabilities in which this intensity and sensitivity could be demonstrated (Harrison & Van Haneghan, 2011). Overexcitabilities are ways of experiencing in an above average duration, intensity, and frequency that lead to enhancement of mental activity beyond the ordinary. These overexcitabilities influence development and act as a measure of developmental potential (Harrison & Van Haneghan, 2011). It is important to note that gifted or non-gifted individuals may possess these overexcitabilities, but differ to the degree.

The theory outlines five overexcitabilities in human populations as follows:

1. *Psychomotor overexcitability* is manifested in excess energy and nervousness. This nervousness may be seen in behavioural tics, nervous habits, as well as impulsive and compulsive behaviour (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006). Excess energy can be demonstrated in greater animation in gestures, expressive enthusiasm, rapid speech, love of movement, pressure for action, the need for doing something new, and undertaking hands-on self-improvement activities (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006).

2. *Sensual overexcitability* is expressed in enhanced sensory and aesthetic pleasure. Here an individual might derive a great deal of pleasure from touching objects, feeling textures, smelling aromas, tasting flavours within dishes, seeing colours, and hearing sounds (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006). Expressions of this overexcitability may also range from sensitivity to one's own breathing and heartbeat, fondness for beautiful trinkets to a strong interest in writing or musical styles (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006).

3. *Intellectual overexcitability* is expressed in the strong need to strive for understanding of the complex, reflection, solving difficult problems, exploring the unknown, and probing questions (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006). This overexcitability may not necessarily lead to academic achievement as it is not related to learning per se. Deep universal questions such as the meaning of life and abstract activities such as

thinking about concepts, theories, analysis, and thinking itself consume persons possessing this overexcitability (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006).

4. *Imaginational overexcitability* is directly related to creativity (Harrison & Van Haneghan, 2011). This overexcitability is inferred from daydreaming, the use of metaphor in speech, use of associations, magical thinking, vivid imagery, love of structured rule-based fantasy games, inventiveness, drifting attention, avid reading, appreciation of the mystical and fantasy (Ackerman, 2009; Harrison & Van Haneghan, 2011; Mendaglio & Tillier, 2006). Many of the fantastical expressions help the individual cope with anxiety.
5. *Emotional overexcitability* is regarded by Dabrowski as the most important for development and entails experiencing life through intense emotions (Ackerman, 2009; Harrison & Van Haneghan, 2011). A highly developed affective memory, feelings of guilt, concern for others, a heightened sense of responsibility, depressive moods are all manifestations of this overexcitability (Ackerman, 2009; Mendaglio & Tillier, 2006).

The importance of the theory of positive disintegration to creativity goes beyond imaginational overexcitability. A major finding by Dabrowski (as cited in Ackerman, 2009) was that creative adults possess a greater degree and variety of overexcitabilities. Another insight is that when imaginational, emotional, and intellectual overexcitabilities are present within the same individual, he/she has greater *developmental potential* and creativity. These three overexcitabilities are directly involved in the disintegration of the primary personality structure. If the lesser overexcitabilities, namely psychomotor and sensual, can be combined with the other three, then extraordinary development and creativity is possible (Ackerman, 2009). It should also be remembered that overexcitabilities only become integrated at the higher levels of development.

The theory of positive disintegration can be illustrated by examining the life of Nikola Tesla. This Serbian-American inventor held an impressive over 700 patents during his life (Hadzigeorgiou, Klassen, & Klassen, 2012). Nonetheless, it was his world-changing inventions and ideas that were ahead of their time that bestowed creative genius status upon him. Tesla's most important invention was the Alternating Current (AC) induction motor that enables the transmission of electricity over large distances (Carlson, 2005). In 1943, the United States Supreme court recognised him as a major contributor to the invention of radio, invalidating the patent held by Marconi (Hadzigeorgiou, Klassen, & Klassen, 2012). Tesla also invented the Tesla coil, which to this day is virtually ubiquitous in television sets, wireless communication devices, radios and a variety of electronic equipment (Carlson, 2005). Among his other well-known inventions were the fluorescent lamp and the speedometer. It is difficult to say with certainty

which level of development Tesla had attained during his life. However, if Tesla scholars are to be believed, his qualities closely match the abundant compassion and self-sacrifice that are known characteristics of individuals that reach Level V (Ackerman, 2009).

The current researcher is of the opinion that Tesla possessed three overexcitabilities. The first, and perhaps strongest, was an *imaginational overexcitability*. This was evidenced by Tesla's exceptionally vivid visual thinking that enabled him to fully design, build, and operate inventions in his mind. This allowed him to build fully functioning working prototypes from plans in his mind at his first attempt. Compare this to accepted pattern of work of those in his profession: Conceive a broad concept of the invention, devise specifics of the invention, undertake calculations, put a design on paper, look for flaws, repeat the process, build a small-scale model, look for further flaws and possible improvements, perhaps repeat the process a few more times, if satisfied build a full-size prototype and hope that it works. Tesla's visualizations are all the more remarkable when compared to his rival and fellow eminent creator, Thomas Edison, who needed to test 6000 combinations of filament before he finally found a combination that made his electric lightbulb work (Brower, 2003). This overexcitability also manifested in Tesla's non-involvement in the commercialisation of inventions that he had perfected and demonstrated (Carlson, 2005). Instead, Tesla would grow restless and rather start a new research project. Finally, the inventor had an affinity for the fantastical ranging from his bold pronouncements about the future, magician-like demonstrations of his inventions, and most pointedly his claim that during a powerful radio signal experiment he received a signal from Mars (Carlson, 2005).

The second overexcitability which Tesla possessed was of the intellectual variety. As previously mentioned, Tesla was at his best in the realm of theories, concepts, grand ideas and his ability to focus on fundamental principles to mentally work out details of inventions was second to none (Carlson, 2005). The seeds of many of his inventions were planted while searching for a *perfect principle* that would lead his next discovery. His love for solving difficult problems was also evident during his demonstration of a remote-controlled boat on an artificial lake when he mentioned that it could be possible to load a boat with explosives and steer it to an enemy ship via remote control (Carlson, 2005). This was the principle underlying modern day guided missiles, only developed several decades later. Another expression of his intellectual overexcitability can be traced throughout academic and working life, questioning his professors on accepted knowledge and later questioning Edison's flawed Direct Current (DC) motor, the widely accepted mechanism used for transmitting electricity at the time (Hadzigeorgiou, Klassen, & Klassen, 2012). It is also noted that Tesla had an interest in the deeper universal and existential questions. For instance, Tesla was a student of the well-known Indian spiritualist, Swami Vivekananda, who used his knowledge of science to spread spiritual and philosophical ideas (Monto, 2010). Tesla

was also not orthodox in his beliefs and promoted Buddhism and Christianity as compatible religions (Cheney, 1981).

Finally, there is evidence that Tesla possessed emotional overexcitability. A manifestation of this overexcitability was Tesla's bouts with depression and later reclusive lifestyle (Carlson, 2005). However, this overexcitability is best illustrated by looking at his motivations for creating his inventions, as well as the ideas that he promoted, but never saw realised by himself or others. His alternating current induction motor was motivated by his desire to transmit electricity across vast distances, so that electricity could become more accessible. When the idea was finally realised, he gave his partners five ninths of the financial rewards (Carlson, 2005). He then turned his attention to the investigation of the wireless transmission of energy with the aim of supplying free and safe energy to the entire planet. While researching X-rays, Tesla was the first to speculate that X-rays could have therapeutic applications. Tesla warned against global warfare and urged the world to instead commit itself to endeavours such as developing a 'world system' that would in addition to text also carry images and sounds, an idea similar to the modern internet. It should be clear that Tesla had a heightened concern for others and pursued most of his inventions and passions for humanitarian ends (Hadzigeorgiou, Klassen, & Klassen, 2012). Tesla's concern for the world can also be seen in the following poem, inspired by observations of the inventor at work, and written by his close friend and poet, Robert Underwood Johnson (http://www.teslasociety.com/famousfriends.htm):

In Tesla's Laboratory

Here in the dark what ghostly figures press! –
No phantom of the Past, or grim or sad;
No wailing spirit of woe; no spectre, clad
In white and wandering cloud, whose dumb distress
Is that its crime it never may confess;
No shape from strewn sea; nor they that add
The link of Life and Death, - the tearless mad,
That live nor die in dreary nothingness:

But blessèd spirits waiting to be born –
Thoughts to unlock the fettering chains of Things;
The Better Time; the Universal Good.
Their smile is like the joyous break of morn;

How fair, how near, how wistfully they brood!
Listen! that murmur is of angels' wings.

Nikola Tesla's exhibited overexcitabilities are consistent with Dabrowski's contention that possessing those three specific overexcitabilities predict greater creativity, developmental potential, and level of development.

The theory of positive disintegration is an interesting lens to view the personality development of creative individuals and may provide multi-faceted answers as to why some individuals are more creative than others.

2.7.2 Kaufman and Beghetto's Four C Model of Creativity

Kaufman and Beghetto (2009) view their *Four C Model of Creativity* as a developmental trajectory of creativity that a person *may* follow across a lifetime. In fact, they admit that a full progression from Mini-c to Big-C is uncommon. The model is based on the belief that everyone can be creative in their own way.

Most creativity research efforts focus on either *Big C creativity* (those eminent geniuses that produce highly creative products) or on *Little C creativity* (representing creativity by average people in the course of their daily lives). Big C creativity can also be called H-creativity (or historically creativity) as it places the creator as the first to produce his/her idea or product (Boden, 2009). Little C creativity can also be thought as P-creativity (or psychologically or personally creativity) as this idea or product may new to individual but others may have come up with the same idea. Although highly useful, this dichotomy has not been helpful in research more developmental or intrapersonal in nature (Kaufman & Beghetto, 2009).

The four C model of creativity includes both the aforementioned categories yet is also an attempt to map and delineate the space between *Little C Creativity* and *Big C Creativity* in terms of creative magnitudes. This is necessary as there has been considerable lumping of everything that is not eminent or Big C creativity into the Little C creativity category (Kaufman & Beghetto, 2009). For example, under the big/little binary distinction an eighth-grade art student (who just learned a shadowing technique well-known to the world but new to her) and an amateur artist (who won a local contest by developing a unique technique only based upon traditional shadowing) are both considered as examples of LIttle C

creativity. Neither exhibit Big C creativity. However, clearly there is a difference between the two cases. The additional two categories included in the Four C Model of creativity are Mini-C and Pro-C creativity. These distinctions address various inaccurate categorisations of creative endeavours.

Beghetto and Kaufman (2007, p.73) define Mini-C creativity as "the novel and personally meaningful interpretation of experiences, actions, and events." This definition recognizes the importance of creativity in personal development and learning. Prior categorizations of creative magnitudes have often ignored the transformative, creative processes inherent in constructing personal insights and knowledge (Beghetto & Kaufman, 2007). Mini-C creativity dovetails quite well with many aspects of Vygotsky's cultural-historical theory, which emphasises that creativity involves both external and internal meaning-making that may be transformative in the learning contexts (Marjanovic-Shane, Connery, & John-Steiner, 2010). In Vygotsky's (as cited in John-Steiner, Connery, & Marjanovic-Shane, 2010, p.14) word's "creativity exists not only where it creates great historical works, but also everywhere human imagination combines, changes, and creates anything new." Furthermore, Vygotsky argues that a creative act may even be a thought or emotional construct known only to the individual (Kaufman & Beghetto, 2009). It is important to consider Mini-C creativity as it enables a more specific evaluation of primary school leaners' creative potential than Big C creativity, which is unrealistic to expect from that age group, or Little C creativity which is too general (Kaufman & Beghetto, 2009). Therefore, Mini-C creativity prevents creative potential and intrapersonal creativity of a mental or emotional nature from being overlooked by those doing the evaluating (e.g. teachers in school). For example, this type of creativity can be seen when a learner creates their own unique, stylised diagram or rhyme to remember the steps to a process. However, it should be noted that Mini-C creativity is *not just for kids*. Mini-C creativity relates to all creators, be they children or adults, as it can be viewed as the initial creative interpretations that may or may not be visible in the final creative product.

Pro-C creativity refers to progression of a developmental nature beyond everyday creativity known as Little-C (Kaufman & Beghetto, 2009). Although most individuals who have reached professional-level expertise in a creative field probably also demonstrated Pro-C creativity, not all professionals in creative industries will reach pro-C level. Research involving writers and composers conducted by Kaufman and Kaufman (2007), as well as Simonton (2000) respectively, suggests that the widely held 10-year rule of expertise may only be sufficient to master the mechanics of the domain and that further time may be necessary to attain Big-C creativity. Therefore, according to the theory, if this 10-year period excludes active experimentation beyond formal training, the creativity displayed after the decade is usually Pro-C creativity (not Big-C creativity). In a study involving professional athletes in team sports, Memmert, Baker, and Bertsch (2010) found that highly creative players accumulated more time in deliberate

practice for their main sport, as well as unstructured play-like activities than less creative players. The deliberate practice may be thought of as learning the mechanics of their sport, while the unstructured activities correspond to a form of active experimentation. The Pro-C level can therefore be attained by hundreds of people in a particular domain. It should also be noted that there are amateur artists that reach the Pro-C level of creativity, but do not primarily support themselves with that specific creative outlet. Figure 2.4 is a graphical depiction of the four C model.

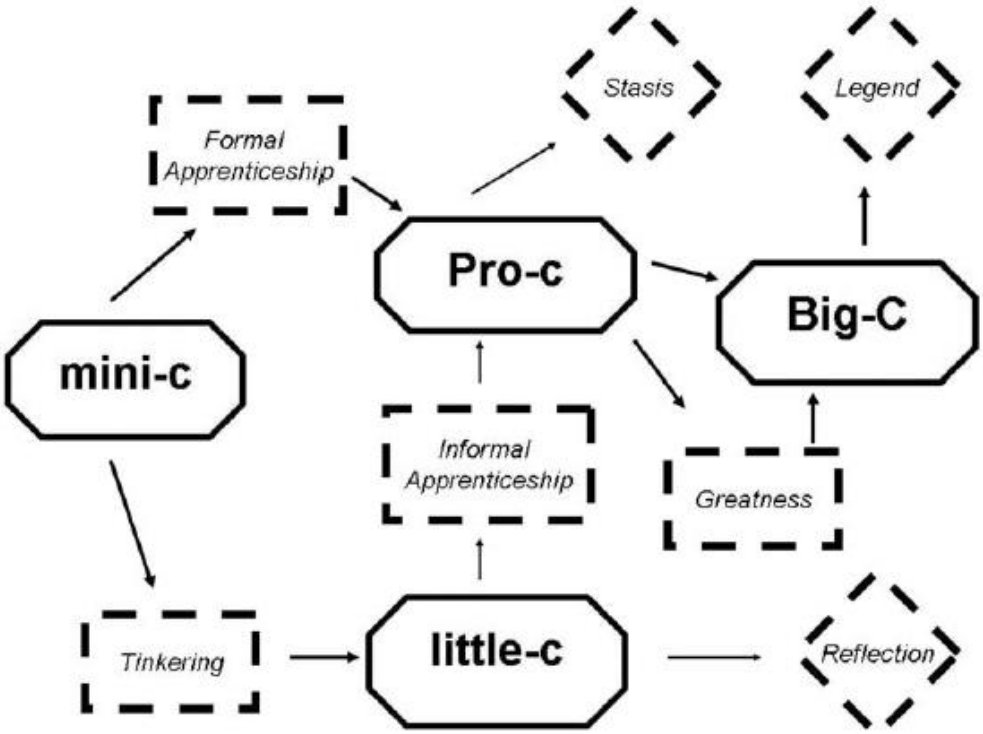

Figure 2.4. The Four C Model of Creativity. Reprinted from "Beyond big and little: The four C model of creativity," by J.C. Kaufman, and R.A. Beghetto, 2009, Review of General Psychology, 13, p. 7. Copyright 2009 by the American Psychological Association.

The four creativities are related as follows. All people start at the Mini-C level and usually transition in one of two ways. One, the transition to Pro-C may take place via a formal apprenticeship (corresponding to the 10-year rule) that may in part happen at an educational institution. Two, the individual can enter a transitional period labelled tinkering, which involves experimentation that leads to domain-specific improvement in creativity (Kaufman & Beghetto, 2009).

Once at the Little-C level, an individual can enter one of two alternate transitional periods. To reach Pro-C level, the individual undertakes an informal apprenticeship (such as gaining a mentor or simply working with more experienced colleagues). Alternatively, an individual may decide that Little-C is enough or have no desire to express creativity in a professional capacity (Kaufman & Beghetto, 2009).

Thus, their development ends at a stage of reflection, using creativity simply to express themselves, explore ideas, or to work out emotional life.

There are two paths open to individuals who attain Pro-C creativity. Some who are persistently creative may achieve the highest level of achievement within his/her lifetime, greatness (Kaufman & Beghetto, 2009). These great creators may then be judged by future generations as having achieved Big-C creativity. An example of such posthumously recognised creativity was the nineteenth century mathematician Evariste Galois' life. After being killed in a duel at age 20, Galois' mathematical writings were viewed as ineffective as there were gaps in his arguments (Cropley & Cropley, 2009). However, after several years, mathematics had sufficiently progressed to recognise Galois as one of the most creative mathematicians to have ever lived.

The other path from Pro-C creativity leads to stasis, where the individual proceeds to the end of their career without offering further creative contributions (Kaufman & Beghetto, 2009). This can happen because the creator has reach a certain level of professional security, or stretching their creativity is no longer as important to them, or the sacrifices to reach the next level become too great. For example, at the height of the actor Alec Baldwin's popularity and success, he declined the opportunity to play the title role in the Jack Ryan series of movies. Baldwin, who is one of the few actors who can command the stage and screen in both dramatic and comedic roles, knew that accepting the role would lead to both great financial rewards, as well greater choices in terms of future film roles. Instead, Baldwin opted to act in television, because film had begun to take a toll on his personal life due to the months away from home on location (Fink, 1997). The less well-paying roles of television offered him the opportunity to stay in one city and maintain a social life, which he deemed more important.

At a final progression of Big-C creativity, the level of individual creative achievement propels him/her to the status of legend. At this stellar point, such an individual and their work become famous beyond the domain where the broad spectrum of society knows of their feats. Einstein, Newton, Picasso, Beethoven, Mozart, Shakespeare, and Edison are among the few who have achieved this legendary level. To illustrate, consider that the general public may know very little about physics, yet many know the name Albert Einstein and his equation $E = MC^2$ (Narechania, 2009).

Taken as a whole, the Four c model presents a more nuanced view of creative individuals based on the level of accomplishment. As a framework, it may also aid researchers in answering complex debates surrounding creativity such as its best method of assessment, its relationship with mental illness, and whether it is domain-specific or domain general.

2.7.3 Guilford's Divergent thinking

Unlike developmental theories of the creative person, psychometric theories do not take a lifetime or maturation view of the creator. Instead, psychometric theories focus on psychological traits or characteristics that increase the likelihood of a person creating products that are deemed as being creative. In addition, the measurement of such traits generally occurs cross-sectionally and not longitudinally.

One such construct called *divergent thinking* was outlined by J.P. Guilford while developing his *Structure of the Intellect* model during the 1950s. Guilford (1967) defined divergent thinking as the ability to produce a variety of responses to an open-ended problem. Runco and Acar (2012) noted that this mode of thinking diverges from the known to the original or novel ideas and consist of four components, namely *fluency* (the number of responses), *flexibility* (the number of response categories), *originality* (the statistical infrequency of the responses) and *elaboration* (the degree to which an individual follows an associative path in thinking). Convergent thinking, on the other hand, is the logical thought mechanism. During problem solving, an individual is likely to use divergent thinking first. Then, the problem solver would use convergent thinking to converge on a single solution (Guilford, 1967).

Divergent thinking can be contrasted with convergent thinking in the following manner (Cropley & Cropley, 2009). The former involves producing multiple answer or ideas by synthesizing unrelated elements (transforming information) or seeing a problem in another way (shifting perspective). The latter is aimed at arriving at the single best solution to a given problem by recognizing the known, reapplying existing techniques, and preserving conventional knowledge (Cropley & Cropley, 2009). Divergent thinking produces solutions that are new (either solely to the problem solver or to wider society as well) while convergent thinking unearths previously existing solutions or those logically derived from known information.

Tests measuring divergent thinking are the most widely used tests for creative potential (Runco, 2010b). Unfortunately, this popularity has resulted in a misconception, specifically that divergent thinking tests are tests of creativity (Runco & Acar, 2012). Divergent thinking is not synonymous with creative thinking. More realistically, divergent thinking is a predictor of creative thinking or creative talent, meaning those scoring highly on divergent thinking tests are more likely to engage in creative behaviour (Runco & Acar, 2012). The use of the words 'potential' and 'likely' indicate that high divergent thinking scores, as with other predictors, are not a guarantee of future creative performance.

A further problem is that the reliabilities for these tests are of mixed acceptability (Runco, 2010b; Weisberg, 2006). For example, Cropley (2000) found the internal consistency of instruments measuring divergent thinking ranged between .42 and .97. Another problem is that some researchers theorise that they only have to administer one index of divergent thinking tests, namely fluency. In reality, originality and flexibility are more strongly related to creativity than fluency (Runco & Acar, 2012). Further support for testing for all four divergent thinking dimensions is that there is unique variance in each of the four dimensions of divergent thinking assessed by various instruments. Fluency only gives an indication of ideational productivity and not creative potential as a whole. Therefore, if appropriately administered, these tests provide information that is as useful as the original theory suggests.

Providing criticism on a more general level, Schmidt (2011) emphasised that given that creative performance varies unpredictably, even under controlled conditions, purely psychometric approaches, such as testing for divergent thinking, may be of little use divorced from contextual and other factors.

2.7.4 Sternberg's Investment Theory of Creativity

Another type of creative person theory is a confluence theory. Confluence theories describe the necessary ingredients that must come together for creativity to occur, but do not describe the process of how creativity works (Kim, 2013). The Investment Theory of Creativity as proposed by Sternberg and Lubart (1995; 1999) is one such confluence theory, which holds that creative people are individuals that possess the willingness and ability to adopt a "buy low and sell high" strategy with regard to ideas.

In this theory, *buying low* refers to pursuing ideas that initially meet resistance, are out of favour, or unknown, but in which the creator sees potential (Zang & Sternberg, 2011). However, if the creator persists, he/she can *sell high*. In other words, when the idea is accepted by a wider audience and its potential is realised, the creator can move on and redirect his/her attention to other unpopular ideas. As any investor will reveal, one needs resources in order to exploit such investment opportunities.

The investment theory of creativity further elaborates on the resources required to achieve creativity. Although five of the resources are person-centred and point to individual differences, conscious decisions to utilize these five, as well as the single context-centred resource, are required (Sternberg, 2012; Zang & Sternberg, 2011). Therefore, the theory emphasises the requirement of a confluence or coming together of these six separate but interrelated resources (Sternberg, 2006; Sternberg, 2012; Zang & Sternberg, 2011), as outlined below:

1. *Intelligence (intellectual abilities).* Three intelligences are deemed particularly necessary for creativity: (a) synthetic intelligence to view problems in unconventional ways, (b) analytic intelligence to evaluate which of one's ideas should be further developed, and which should be discarded, as well as (c) practical-contextual intelligence to promote one's ideas and persuade others of their value. It is of importance that there must be a confluence of all three intelligences. If not, the result may be a non-creative routine, or unevaluated, or well-promoted, but non-useful idea.

2. *Knowledge.* Knowledge is a double-edged sword in some respects. On the one hand, one needs expertise or at least a broad knowledge base relating to a field or domain (as previously highlighted within this chapter) to be creative within that field. On the other hand, being so immersed within the knowledge of a field can result in a habitual and entrenched perspective, closed off to new approaches. The decision to utilise previous knowledge must be accompanied by the decision not to become blinded by that knowledge.

3. *Intellectual style.* Intellectual styles refer to preferred manners of utilizing one's abilities. Sternberg views intellectual styles as decisions regarding how a person's available skills are used and are distinct from abilities themselves. The investment theory of creativity highlights three intellectual styles that are viewed as important for creativity. The legislative style is the preference for thinking and doing things in one's own way. The global style is the preference for thinking holistically, meaning seeing the bigger picture of a field, or a problem, to identify potentially fruitful ideas to pursue. Lastly, the liberal style is the preference to think in new ways that differ from the established practices.

4. *Personality.* Certain personality attributes are required to be creative. These attributes include but are not limited to the willingness to tolerate ambiguity, willingness to overcome obstacles, willingness to take risks, and self-efficacy. When engaging in the buying low and sell high strategy, these attributes help an individual go against the accepted practices and move out of his/her comfort zone. The investment theory of creativity posits that one can decide to rely on such personality attributes for creative purposes. Some attributes such as willingness to tolerate ambiguity may be more important for longer-term creativity, while other attributes may be more useful for short-term creativity (Zang & Sternberg, 2011).

5. *Motivation.* Research by Amabile (1996) has highlighted the importance of intrinsic, task-focused motivation for creativity to occur. In other words, a person needs to love what he/she does and find the task itself enjoyable. Potential rewards such as recognition or financial reward are less important for creative tasks that are enjoyable. Instead, the task must appeal to the creator.

6. *Environment.* For creativity to happen, a person requires an environment that supports and rewards ideas that are not only useful, but novel as well. Non-supportive environments are marked by major obstacles, such as when one's well-being, career, or life may be detrimentally affected when thinking in an atypical manner. Minor obstacles, such as receiving negative feedback, can also occur in largely supportive environment. In both instances, the person can decide to be creative in spite of the environmental obstacles. A supportive environment not only sparks and supports creative ideas, but facilitates the refinement of those ideas as well (Zang & Sternberg, 2011). It is also important to consider who evaluates creative ideas and in what sort of culture (ethnic, national, or organisational) these evaluators are immersed as this influence what is considered creative and how support is provided (Sternberg, 2012). For example, suppose one is the mentee involved in a mentoring relationship. If your mentor is American and working within an American organisation, he/she will likely engage in sponsorship behaviour, meaning the promotion of you and your ideas to other organisational members (Clutterbuck, 2008; Jenkins, 2013). However, if your mentor is European and working within a European organisation, he/she will likely limit their behaviour to one-on-one guidance and developmental behaviours.

There are several aspects regarding the confluence of the above resources that need to be emphasized. Firstly, not all resources are utilized in all displays of creativity (Zang & Sternberg, 2011). Secondly, certain resources, such as knowledge, possess thresholds below which no creativity is possible no matter the level of other resources (Sternberg, 2006). Thirdly, the importance of each resource changes from one creative endeavour to the next (Zang & Sternberg, 2011). Fourthly, a weakness in one resource may be partially compensated by the strength of another resource, such as when strong intrinsic motivation makes up for a unsupportive environment (Sternberg, 2012). Finally, interactions between strong resources may multiplicatively heighten creativity (Sternberg, 2006).

An example of the Investment theory of creativity at work can be seen in the pitching sessions of the *LaunchLab*, an initiative developed by Stellenbosch University, where prospective entrepreneurs present their business ideas for the chance to win venture capital, advice, and mentoring.

When an entrepreneur dreams up a novel business idea, he/she uses synthetic intelligence to spot the untapped business opportunity and analytic intelligence to self-screen the business idea by asking questions. *Will anyone be willing to pay for the core goods or services of the proposed business?* The entrepreneur uses his practical-contextual intelligence to develop his pitch into a persuasive message by emphasising how and why the business idea will work in the real world.

The entrepreneur needs enough knowledge about the industry in which the proposed business will operate and needs a basic level of business management knowledge. Perhaps the entrepreneur has previous experience or knowledge on how a certain service is generally rendered in a particular industry and how an unrelated method can be applied to this service. Knowledge about the judges and the process of the pitch can also assist the entrepreneur to produce a good pitch.

The legislative and liberal thinking styles are generally useful for any entrepreneur in terms of idea generation. The global thinking style will help the entrepreneur evaluate the business idea and assist in thinking of questions that might be asked by the pitch judges.

Generally, starting a small business is fraught with challenges and small businesses lack the resources of large organisations. Therefore, an entrepreneur must be willing to overcome obstacles. Willingness to take risks, tolerance of ambiguity, and self-efficacy are personality attributes cited by both the investment theory of creativity as well as entrepreneurial personality research (Brandstätter, 2011; Zhao, Seibert, & Lumpkin, 2010). Self-efficacy and willingness to take risks are also essential to making pitch presentations to a panel of judges. If the business idea is not selected, an obstacle of sourcing funding will have to be tackled.

It would be a mistake to start your own business if you don't view being an entrepreneur as being its own reward. The entrepreneur should also be intrinsically motivated to provide the proposed service or supply the proposed goods to the particular customers in a particular manner.

Prior to pitching, an entrepreneur should enlist the opinions of trusted individuals with appropriate expertise who are neither nay-sayers nor yes men. These people should provide honest opinion, as well as constructive criticism. Alternatively, their assistance may be limited to listening and critiquing the entrepreneur's pitch. This external support can help the entrepreneur refine the business idea, the pitch, and assist in anticipating questions to be asked by the judges.

One major limitation of the investment theory of creativity is the generality of the "selling high" behaviour of the creative person (Weisberg, 2006). In the domain of fine art, the impressionists were initially heavily criticised. In other words, they were initially buying low. However, their style became gradually accepted in art critic circles and spread around the world. Renoir and Pisarro, two of the original impressionists, later developed other styles and, therefore, sold high (Weisberg, 2006). However, Monet, the foremost proponent of impressionism never left the style. In other words, Monet never sold high. This example

and other instances where highly creative individuals do not move on to other ideas once their original unpopular idea gains wider acceptance, cast doubt on the description of creative people as buying low and selling high.

Another drawback of the investment theory of creativity is that some of the descriptions of the resources lack detail. For example, Sternberg and colleagues do not describe what a supportive environment looks like. Instead, they limit their discussion to the effects of a supportive environment.

A further limitation of the theory, as cited by Weisberg (2006), is its mention of the negative effects of knowledge on creativity. However, the current researcher is of the opinion that the investment theory of creativity presents a balanced view of the role of knowledge, encouraging the use and development of knowledge while warning against fixation effects.

2.8 Intrapersonal Factors of Individual Creativity

This section will highlight selected constructs that have been touted as predictive of creativity at the individual level.

2.8.1 Openness to experience

As one of the Big Five personality variables, *openness to experience* refers to an interest in originality for its own sake (Cropley & Cropley, 2009). Open individuals are generally curious and imaginative, therefore these individuals tend to be more creative (Feist, 2010). These people gain enjoyment form going beyond the conventional without necessarily receiving a tangible payoff (Cropley & Cropley, 2009). In addition, open people tend to possess traits such as self-confidence and tolerance for ambiguity. Feist (2010) noted that the connection between openness to experience and creativity has developed well beyond theoretical to an empirical one. A multitude of studies support the positive relationship (Feist, 1998; Dollinger, Urban, & James, 2004; Perrine & Broderson, 2005).

2.8.2 Kirton's Adaptor-Innovator style

Much of creativity research focuses on determining the creative level of individuals (Kwang, Ang, Ooi, Shin, Oei, & Leng, 2005). In other words, such inquiry focuses on answering the question: *How creative are you?* In contrast, Kirton developed the Adaption-Innovation (A-I) theory to delineate cognitive styles of creativity. In other words, A-I theory focuses on answering the question: *How are you creative?* A-I theory delineates two cognitive styles, namely *adaption* and *innovation*, that operate on a bipolar continuum (Chilton & Bloodgood, 2010). This means that an individual's cognitive style may lie anywhere on the continuum between complete adaption and complete innovation. It is important to note that A-I theory views cognitive style as a preference and not hard-wired behavioural responses to certain stimuli.

High adaptors are highly detail-oriented, prefer to work within a defined structure, and desire to work in a group composed of other adaptive people (Chilton & Bloodgood, 2010). They prefer to solve problems by developing a small number of potential solutions in great detail. Adaptors deal with change by adapting their current paradigm in an incremental fashion. These individuals develop rules for decision-making and planning, as they need a reason for their every action.

High innovators focus on the big picture, shun formal structures, and prefer to work alone (Chilton & Bloodgood, 2010). These individuals come up with a large number of solutions, some of which appear unrelated to the problem at hand and not detailed. They are extremely open to shifting their own paradigms to the new when change is required or when they are bored. Innovators make it up as they go along instead of following rules and may bend unbreakable rules to the extreme.

A-I theory has highlighted an important limitation of group problem-solving that arises whenever two or more people come together to solve a problem (Kirton, 2003). According to Kirton, these two or more individuals are faced with two problems. Problem A is the problem they have come together to solve, while problem B is how to manage each other. Problem B refers to the fact that team members may sit on vastly different positions on the Adaption-Innovation continuum and their working preferences may not gel. However, Kirton (2003) believes that a diversity of cognitive styles is needed to solve a diversity of problems. In other words, both adaptors and innovators are needed for problem-solving. In fact, Kirton asserts that everybody, both adaptors and innovators, can be creative.

According to Kaufmann (2004), the main limitation of A-I theory is that Kirton's description of the adaptors' preferences, with its emphasis on rule-and-structure conformity, resemble descriptions of

'uncreativity' or 'countercreativity' more than creativity. Kaufmann asserted that if both styles can be creative, it means that Kirton's definition of creativity is inclusive of problem-solving that is not novel and merely logical.

2.8.3 Kaufmann's Assimilator-Explorer Style

The bipolar cognitive style dimension known as Assimilation-exploration ranges from set-breaking, novelty-seeking to past-experience-based, rule-guided cognitive strategies in problem solving (Martinsen & Diseth, 2011). Kaufmann, the originator of this construct, based assimilation-exploration on Piagetian theory, but introduced an individual difference perspective and emphasized that individuals can both respond to, as well as create novelty. These individual differences are observable in relatively stable dispositions during problem-solving cognition.

A-E theory distinguishes between *assimilators*, who prioritize using the familiar in problem-solving, and *explorers*, who emphasize searching for new ways in solving problems (Martinsen, 1995). This theory holds that assimilators perform better on tasks for which they have a high degree of relevant experience, while explorers perform better on tasks with a high degree of novelty (where they have less experience). Therefore, assimilators can also display creativity, but under conditions of high relevant experience or, as recent research has shown, where they are highly motivated (Martinsen, 1994) and possess a positive mood (Kaufmann & Martinsen, as cited in Martinsen & Diseth, 2011).

Kaufmann's assimilator-explorer styles differs from Kirton's adaptor-innovator styles in that the latter is conceptualised as two types of creativity regardless of conditions while the former is activated under specific conditions (Martinsen & Diseth, 2011).

2.8.4 Positive affect

Affect is a subjective feeling state that includes specific ones, such as anger or happiness, as well as more enduring mood states, such as depression or cheerfulness (Frijda, as cited in Baas, De Dreu, & Nijstad, 2008). Davis (2009) noted that affect is a superordinate or generic concept that encompasses both emotion and mood.

However, it is possible to distinguish between these two subtypes of affect. Emotions are directed toward a particular stimulus in the individual's environment, such as an event and an object, or a person that

directs attention, as well as action (Davis, 2009). For example, an individual becomes angry because another driver parked his/her car in the individual's assigned parking space. In addition, an array of specific emotions exists such as positive ones, like happiness, interest, and contentment, or negative ones such as anger, fear, and sadness. In contrast, moods are not directed at any stimulus, are more diffuse, and generally less intense than emotions (Davis, 2009). Unlike emotions, moods are usually not described as multiple specific states in empirical research. Instead, moods are generally described as a dichotomy – one is in either a positive or negative mood. Another difference between the subtypes of affect, albeit slightly less reliable than stimulus directedness, is duration. Emotions typically last for seconds to minutes, while the duration of moods ranges from several hours to days or even months. However, there are exceptions to these patterns of duration where moods can be fleeting, and emotional episodes may take longer to subside.

The *broaden hypothesis*, drawn from the broaden-and-build theory of positive emotions, states that positive emotions, unlike negative emotions and neutral states, broaden the array of thoughts, perceptions, and action urges that come to mind (Fredrickson & Branigan, 2005). Positive emotions include joy, interest, contentment and love. These broadened thoughts are generally more novel and may lead to increased fluency (i.e. an increase in the raw number of ideas). There is evidence to suggest that positive emotions also open up an individual's awareness, making spotting links between ideas easier (Fredrickson, 2004; Fredrickson & Cohn, 2008). This is linked to increased flexibility, which is defined as the number of idea categories.

In a meta-analysis conducted by Davis (2009), the positive-mood-enhances-creativity assertion was supported. Specifically, the study found that positive moods enhance ideation with its emphasis on originality, fluency, and flexibility. However, the relationship between positive moods and the rest of the creative process, which include evaluative aspects beyond ideation, is less robust. No definite advantages of negative moods for creativity were revealed during the study conducted by Davis (2009).

In another meta-analysis, Baas et al. (2008) found support for three major hypotheses relating to the mood-creativity research. First, *the hedonic tone hypothesis*, which posits that mood states with a positive hedonic tone (e.g. happiness, relaxed), which enhance cognitive flexibility, increase creativity to a greater degree than mood states with a negative hedonic tone (e.g. fear, sadness). Second, *the activation hypothesis*, which proposes that activating mood states (e.g. happiness, elated, fear, anger) increase creativity to a greater degree that deactivating mood states (e.g. calm, relaxed, sad, depressed) by facilitating cognitive flexibility, as well as the analysis, processing, and combination of information. Third, a hypothesis based on regulatory focus theory, was formulated. Regulatory focus

theory describes the two foci of self-regulation people use to achieve their goals at any given moment (Yen, Chao, & Lin, 2011). When promotion-focused, people focus on the pursuit of gains and advancement or the avoidance of non-gains. People in a promotion focus centre their attention on positive outcomes and are motivated by aspirations and accomplishments. When prevention-focused, people focus on the avoidance of losses or seeking of non-losses. People in a prevention focus centre their attention on negative outcomes and are motivated by duties and responsibilities. In the meta-analysis conducted by Baas et al. (2008), their *regulatory focus hypothesis* posits that creativity can be predicted by the interaction between a mood state's associated regulatory focus and its level of activation. In other words, activating promotion-related mood states (e.g. happiness) increase creativity, while activating prevention-related mood states (e.g. fear) decreases creativity. Neither promotion nor prevention-related deactivating mood states (e.g. sadness or relaxed state) affected creativity.

However, negative affect may not be all bad for creativity. Bledow, Rosing, and Frese (2013) found that a shift from negative to positive affect yielded a larger increase in creativity than a mere increase in positive affect. Specifically, in their experiment, this affective shift condition resulted in higher levels of originality and flexibility (i.e. the number of idea categories). Fluency (i.e. the raw number of ideas) was not affected by either condition. The implication of these finding is that tolerance and, more importantly, the ability to down-regulate episodes of negative affect is necessary for creativity to occur (Bledow et al., 2013). Findings by Campion and Levita (2014) suggest that passively listening to or dancing to upbeat music for five minutes may aid in creating such a shift toward positive affect.

Theorising how individual affect plays a role in individual creativity in an organizational context, Amabile, Barsade, Mueller, and Staw (2005) have developed the affect-creativity cycle. This model is illustrated in Figure 2.5.

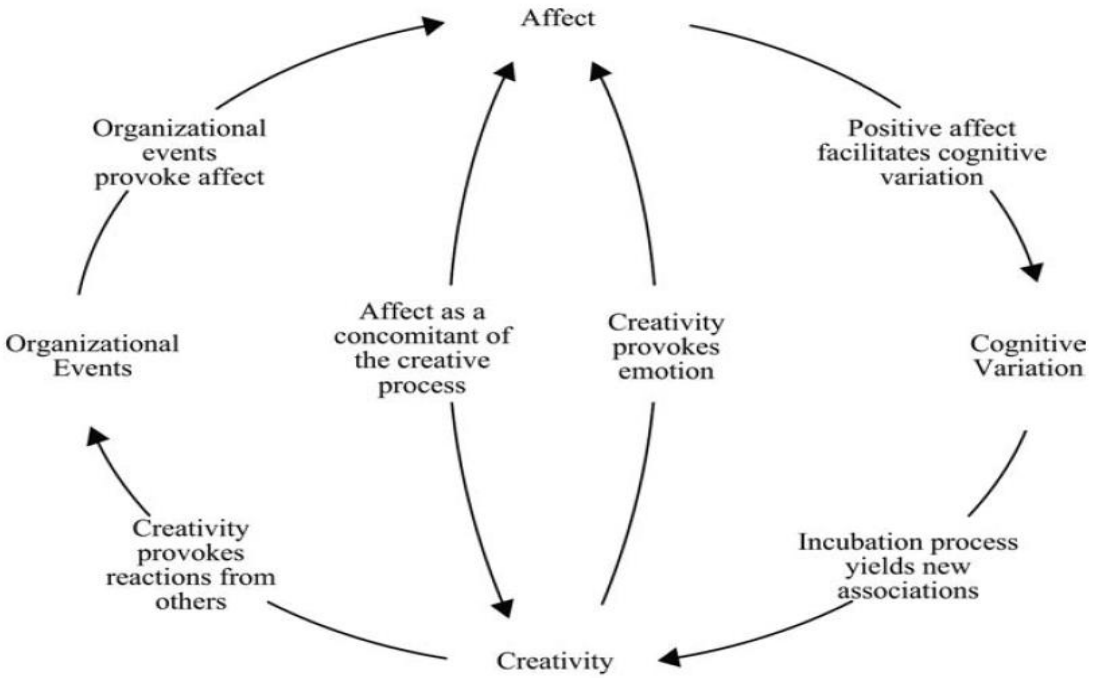

Figure 2.5. The affect-creativity cycle. Reprinted from "Affect and creativity at work," by T.M. Amabile, S.G. Barsade, and J.S. Mueller, 2005, Administrative Science Quarterly, 50, p. 392. Copyright 2005 by Sage Publications.

In simple terms, affect is the result of how others receive an individual's creative idea. When reactions are positive and encouraging, an individual's affect is likely to be positive. This positive affect, in turn, results in increases in cognitive variations and creativity. This may then form part of a virtuous cycle (as seen in the outer cycle in Figure 2.5). However, even if an individual does not reveal his/her creative idea to others in the organisation, the act of creative thinking itself can produce positive emotion in the individual. This would still heighten levels of cognitive variation and creativity, even without external feedback. It should be noted that the opposite cycle involving negative affect, which has a detrimental effect on creativity, is also possible.

2.8.5 Intrinsic motivation

Intrinsic motivation can be described as doing an activity for the psychological enjoyment of the activity in itself (Cropley & Cropley, 2009). After decades of empirical research findings concluding that extrinsic factors such as expected evaluation, competition, and even expected reward are detrimental to creativity (Amabile et. al, 2004; Amabile, 1996), the principle that intrinsic motivation is crucial for creativity is now widely accepted. In a recent meta-analytic study, Jesus, Rus, Lens, and Imaginário (2013) confirmed a positive relationship between intrinsic motivation and product creativity. A study conducted by Dewett

(2007) reported that intrinsic motivation is positively related to risk-taking, which is widely viewed as integral to creativity. Another mechanism in the intrinsic-motivation-creativity link may be that intrinsically motivated individuals are more likely to persevere and spend hours developing the necessary domain-relevant skill (as required by the ten-year rule and many creativity theories), because they love doing the particular activity. Subsequently, as they develop, such individuals will notice gaps or defects in the status quo of the domain and experiment, because they are personally dissatisfied or curious or assume it is their responsibility to advance the domain (Cropley & Cropley, 2009). Whatever the initial reason, if intrinsic motivation for an activity is strong enough, risk-taking experimentation and resultant creativity is more likely to be sustained over time.

Extrinsic motivators such as pay, praise, awards, and the avoidance of punishment may lead to conformist behaviour and seeking safer known solutions (Cropley & Cropley, 2009; Hennessey, 2010). However, these are 'carrot and stick' motivators aimed at controlling behaviour. Research has suggested that when extrinsic motivators are aimed at providing information, creativity may be enhanced (Eisenberger & Armeli, 1997; Eisenberger & Rhoades, 2001). These informational extrinsic motivators may include constructive feedback or prior guidelines that help make explicit *where* and *how* creativity is needed. This is in line with calls by Unsworth, Wall, and Carter (2005) for organisations to communicate the *creative requirement* (or the importance and expectation of creative, work-related ideas) to employees.

In an attempt to counteract the negative effects of the 'carrot and stick' extrinsic rewards, Hennessey, Amabile, and Martinage (1989) have developed so-called immunization techniques such as *intrinsic motivation training* aimed to making tasks seem more exciting and helping participants to de-emphasize expected extrinsic rewards. The intrinsic-motivation-trained participants yielded higher levels of creativity and maintained their intrinsic motivation levels even under conditions where extrinsic rewards were offered.

2.9 Theoretical Perspectives on the Deliberate Development of Creativity

This section will elucidate a selection of theoretical approaches to developing creativity in a deliberate fashion. These theoretical positions are manifested in both scholarly and popular literatures.

2.9.1 Intelligent Fast Failure (IFF)

In the previous sections of this chapter, there has been reference to creators reporting being struck by the metaphorical bolt from the blue. However, in the case of Doctor Jack V. Matson, this was not the sudden burst of insight reported by so many other creative individuals. Matson was literally struck by lightning and decided afterwards to pursue a more creative path in his career as an engineering lecturer (Tahirsylaj, 2012). He wanted to encourage creativity from his students, but traditional brainstorming approaches were not well received. It was only during a building contest with popsicle sticks that he observed that the tallest structures were built by those who initially tested many ideas and the seed for intelligent fast failure was planted.

Intelligent fast failure is a theory of intentional risk-taking at the individual and organisational level in which individuals undertake manageable risks, minimizing the associated cost while maximizing their learning until a solution is devised to reach the desired outcome (Tahirsylaj, 2012). It is a useful tool for teaching and encouraging creativity, as it can unlock knowledge usually lost as a result of the 'failure is bad' socialization within which many people and organisations are immersed. This accepted socialization is in sharp contrast to the beliefs regarding the benefits of failure of Thomas Edison who remarked to a co-worker after a succession of unsuccessful experiments, "We haven't failed. We now know 100 things that won't work, so we're that much closer to finding what will" (Einstein, 1979, p. 202).

The major distinction between this and other failure theories is that IFF encourages several simultaneous experiments at both organizational and individual level, while other theories promote experimenting with one idea at a time at the organizational unit level (Tahirsylaj, 2012). Here, once more, we find a parallel with Thomas Edison who measured success by the number of experiments that can be crammed into a single day (Millard, 1990).

To use intelligent fast failure, one needs to adhere to two agreements (Tahirsylaj, 2012):

1. Understand and overcome the fear of failure. It has to be understood that this fear is counterproductive and that any creative risk includes a margin for error that may result in failure.
2. Make the decision to learn from failure. When an idea fails, learn what went wrong and do not stop at the first attempt. Edmondson (2011) noted that in some scientific fields, over 70 per cent of experiments are unsuccessful, but these researchers know that failures contain valuable information that propels knowledge forward.

Three principles underpin Intelligent Fast Failure (Tahirsylaj, 2012), namely:

1. Generating ideas. The emphasis is on generating as many ideas as possible. Recording these ideas must become a habit and the use of an idea notebook is recommended.

2. Running experiments. This principle involves sifting the most promising ideas to be tested via experiments and learning from successful, as well as unsuccessful experiments. As Hargadon (2008) noted, a failed idea in one area can become a successful solution in another context, as well as help avoid a repetition of the same mistake in other projects.

3. Shifting perspectives. This entails the understanding of the perspectives of others, especially why an idea was not accepted by the wider community or organisation.

Matson developed three concepts that operate at the heart of the Intelligent Fast Failure when dealing with new ideas:

1. *STRAFE (Success Through Rapid Accelerated Failure Engineering and Entrepreneuring).* Inspired by World War Two pilots firing on the enemy, STRAFE means trying out many ideas simultaneously, as only few will hit the mark, but the others will provide learning for what does not work (Tahirsylaj, 2012). When applied, STRAFE also shortens the time required from trial and error to success.

2. *CHAOS (*Creating Havoc Accelerates Outrageous Success). The CHAOS concept refers to the refinement, improvement, and redesign of a creative product (Tahirsylaj, 2012). Being your own greatest competition is a key mindset to applying CHAOS.

3. *Fast history*. The concept of fast history refers to the tendency for ideas to become outdated very quickly in our modern age. To overcome fast history, individuals must diversify their interests and hobbies to fields that are unfamiliar to them and then connect this new knowledge with their existing knowledge to produce new ideas (Tahirsylaj, 2012). In addition, internal and external social networks become important as these networks connect people with a wider range of ideas outside their knowledge base (Hargadon, 2008). This is consistent with social network theories focusing on Social capital, referring to the total potential and actual resources derived from the network of social relationships of individuals or social groups (Nahapiet & Ghoshal, as cited in Payne, Moore, Griffis, & Autry, 2011). For example, Granovetter's *weak ties theory* holds that a weak tie, meaning a relationship between a member of a social group and an individual outside that social group, is likely to grant such a group member access to non-redundant and potentially novel ideas, resources, and information (O'Donnell et al., 2007). Research on internal networks such as intra-organisational relationships among employees, has shown that social capital has

a positive influence on ideation and organisational creativity (Björk, Di Vincenzo, Magnusson, & Mascia, 2011; Lui, 2013).

The major limitation of Intelligent Fast Failure as an approach for developing creativity lies in the degree of applicability across contexts. For example, Intelligent Fast Failure may not be a good fit for environments such as emergency rooms or extreme sports such as free-climbing where mistakes may prove fatal (Tahirsylaj, 2012).

2.9.2 Learning from eminent creators

This approach assumes that one can learn to be creative by absorbing and practicing the strategies and principles of eminent artists and scientists. As a consequence, this approach inherently focuses on *Big C creativity* only, with the rationale that if mere mortals can master at least some of the Big C creator's habits, they too could become creative (if only at the Little C or everyday creativity level).

There have been two broad lines of attack used for learning from eminent creators. First, there are various popular books focusing on these creators' creative habits and lessons from their lives. Books that fall under this category include the *Strategies of genius* series of books by Dilts (1994; 1995) and *How to think like Leonardo Da Vinci: Seven steps to genius every day* by Gelb (2000). These and other similar books run the gamut in terms of their location on bookstore shelves, their placement ranging from self-development to business to arts sections. The positive reviews and ratings on websites such as http://www.goodreads.com indicate that many readers have found these books helpful, but popularity may remain their only merit without scientific research validating the advice espoused.

The other route is the scholarly study of eminent creators. Two of the more sophisticated methods are *historiometry* as championed by Dean Keith Simonton (Simonton & Ting, 2010) and Howard Gruber's *evolving systems approach* (Gruber, 1996; Gruber & Wallace, 2001; Rostan, 2003).

Historiometry is the process of first subjecting historical and biographical data to quantitative measurement and then statistically analysing these measures to test hypotheses regarding human behaviour. When applied to creativity, it is theorised that eminent creators leave their mark on history, as well as evidence that can be unearthed by historiometric research (Simonton & Ting, 2010). At the individual level of analysis, the process starts by compiling a large list of eminent creators within a single domain or within a selected number of domains, typically using reference books and biographies as

sources. This sample can be limited in terms of time (usually using 20-year periods) and geographical areas (country, province, region, or even city). Then, each creator is scored on a large number of independent and dependant variables. The independent factors may include those related to career development (e.g. greatest work, age at first major work, awards received), training and education (e.g. highest degree, academic achievement, role models, mentors), family background (e.g. socio-economic status, birth-order), and sociocultural events (e.g. civil war, political or social instability). The dependent variables chosen are usually either eminence achieved or the creative productivity of the creator over his/her lifetime (Simonton & Ting, 2010). The data are then subjected to various statistical analyses.

The evolving systems approach was developed as both a case study method and theory by Howard Gruber to address previous omissions in creativity research. These omissions include investigating the possibility that the creative act may be part of a longer process that unfolds over a lifetime and going beyond the thesis that creative products are merely a product of a special personality held by both psychoanalytic and psychometric movements to differing degrees (Brower, 2003).

Rostan (2003) noted that the evolving systems approach requires the researcher to reconstruct the meaning of creator's experiences from their subjective developing mind's perspective. The evolving systems approach differs from other ways of studying eminent creators in several ways (Gruber & Wallace, 2001). Firstly, it involves the direct study of a creative work as it unfolds and focuses on what the creator does while creating over time, not depending on indirect measures. Secondly, for the reconstruction and tracing of the path of the creative product to be possible, abundant material such as the work itself, correspondence, and the creator's notebooks must be available. This is necessary to avoid making speculative leaps. Thirdly, the researcher requires both knowledge of the domain and understanding of the creator's work (Gruber & Wallace, 2001). Lastly, the evolving systems approach avoids trying to come up with a list of traits that explain the creator's achievement.

Instead, the evolving systems approach, as the name implies, takes a systemic and developmental view. In other words, the researcher must look at how the creator's mind organised related systems, such as knowledge, affect, social interactions, serendipity, and the physical world (Brower, 2003). It should be noted that systems are not viewed as fixed – they are always evolving over time (Gruber & Wallace, 2001). Instances where the creator deviates from his individual or societal norms to create must be identified, as these are opportunities for personal development and change. Some approaches to case study might ignore such instances as errors of research or description, but the evolving systems approach uses this to isolate deviation-amplifying systems that are underlying such deviations. In addition, Miller (2012) noted that creative work is viewed as interactive (taking place in social and

historical contexts), constructionist (as the creator consciously develops skills for the work), experiential (as the creator develops emotional awareness of the work) and pluralistic (involving multiple projects, relationships, and insights).

Overall, both popular and scholarly approaches may be fruitful in terms of identifying and applying useful habits and strategies of those who have achieved creatively. However, findings concerning life circumstances within which eminent creators produced works may be less useful or not be possible or even desirable to recreate. Still, some extreme life circumstances may be recreated in 'softened' variations. For example, the fact that Einstein isolated himself from social relations for extended periods when he did his best creative work (Gardner, 1993) can be creatively softened to mean *'Schedule and protect a specific time each day to engage in your creative projects.'*

2.10 Empirical Research regarding the Deliberate Development of Creativity

This section will focus a selection of approaches to developing creativity in a deliberate fashion that have been investigated scientifically through various types of inquiry. These approaches have been validated via empirical research.

2.10.1 Improvisational exercises

In popular culture, improvisation is the spur-of-the-moment creation of something new out of nothing (Lemons, 2005). Although this definition is superficial, it alludes to the notion that improvisation is the creative product and process occurring simultaneously (Lewis & Lovatt, 2013). However, Montouri (2003) noted that improvisation has conjured up connotations of an activity that is makeshift, performed when there is a temporary breakdown of proper systems and procedures. Contrary to such lay perceptions, in addition to being spontaneous, improvisation builds on what has been introduced by others and operates best within a structure, theme, setting or other constraints to ensure relevance (Lemons, 2005).

Research findings suggest that experts, regardless of domain, reach a level of proficiency where they constantly improvise independent of the rules and see errors as opportunities (Barrett, 1998; Dreyfus & Dreyfus, 1986). Clearly such experts' creativity is greater than the sum of their procedural knowledge

and experience. It is therefore seen as important to develop improvisational skills, not only for when existing systems malfunction, but to aid personal creativity independent of such emergency situations. Fan (2013) suggested that improvisational skills help individuals respond spontaneously to the unexpected, take initiative, and escape their restrained beliefs when faced with problems.

In a qualitative study involving seven individuals from diverse disciplines who all employ improvisation in their work, Lemons (2005) identified elements present in improvisation. These include risk/challenge, safety, communication, community/teamwork, honest emotional expression, joy, and self-actualization. It occurs to the current researcher that there is some similarity between these elements and Ekvall's dimensions of creative organisational climate (discussed in a previous section within this chapter). As most research on improvisation and creativity is undertaken at the individual or group level involving a once-off intervention, this leads to an interesting and neglected research question, namely: Can an organizational climate for creativity can be created by introducing organisation-wide improvisational work practices? Introducing improvisation in workplace or educational settings may be challenging. Reporting on studies focusing on the improvisational potential of supportive technology (i.e. short message service communication and micro-blogs) in learning, Dillon, Wang, Vesisenaho, Valtonen and Havu-Nuutinen (2013) found that supportive conditions need to be created and learners need to be made aware of improvisational possibilities before technology can be used to improvise during learning.

At the very least, Vera and Crossan (2005) suggested that training involving improvisation theatre exercises may contribute to team innovation when the work environment is conducive to such improvisation. Although the improvisation-creativity link is a relatively recent research stream and has not yet been empirically proven beyond doubt, some indirect evidence does exist. In this vein, two experiments involving verbal and musical improvisation conducted by Lewis and Lovatt (2013) indicated that improvisation led to increases in divergent thinking, specifically in three of its dimensions fluency, originality, and flexibility. The reader may recall that it has been established that divergent thinking is not synonymous with creativity, but rather a predictor of creative potential. Therefore, there is promising evidence of improvisation's indirect effect on creativity.

There are a multitude of books available, outlining various improvisational exercises and how to use them. For example, Koppet's (2001) book, *Training to imagine: Practical improvisational techniques to enhance creativity, leadership, teamwork and learning,* is one such book that may be helpful.

2.10.2 Creative problem-solving method-based training

Although there is some overlap between categories, creativity training can be split into three broad groups. The first category the current researcher calls *cultivating creative attitudes and habits of mind*, which focuses on developing curiosity, spontaneity, and other attitudes or habits deemed useful for being creative. The second category, *training in the use of New Age open exploratory activities*, is similar to the first category but differs from it in that it views the creative process as a spiritual practice and ignores the usefulness or quality requirement of creativity (Sawyer, 2012). Any product is considered creative and refinement or improvement of such a product is seen as irrelevant. The process, without sticking to a set plan, is more important than the product. This category involves training in activities that include very little guidance beyond how to start and only a few of these activities can be applied to specific problems. The bulk of these techniques are usually implemented as part of a daily routine with creative results only observable or *felt* after weeks or months. Open exploratory activities include guided imagery, meditation, Zen sketching, free or automatic writing, and keeping a thought-log (Piirto, 2004). The aim of this type of training is to capitalise on what the mind's eye sees or to gain insight in the Gestalt sense of the term. The third category and focus of this thesis is *training in the use of creative problem-solving methods*. This category differs from the second category as these methods possess steps and guidelines individuals and groups can use to navigate from problem to solution.

This type of creativity training, as the label suggests, involves training learners in the use of creative problem-solving methods such as Creative Problem Solving, Lateral thinking, Six thinking hats, Mind mapping, Synectics, and TRIZ. The nuts and bolts of these six and other methods will be explained and critiqued in the next section of this chapter. In this section, the focus shall remain on research regarding training interventions related to these methods.

Among these methods, CPS has received the widest research attention (Puccio, Firestien, Coyle, & Masucci, 2006). In a study that involved research and development workers, Wang and Horng (2002) found that CPS training significantly increased the fluency (number of ideas) and flexibility (number of idea categories) as well as the number of service reports addressing technical problems authored or co-authored by the intervention group. Basadur and his colleagues have undertaken several studies examining the effect of CPS on attitudes. In one such study, Basadur, Pringle, and Kirkland (2002) found that CPS training significantly increased participants' preference for ideation and decreased their tendency for premature critical evaluation of ideas.

An investigation by Birdi (2005) evaluating courses built around Edward De Bono's *Thinking hats* and *Lateral thinking* found that these training interventions increased participants' creativity knowledge (i.e. being able to apply these methods to problems) and idea generation.

Spencer, Anderson, and Ellis (2013) reported that the use of *Mind mapping* as part of a family nurse practitioner course focusing on health promotion enabled learners to solve complex problem-based case studies in a collaborative fashion. Most of the learning and generation of solutions were generated when students presented their mind maps to their peers. In another nursing education study involving the development of patient care plans, Kern, Bush, and McCleish (2006) reported that Mind mapping assisted students in customising care plans to suit the individual patient and gaining a holistic perspective of the patient. In addition, the summative evaluation at the end of the study yielded 91 per cent of students agreeing that mind-mapping increased their critical thinking.

Gendrop (1996) reported higher originality post-test scores for nurses that underwent *Synectics* training than a control group that did not. Another study by Scheepers and Coetzee (2010) asked final year creativity and innovation management students to rate their creative abilities, communication skills, problem-solving, and teamwork both prior and after a Synectics workshop. The study employed two post-tests separated by three months, which both yielded improved self-ratings of post-intervention performance on the four outcome variables and consistent agreement by participants that their own pre-test self-ratings were unrealistically high. Scheepers and Coetzee (2010) concluded that Synectics could be of used even for a sample with prior exposure to and understanding of creativity theory.

Belski (2009) investigated the differential effect of infusion (i.e. infusing thinking and problem-solving within a discipline-based curriculum without specifically teaching problem-solving) and enrichment (i.e. teaching specific problem-solving methods parallel to the discipline-based curriculum) approaches on problem-solving abilities of engineering students. Students exposed to the enrichment condition (in this case a *TRIZ* course) reported that using TRIZ tools assisted them in being more structured in their problem-solving and systematic in their thinking. These students were also able to produce elegant solutions to course exercises. The TRIZ thinking course participants' confidence in solving unfamiliar challenges was significantly higher than those of discipline-based courses, providing some support for the enrichment approach to enhancing problem-solving skills. Conducting an organisational study evaluating the impact of a TRIZ training course, Birdi, Leach, and Magadley (2012) found that the intervention gave rise to increased motivation to innovate, as well as gains in creative problem-solving skills. Furthermore, trainees were able to cite examples of post-training workplace application of TRIZ learning.

The results of a meta-analysis of 70 studies conducted by Scot, Leritz, and Mumford (2004) confirmed that creativity training is effective. Furthermore, it was concluded that training focusing cognitive processes linked to problem-finding, constraint identification, conceptual combination, and idea generation were particularly effective. Scot et al. (2004) suggest that this finding points to the effectiveness of creativity training being driven by developing and providing guidance regarding the application of cognitive abilities. This guidance is provided through training learners in strategies or heuristics for working with information. Creative problem-solving methods, including those cited above, are at their core thinking tools or sets of strategies that guide individuals or groups through problem-solving. Therefore, although the utility of other categories of creativity training cannot be dismissed out of hand, the results of their meta-analysis suggest that training learners in the use of creative problem-solving methods is particularly effective.

2.11 Overview of Creative Problem-solving Methods

The following section contains a discussion of thirteen of the most well-known creative problem-solving methods. Each method will be described and critiqued with regard to their limitations. The methods critiqued include brainstorming, the nominal group technique, systematic integration of solution elements, the Kawakita Jiro method, mind mapping, the evaporating cloud, rich pictures, Synectics, Lateral thinking, Six thinking hats, the universal traveller, CPS, and TRIZ. This overview should illuminate the weaknesses of the existing creative problem-solving methods and spotlight the deficit in scientific research that accompanied the development of most of these popular methods.

2.11.1 Brainstorming

The basic premise of Brainstorming is that participants' ideas will stimulate other ideas to create a snowball effect of ideas generated (Proctor, 2010). It is also rooted in the belief in the superiority of group thinking over individual thinking (Sawyer, 2012).

The four rules of Brainstorming are as follows (Proctor, 2010):

1. All criticism is banned.
2. Wilder ideas are encouraged.

3. Quantity of ideas is needed – more is better.
4. Combining and building on the ideas of others is welcomed.

Presently, brainstorming is renowned as the most popular creativity technique in history (Lehrer, 2012). So much so, that in popular culture the word is synonymous with creative idea generation with many a manager uttering words such as 'We'll just brainstorm some ideas' without referring to the documented procedure developed by the late Alex Osborn in 1936. It could be hypothesized that this is a result of the most well-known principles of the method, namely that criticism is not allowed, and that freewheeling is encouraged. These two tenets give the impression of a method without structure and as a result that any creative ideation by a group constitutes brainstorming in the minds of the public. As alluded to above, Brainstorming is often misunderstood and consequently incorrectly executed by many who have not received training or studied its process (Proctor, 2010).

Brainstorming consists of the following steps (Hicks, 2004; Michalko, 2006; Proctor, 2010):

1. Prepare for the brainstorming session by choosing the participants (10-12 people including a leader and a scribe), location (with comfortable chairs, flipcharts, marker pens, etc.) and sending a memo to all participants explaining the basic process and the problem to be brainstormed.
2. At the start of the session, the facilitator states the problem as specifically as possible and clarifies any confusion the group raises. For example, seeking new product ideas may be problem as given.
3. The participants verbally offer redefinitions of the problem in 'How to' form. The redefinitions could be limited to a sub-problem (e.g. *How to identify profitable new products*) or use a metaphorical approach (e.g. *How to be the early bird that catches the worm*, referring to gaining entry to a new market via this new product) or view the problem from different angle (*How to satisfy the wants and needs of customers*). These restatements are recorded along with the original problem.
4. Once these redefinitions are on the flip chart, the facilitator selects the most relevant of these statements and the redefinition process is repeated, often building on or combining the relevant redefinitions chosen.
5. Finally, the facilitator identifies one or more of the redefinitions, which the group must use for idea generation.

6. After the brainstorming session, the facilitator should select the most promising ideas and send these to an evaluation panel (other than the brainstorming group) for final evaluation.

Proponents of brainstorming suggest that the method creates a stimulating atmosphere of constructive rivalry with participants competing to generate more and wilder ideas (Hicks, 2004). However, a myriad of criticisms against brainstorming casts doubt on such claims.

Sawyer (2012) noted that the body of research accumulated over the course of decades has demonstrated that brainstorming groups think of fewer ideas than an equal number of individuals. It has even been suggested that even though the no criticism rule exists, brainstorming elicits an unspoken air of criticism and never becomes playful enough to produce a free flow of ideas (Brown, 2009).

Another problem with brainstorming is that its reliance on random association may not lead to original solutions (Proctor, 2010). Participants may only be connecting known ideas or notions and not searching beyond their first ideas that come to mind.

The other major drawbacks of brainstorming include its susceptibility to social loafing, production blocking, groupthink, and evaluation apprehension as discussed in Chapter 1 (Heslin, 2009). S*ocial loafing* may occur due to rapid-fire, freewheeling idea generating that other participants may exhibit when the process is in full swing. Michalko (2006) noted that brainstorming represents serial processing of information as only one idea can be suggested at a time, which leaves the process open to *production blocking* due to brainstorming's turn-based nature. Due to the verbal nature of the submission of ideas, *groupthink* may become a problem as the loudest voices tend to dominate discussions while *evaluation apprehension* may occur as the ideas are offered verbally within the group. A further disadvantage of brainstorming is the occurrence of *downward comparisons* (also known as downward performance matching or downward production matching), where participants match the amount and type of ideas of the lowest performers within the brainstorming group (Roy, Gauvin, & Limayem, 1996). Finally, brainstorming tends to encourage *cognitive narrowing*, which entails ideas becoming more focused in one direction or train of thought as the group discussion limits the number of alternate directions that are accepted (Wood & Pickerd, 2011). This is consistent with research by Kohn and Smith (2010), who found that exposure to the ideas of others, as is the case in brainstorming, reduced the novelty of subsequent ideas generated and increased conformity to the ideas of others. This narrowing does not affect the quantity of ideas, but reduces the number of semantic categories in which ideas can be grouped (Goldenberg & Wiley, 2011). For example, if five participants have mentioned ideas from two categories, there may be a tendency for the rest of the group to generate ideas in those same two

categories. These findings suggest that the assumption of 'idea quantity necessarily leads to quality' is flawed.

2.11.2 Nominal group technique

The *nominal group technique* was developed during the 1970s by Delbecq and his associates after considering the limitations inherent in brainstorming (Hunton & Gold, 2010). The name was derived from the fact that participants work individually for part of the technique and are thus part of a group in name only during that stage (Boddy, 2012). The nominal group technique was developed to eliminate barriers to individual contributions to group outputs as each individual is afforded an equal input idea generation and selection without competition for speaking time (Asmus & James, 2005).

Boddy (2012) outlines the steps of the nominal group technique as follows:

1. Once familiarised with the problem or question, participants are asked to silently and independently write down their ideas with each idea recorded on a sticky note.
2. Ideas are then presented by participants in a round robin fashion or by the moderator and displayed on a white board or large piece of paper for the group to consider.
3. Ideas are then discussed via an interactive group discussion.
4. Participants independently rate or rank the ideas, resulting in numerical values for each idea based on the number of votes it receives for any given criteria. During this step, originators of ideas may be invited to clarify their ideas to the rest of the group if any confusion exists.
5. Individual rankings are combined to create group scores for each idea. The highest valued idea or ideas are refined further by the group.

Due to its structure and protocols, the nominal group technique's outputs are less dependent on moderator behaviour and participant mix (Sutton & Arnold, 2013). Consequently, its structure also decreases the moderator training requirements (Boddy, 2012). The technique reduces misinterpretations as participants may be used to clarify or elaborate on their own ideas (Sutton & Arnold, 2013). Production blocking is also reduced due to the fact that ideas are generated independently from the group (Hunton & Gold, 2010). Cognitive narrowing is also reduced using the nominal group technique, because a single train of thought is not followed as is the case with a brainstorming group (Boddy, 2012).

It should be noted that the nominal group technique's limitations are in part dependent on variations on its process. For example, if step two is implemented anonymously (i.e. the moderator presents the ideas and the participants are aware of this beforehand, participants may engage in social loafing (Hunton & Gold, 2010). However, if step two is not undertaken anonymously, evaluation apprehension may be experienced by participants (Hunton & Gold, 2010).

In addition, caution should also be exercised when assembling a nominal group out of a hierarchical group within an organisation, as junior participants may become inhibited in the presence of more senior colleagues (Sutton & Arnold, 2013). Furthermore, O'heocha, Wang, and Conboy (2012) argue that voting lacks the richness of a more interpretative evaluation of ideas.

2.11.3 Systematic integration of solution elements

Systematic integration of solution elements (also known as *Successive integration of elements*) was developed by Schlicksupp for use within interdisciplinary teams tasked with devising complex solutions where only a few possible solutions are apparent (Perteneder, Hahnwald, Haller, & Gaubinger, 2013). The group utilising this method usually consists of 4 to 6 participants.

Systematic integration of solution elements consists of the following steps that must be followed:

1. After the problem is presented, the participants individually jot down ideas for solving the problem (Calwell, n.d.);
2. Two participants each read out one of their ideas (Calwell, n.d.);
3. Then, the rest of the group extracts beneficial aspects from the two ideas and try to integrate these aspects to form a third idea (Perteneder et al., 2013).
4. Next, another participant presents a fourth idea.
5. Step 3 is repeated using the integrated (third) idea and the newly presented fourth idea to form a fifth idea.
6. The entire process is repeated until all ideas are exhausted and integrated to produce a final list of exceptional ideas (Calwell, n.d.). The pros and cons of the listed ideas are considered to select the final solution (Perteneder et al., 2013).

Stewart and Simmons (2010) used 'how to alleviate traffic congestion in Los Angeles' as an example problem to illustrate the use of this method:

- *Idea 1:* Covert all lanes into car pool lanes (lanes for vehicles transporting two or more passengers).
- *Idea 2:* Construct more roads.
- Combine idea 1 and 2 to form *Idea 3:* Construct entire roads (not merely lanes) for carpooling.
- *Idea 4:* Improve public transport.
- Combine idea 3 and 4 to form *Idea 5:* Enforce a fee from motorists who don't car pool and utilise the funds from this fee to improve public transport.
- *Idea 6:* Encourage employers to give employees an incentive to car pool.
- Combine idea 5 and 6 to form *Idea 7:* Encourage businesses to arrange minibuses equipped with wi-fi to transport employees in the car pool lane so that they can start working or reading through work emails before they get to the office.

According to Calwell (n.d.), *systematic integration of solution elements* ensures that all participants' ideas are considered and not dismissed out of hand. As the method focuses on the positive aspects and benefits of each idea during integration, participants identify highly with the final solution (Perteneder et al., 2013). It also has the added benefit of encouraging constructive convergence, meaning building on the ideas of others in order to zero in on a final solution (Calwell, n.d.). Perteneder et al. (2013) noted that the collective benefit extraction and integration is enhanced by diverse perspectives such as is the case with multi-disciplinary teams.

However, while *systematic integration of solution elements* contributes in all of the above regards, one major limitation is that integrating all ideas presented may prove problematic at the best of times and impossible when two ideas are mutually exclusive.

2.11.4 The KJ method

During a scientific expedition to a remote Japanese mountain village in 1951, Japanese anthropologist and ethno-geographer, Professor Jiro Kawakita struggled to integrate masses of non-repetitive, heterogenous, qualitative field notes that had been collected on note cards (Scupin, 1997). It was only

when Kawakita altered the spatial arrangement of the note cards on his desk that he began to discover the holistic meaning that had been recorded on the cards.

Over the next 15 years, Kawakita would systematize and develop this initial insight as both a research method and a creative idea-generating method known as the Kawakita Jiro or KJ method. The KJ method involves a centuries-long neglected form of reasoning called Abduction that is neither deduction nor induction and is used to sort out chaotic, confusing ideas such as when a researcher chooses a hypothesis to test from several options (Scupin, 1997). Upon the completion of the method, Kawakita published and outlined the KJ method in his books "*Hasso Ho"* (Way of Abduction) in 1967 and "*Ziku Hasso Ho"* (Sequel to Way of Abduction) in 1970 (Yoneyama, 2007). Since that time, the KJ method has become popular among Japanese corporations and quality practitioners who regard it as a tool to be utilised within *total quality management* (Lepley, 1998). Furthermore, Takai and Ishii (2010) suggested that the KJ method has become essential in the product development process for the identification of customer needs and sorting of a large number of these needs into a smaller more manageable number of representative need categories.

Lepley (1998) recommends using the KJ method when much time is required to identify the root cause of a problem and solutions are not needed immediately. Proctor, Tan, and Fuse (2004) note that the KJ method, like other less well-known Japanese creativity techniques, places great emphasis on understanding the meaning of words or observations especially when used by groups. This emphasis is highly congruent with the pillars of Japanese creativity, namely focuses on teamwork, training, communication, and processes (Proctor et al., 2004). However, it should be noted that although the KJ method is commonly used by groups, it can be used by individuals as well.

The KJ method consists of the following steps that must be followed:

1. Agree on a problem to be solved or a question to answered (Lepley, 1998). It should be noted that when the method is used by a group that consensus must be reached about the question before proceeding.

2. *Card-making:* Ideas relevant to the question are written on cards or sticky notes or adhesive labels (Scupin, 1997). This idea-generation occurs in silence for 7-10 minutes (Lepley, 1998). Only one idea with a clear meaning must be written down on a card and no judgement of the importance of any single idea is permitted at this stage (Ohiwa, Takeda, Kawai, & Shiomi, 1997).

3. *Card-grouping:* The collected cards are then shuffled, spread out on a table or large sheet of paper (in the case of sticky notes and labels), and read silently and carefully a few times (Calwell,

n.d). Through this repeated reading, the individual or group will begin to notice that some ideas are similar or closely related. It is important that intuition is used in judging the similarity and relatedness, as over-reliance on logic will make the process less organic (Scupin, 1997). Natural groups or themes will begin to emerge among the ideas. Participants are allowed to silently move the cards to form these groups and moving a card previously moved by another participant is acceptable (George, Rowlands, Price, & Maxey, 2005). Silence is maintained even when participants disagree on where a card must be placed, and such a card must be duplicated and placed in both groups. Card-grouping should be repeated until less than 10 groups remain. Headings or titles are then selected that reflect the contents of each group of ideas (Calwell, n.d). This selection is reached by a consensus approach in one of two ways. One, headers may be drafted via an interactive group discussion or, two, the facilitator may formulate titles during a break and then puts these options to the group to decide.

4. *Optional header-grouping:* If so desired, participants may review the 10 headers and if some of these headings logically represent a common broader theme, a master header or supergroup header is created for the larger cluster of group headings (George et al., 2005; Plain, 2007). Idea groups that do not fit under any supergroup heading may remain as a single group on its own (George et al., 2005).

5. *Chart-making:* This step involves arranging the groups of ideas on a large sheet of paper after the original question is written at the top of the sheet. See Figure 2.6 below. The participants must thoroughly consider the semantic relationships of idea groups and their representation as the spatial relationships on the chart (Ohiwa et al., 1997). This chart is called an affinity diagram, because it organizes ideas based on how these ideas inherently go together or possess a natural similarity (Haselden, 2003). This spatial representation helps participants appreciate the overall problem situation (Calwell, n.d.). Relationship lines may be drawn between groups and individual ideas within different groups and it may also be beneficial to write comments on the affinity diagram (Ohiwa et al., 1997).

6. The explanation of the resultant affinity diagram is written. The affinity diagram can be thought of as the spatial representation of the problem, while the written explanation is the sequential representation of the same information (Ohiwa et al., 1997). It is beneficial to ask participants to consider how the idea groups that they have developed will influence possible solutions (George et al., 2005). Several oversights made during the previous step or aspects of the problem invisible up to this point may be discovered during this step. It should be emphasized that solutions to the problem are often generated whilst participants explain what the affinity diagram (See Figure 2.6) means to them (Calwell, n.d.)

The KJ method works best when ample ideas with sufficient detail are generated (Gray, Brown, & Macanufo, 2010). To ensure that the quality of the sorting is high and results in meaningful categories, participants' insights into relationships between ideas must be clear (Gray et al., 2010).

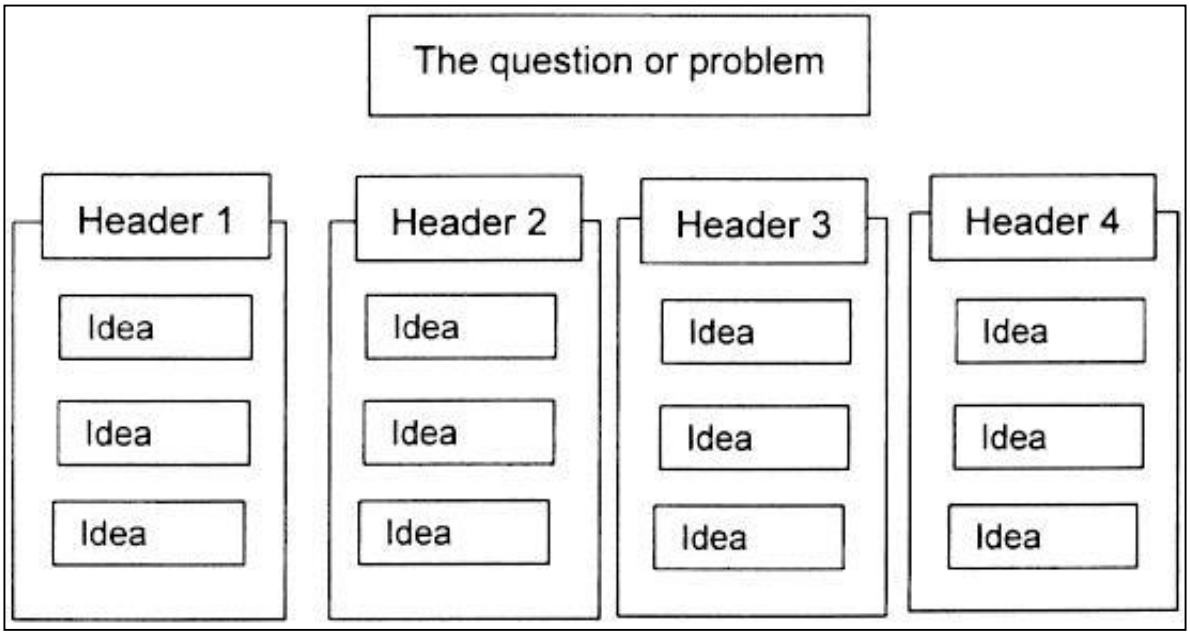

Figure 2.6. An example structure of an affinity diagram. Reprinted from "Problem-solving tools for analyzing system problems: The affinity map and the relationship diagram," by C.J. Lepley, 1998, The Journal of Nursing Administration, 28, p. 46. Copyright 1998 by Wolters Kluwer Health, Inc.

As the KJ method relies on consensus when applied by a group (especially for the initial question and card-grouping steps), the potential exists for a few participants' opinions to skew the grouping (Takai & Ishii, 2010). Another limitation is that it is difficult to objectively verify that all participants' opinions are reflected in grouping steps (Takai & Ishii, 2010).

2.11.5 Mind mapping

Mind mapping as it is known today was developed in the 1970s by a British educational consultant, Tony Buzan, as a tool to rapidly organize a large amount of information visually, aid in memorization, and enhance problem solving (Warren, 2012). A mind map is a diagram of major ideas represented by primary branches and illustrative examples denoted by secondary branches radiating out from a central topic (Burgess-Allen & Owen-Smith, 2010). Mind maps depict the spontaneous association of ideas that

are the product of human non-linear thinking with the ultimate objective in a problem-solving context being the creation of more creative associations between ideas (Davies, 2011).

Buzan and Griffiths (2010) outline the steps for mind mapping as follows:

1. Start with a blank piece of paper turned sideways (landscape orientation) and draw an image in the centre to represent your proposition or goal;
2. Draw a thick curved line radiating from the central image by drawing two thin curved lines connected at their tips;
3. Colour the inside of the thick curved line (also known as a primary branch);
4. For each thick line you draw, a keyword must be written on it. These are your initial impressions or main ordering ideas. Single words are preferred to phrases or sentences as the latter limits the organic nature of human thought processes. Keywords and images chosen may be related to the what, who, where, when, why, which and how of the topic. Alternatively, imagining your topic as a book and naming chapter headings may spark keywords.
5. Add second-level branches with keywords representing associated ideas. These second level branches are drawn thinner and connected to the main branches. Add third level branches that flow from the second level.
6. Work clockwise and create other primary, secondary and third-level branches. Keep repeating the process until you feel your mind map is complete or fatigue sets in (See Figure 2.7).

Figure 2.7. An example of a mind map – a biography of Tony Buzan. Reprinted from "A biography of Tony Buzan," by T. Buzan, n.d., Retrieved September 10, 2014, from http://www.tonybuzan.com/about/. Copyright (n.d.) by Tony Buzan.

Using Mind mapping as a creative problem-solving method, the above steps must be implemented in the following manner (Buzan & Griffiths, 2010):

1. For a period of twenty minutes and at pace, create a mind map of everything that comes to mind around your problem;
2. Take a short break;
3. Integrate the ideas produced;
4. Create a new mind map, taking special care to identify major branches and allowing duplication of ideas and concepts on multiple branches;
5. Take another break;
6. With new insights gained in preceding steps, create another mind map at pace;

7. To reach a solution, the final mind map must be studied. This will reveal further sub-branches that may lead to solution or connections between ideas on different branches will become evident.

In an experimental study involving industrial design students by Kokotovich (2008), mind mapping in the early phases of the problem-solving process was found to produce complex associations and issues, delay the emergence of completed ideas, allowing time for creative connections among issues and ideas to occur to participants. Mind mapping also allowed students to see both the fine-scale details, as well as the big picture of the design problem. Results indicate that mind mapping allows participants to articulate a larger number of design issues at an earlier stage, leading to design proposals that are rated as being more well-reasoned and creative. The resultant design-thinking of students using mind mapping closely matched that of expert designers. Furthermore, the generated mind maps acted as memory aids or records of the design process, permitting students to refer back to their reasoning at any time of the process (Kokotovich, 2008). This has the additional benefit that the thought processes of individual novice design students can be guided and examined during learning processes.

The current researcher first encountered mind mapping as a studying aid while at school and was not aware of its creative thinking applications until years later. This perception of mind mapping as study aid has remained and may mirror the popular views regarding the technique. However, when one considers the importance several creative process theories place upon memory (geneplore, cognitive network model, CHOICES model) and externalisation (geneplore, cognitive network model), mind mapping's application for learning and creativity may not be two separate research endeavours.

When implemented in group form, mind mapping is an effective method of ensuring that a myriad of perspectives are captured and may assist in achieving a shared understanding (Burgess-Allen & Owen-Smith, 2010). However, difficulties may arise when people other than the creator of a mind map try to read and understand such a distinctive, personal representation of ideas (Davies, 2011). Perhaps the most serious disadvantage of mind mapping as a problem-solving method is that it only depicts the simple associations and cannot be used for the analysis of complex relationships between ideas (Davies, 2011).

2.11.6 The evaporating cloud

During the 1980s, Doctor Eliyahu Goldratt developed a systems methodology or management philosophy aimed at continuous improvement called the *theory of constraints* (Inman, Lair Sale, & Green, 2009; Kim, Mabin, & Davies, 2008; Mabin & Balderstone, 2003). Originally, the theory of constraints was conceptualised as a scheduling algorithm within a manufacturing environment, but the addition of thinking processes widened its application to many different types of organisations (Mabin & Balderstone, 2003).

Within this methodology, thinking processes are logic-based tools that utilize cause-and-effect diagrams to represent the conflict situation and answer three questions (Inman et al., 2009):
(1) What to change?
(2) What to change to?
(3) How to create change?

One of these thinking processes is the *evaporating cloud* (also known as the *conflict resolution diagram*). Goldratt believed that at the heart of problems are conflict situations where no acceptable compromise appears open to the problem solver (Kim et al., 2008). These conflicts can be experienced externally between two parties (people or business units), as well as internally, such as a manager struggling with a difficult choice (Anderson, Gupta, & Gupta, 2013).

Goldratt developed the evaporating cloud as a structured method to identify all elements of the conflict situation, assumptions causing the conflict, and to inspire solutions (termed injections) to invalidate some of the identified assumptions (Gupta, Boyd, & Kuzmits, 2011). The evaporating cloud has been applied to interpersonal conflict, supply chain management, resource allocation in schools, creative design processes, forest harvesting, and managerial dilemmas amongst others (Kim et al., 2008).

Taylor and Poyner (2008) noted that the evaporating cloud is drawn and read left to right, starting with the common goal/objective of both parties, then the requirements of both sides to accomplish the common goal, and finally the prerequisites to achieving the requirements.

Figure 2.8 contains an example of an evaporating cloud for a specific problem taken from Taylor and Poyner (2008).

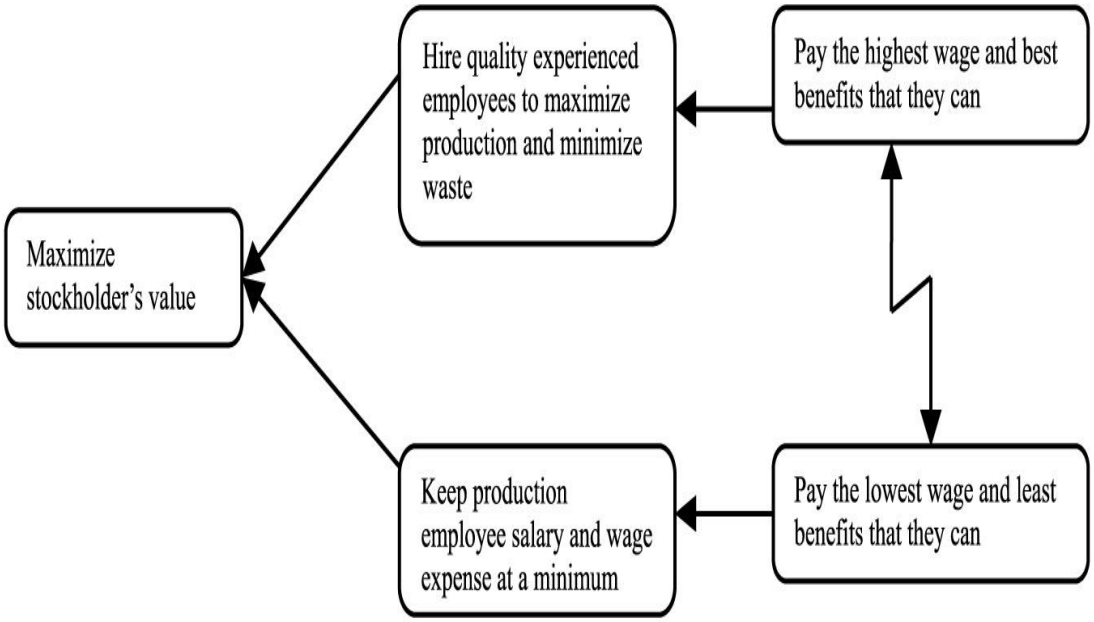

Figure 2.8. An evaporating cloud. Reprinted from "Goldratt's thinking process applied to problems associated with trained employee retention in a highly competitive labor market," by L.J. Taylor, and I. Poyner, 2008, Journal of European Industrial Training, 32, p. 603. Copyright 2008 by Emerald Group Publishing Limited.

- The common goal/objective [A]: To maximize shareholder value;
- Requirement [B]: In order to achieve the common goal, the organisation must hire experienced employees to maximize production and minimize waste;
- Requirement [C]: In order to achieve the common goal, the organisation must at the same time keep the production wage bill at a minimum;
- Prerequisite for B [D]: In order to hire experienced employees, the organisation must pay the highest wage and best benefits;
- Prerequisite for C [D']: In order to keep the production wage bill at a minimum, the organisation must pay the lowest wage and least benefits.

The conflict in the above situation is clear. It seems impossible to keep the production wage bill at a minimum and hire experienced employees at the same time. However, there are assumptions locked up in the conflict. For example, it is evident from looking at the diagram that it is assumed that experienced employees can only be attracted by high wages and benefits. The injection cited by Taylor and Poyner (2008), as can be seen in Figure 2.9, is to hire experienced employees through a temporary employment agency, thereby still reducing wage costs while gaining required production experience.

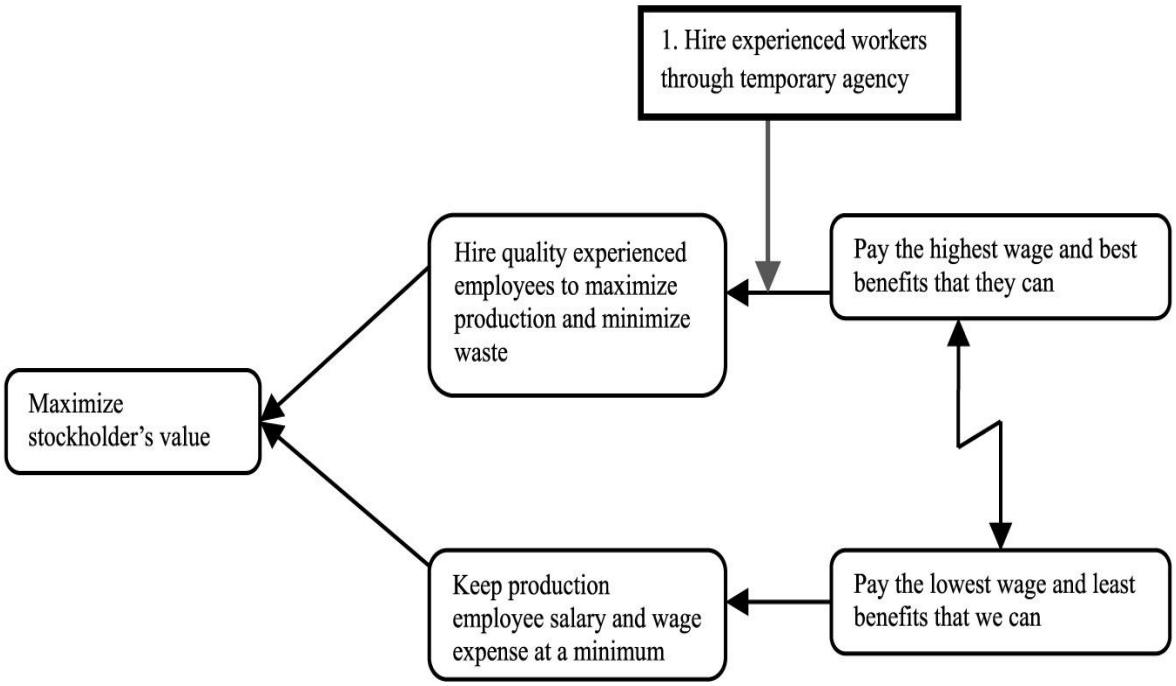

Figure 2.9. An evaporating cloud with an injection. Reprinted from "Goldratt's thinking process applied to problems associated with trained employee retention in a highly competitive labor market," by L.J. Taylor, and I. Poyner, 2008, Journal of European Industrial Training, 32, p. 604. Copyright 2008 by Emerald Group Publishing Limited.

While contributing in identifying underlying assumptions, Rantanen and Domb (2008) stated that the evaporating cloud does not adequately address how to generate an idea to resolve the conflict or *find an injection* as Goldratt terms it. His vague advice in this regard is to use a reference environment (Rantanen & Domb, 2008). It is unclear what Goldratt means by this and leaves problem-solvers free to speculate whether this refers to creating a database of methods to inspire injections or the use of analogical thinking or even a benchmarking approach.

2.11.7 Rich pictures

Originally developed as part of the *soft systems methodology,* pioneered by Peter Checkland, *Rich pictures* is an information gathering tool that may also be used as a free-standing method outside of the soft systems methodology (Bell & Morse, 2013). This group method assists participants to look at problems from new perspectives and can be used as follows (Proctor, 2010):

1. Develop a problem statement and write it on a flip chart.

2. Ask participants to draw two pictures that are metaphors of the situation. The first picture must represent how they would prefer to see the situation in future, while the second drawing should represent their view of the present situation.
3. Ask each member of the group to describe his/her picture of the present, also mentioning the properties of the object drawn. Do the same for each picture of the future.
4. Participants must then generate ideas based on the descriptions.

Visual depictions of problems, such as rich pictures, aid in the communication of problems to others and convey the relationships and arrangements between problem elements (Bell & Morse, 2013; Hicks, 2004). Checkland and Poulter (2006) emphasize that a rich picture is superior as a medium to the linear written word for showing complex, interacting relationships. It should be noted that rich pictures are created in a hand-drawn style, avoiding straight lines, right angles and rectangular boxes as these have traditionally connoted a mechanical absolute certainty whereas hand drawing emphasize an organic learning process (Checkland & Poulter, 2006). For example, let us suppose the staff in the marketing division of an organisation are concerned about the present uncertainty over the measurement of the impact of a new promotional campaign and the pressure it will place on them. One could draw a scale (representing measurement) and a question mark next to it (connoting uncertainty), connected by an arrow to a person (signifying the marketing staff) with a one-ton weight above his/her head (symbolizing pressure).

According to Checkland and Poulter (2006), this method provides a snapshot of the problem situation, which may not remain the status quo for very long. The current researcher is of the opinion that this limitation could be magnified if participants are caught in old perceptions of the problem instead of perceptions closer to current realities.

2.11.8 Synectics

Synectics is the product of a group of inventors from the Arthur D Little consulting company led by William J.J. Gordon and George Prince who tape-recorded their invention sessions and meetings during the 1950s to discover what aided creativity and what did not (Nolan, 2003). Prior to their meeting, Gordon had lectured psychology at Harvard University where he cultivated an interest in the effect of psychological states, such as detachment and deferment, on creativity, while Prince had been a creative

director at an advertising agency who became interested in stimulating creativity via repressed thoughts (Harriman, 2010).

Synectics is primarily used as a group method, where specific roles must be played. The *problem owner* or *client* is the person who brings the problem to the attention of the rest of the group and must furnish the group with enough details of the problem. The *Leader* guides the group through the Synectics process, ensuring the rules are adhered to, encouraging speculation, recording all ideas and managing time (Proctor, 2010). The other participants make up the rest of the group and must adhere to the Synectics guidelines and help the problem owner with his problem.

Although there are variations on the Synectics process, the following steps are the most commonly cited (Hicks, 2004; Proctor, 2010):

1. *State the problem:* Here the problem owner describes the problem as fully as possible as a single sentence;

2. *Analysis:* The problem owner is asked to describe the events that led to the recognition of the problem. Several questions can be posed to the problem owner, such as: Why is it important that the problem be solved and why is it your problem? What have you already considered or tried and what was the result? Do you have the power to implement a solution? If you could solve the problem by wishing, what would your ideal solution be?

3. *Goal Orientation:* The group is asked to generate several restatements of the problem as given. During this stage, evaluation is banned, and group members are encouraged to speculate much like in brainstorming and to use notepads for this purpose.

4. *Selection:* The problem owner considers the various restatements and chooses two or three that best describe the problem in an interesting sense (and not necessarily in a practical sense). These selected restatements will be used as springboards and may be combined into one. He/she is then asked to explain why he/she chose the specific springboard and how he/she intends moving forward with this idea. If no specific actions are possible, then an excursion is needed.

5. *Excursion:* There are four types of analogies identified within Synectics. Personal analogy uses our personal experiences or emotions to relate an individual with the problem. Direct analogy is a comparison between the problem object or situation and facts, technology or information form a different environment. Symbolic analogy is relating the problem to symbolic imagery. Fantasy analogy at its most fantastic involves using wish fulfilment, while at its least fantastic, simply requires ignoring restrictive rules. Excursions are techniques that activate analogical thinking by

getting distance from the problem, generating irrelevant material, and then relating the irrelevant material back to the problem. There are different types of excursion, but the most commonly used are example excursions and imaging excursions. The example excursion involves taking a keyword from the problem statement or springboards and looking for analogies. The imaging excursion involve a few rounds of word association from an initial evocative word, followed by the instruction for the group to construct a weird story based on the last word, in a round robin fashion, building on the last person's contribution. The group is then asked to replay the story in their minds while thinking absurd solutions to the problem.

6. *Itemized response:* The leader then asks the problem owner to identify the most promising, yet still absurd ideas and paraphrase these ideas. The problem owner must then identify the practical and helpful aspects of each idea. Next, the problem owner is asked to identify his/her biggest concern about the same idea in a 'how to' or 'I wish' format. The group can make suggestions on how to overcome this concern. The itemized response process is repeated if concern is only partially overcome.

7. *Possible solution:* Once a solution is formed and the problem owner reports no further need for help, the possible solution is written up and rated on Newness, Feasibility and Appeal.

One of the limitations of Synectics is also one of its touted strengths. It is claimed that one of its advantages over brainstorming is the fact that a problem owner is identified at the start and that this person is also the solution owner responsible for implementing the final idea. However, as Hicks (2004) points out, if there are several problem owners for the same problem, then multiple Synectics sessions with multiple groups working on different parts of the problem must be run simultaneously. Combining the results of parallel Synectics sessions may prove problematic.

The major limitation of Synectics lies in the fact that the problem-solver must engage in complex mental transformations of the problem such as being able to see the paradox in a problem, as well as identifying appropriate analogies for the current problem. The use of Synectics also requires a level of method-specific expertise only gained by training. Furthermore, in group form Synectics must be led by an experienced consultant or facilitator.

2.11.9 Lateral thinking

Lateral thinking was developed by medical doctor Edward De Bono in 1967 after he had researched the nature of self-organizing biological systems (Dingli, 2009). This research sparked the idea that the human mind could be similarly self-organizing and produce novel outputs based on environmental inputs and past experience (Dingli, 2009). In this way, Lateral thinking utilizes intentional mental efforts as inputs to alter habitual patterns of thought. According to De Bono (2009), the word 'lateral' emphasizes the notion of moving across instead of along these well-trodden patterns.

Proctor (2010) noted four factors that are of paramount importance to Lateral thinking:

1. The recognition of dominant ideas linked to a problem that polarize perceptions related to the problem;
2. The relaxation of rigid, automated thinking;
3. The search for varied perspectives;
4. The use of chance to stimulate ideation.

As a method, Lateral thinking differs from the other methods in this section as it does not possess explicit sequential steps but uses a set of tools that can be used in any order. These tools are used to change thinking patterns and perceptions. Lateral thinking can be utilised as either a group or individual method and the following are its most prominent tools:

1. *Focus* is utilized at the beginning of a Lateral thinking session to orient efforts (Dingli, 2009). De Bono (2009) differentiated between two types of focus. Firstly, purpose focus narrows the reason for engaging in Lateral thinking, such as problem-solving, process simplification, conflict resolution, performance improvement, etcetera. The second type is called area focus and narrows down the area where problem-solving is required by using a prompt such as 'We want some new ideas about erasers', where erasers are the identified area (De Bono, 2009).
2. *The Alternatives tool* is aimed at generating a large variety of perspectives on a problem and includes several approaches. *Fractionation* is the breakdown of the problem or situation into component parts without using a logical criterion for subdivision, while *Bridging divisions* involves rearranging the parts into a new whole (Proctor, 2010). *Keyword omission* involves the replacement of keywords in a discussion with equivalent, but less common terms, such as work service payments instead of wages. *Rotation of Attention* involves shifting attention to peripheral factors associated with of a problem away from the core of the problem. *Quota of alternatives*

keeps the number of ideas down to a manageable set, focusing only on those that are fundamentally different. *Avoidance devices* are ways of opening the mind up to receive new perspectives while preventing the old well-worn ideas or ways of thinking from surfacing (Proctor, 2010).

3. *The stratal technique* refers to listing multiple statements connected to the problem but that are unconnected to each other in order to sensitise the mind (De Bono, 1993). Ideas are created by combining these statements. *The filament technique* entails selecting words from each stratal statement to form a new idea.

4. *Concept fan* involves working backwards through a process of abstraction from the final objective (solving the problem) to broad concepts, to specific concepts, to practical ideas and, if necessary, analyse each level (De Bono, 2009). This is accomplished through questions. What broad concepts get us closer to the final objective? What specific concepts support the broad concepts? What practical ideas can activate these specific concepts?

5. *Provocation* (PO) entails the use of wishes or absurd statements to create solutions (Puccio, Cabra, Fox, & Cahen, 2010). Such statements are prefaced with the word 'Po,' (or Provocative Operation) so that everyone knows a provocation is to follow. There are four major varieties of provocation: escape, reversal, distortion, exaggeration and wishful thinking (De Bono, 2009). Escape works by removing something taken for granted in a situation. Reversals reverse normal relationships in the problem situation. Distortions operate by changing the sequence in a relationship or process (Dingli, 2009). Exaggeration works by exaggerating a dimension of the problem upward or downward to an unreasonable extreme (Proctor, 2010). Wishful thinking uses 'what if…' or 'suppose we…' or 'what would happen if…' trigger questions to set up impossible fantasy situations (Dingli, 2009).

6. *Movement* is a principle that emphasizes moving forward from a provocation with an idea, regardless of the perceived value of the idea. It encourages judgement-free experimentation and visualizing how these mental experiments will unfold, focusing on positives and under which conditions proposed solutions will work. De Bono (2009) distinguishes between five methods of achieving movement. *Extract the concept* seeks the underlying concept in operation in the problem situation and then uses it to develop an idea. *Focus on the difference* is used to identify the differences between the provocation and the current situation and to build on these differences. *Positive Aspects* aims to use any positive value brought forth by the provocation and to realise these values in a practical way. *Moment to moment* involves visualizing the provocation in action, paying careful attention to what is occurring, and developing new ideas

form those mental observations. *Special Circumstances* asks whether any circumstances exist where the provocation can have value exactly as stated (De Bono, 2009).

7. *Challenge* entails the questioning of the status quo and its associated deeply held assumptions (Dingli, 2009). The aim of this tool is to find alternate ways of accomplishing a particular aim by blocking the current way as an option (De Bono, 2009). Dingli (2009) noted that even when existing ways work well, challenge may result in improvement, cost cutting, and added value. Users of challenge should be cognizant of the guideline that challenge should never be used as an attack and, therefore, criticism of the status quo is prohibited (De Bono, 20009). Challenge simply asks the question: If the current way was not an option, what else would you do?

8. *Random Entry* involves generating ideas stimulated with the help of words or objects that are selected at random and are not related to the problem (Puccio et al., 2010). If a starting point is 'cherry-picked' or not randomly chosen as instructed, such a selection would relate to habitual thinking and would not generate new patterns of thinking (De Bono, 2009). Sources of random stimuli to use during random entry include magazines, printed cards, images from electronic databases, and everyday props (Dingli, 2009).

9. The *creative pause* refers to an interruption of routine by slowing your thinking deliberately to pay attention for 30 seconds (De Bono, 1993). The benefit may not be immediately apparent.

10. *Harvesting* is typically utilized at or near the end of a Lateral thinking session with the aim of prioritizing, selecting and managing generated ideas (Dingli, 2009).

One observable limitation of Lateral thinking, when considering the full set of tools outlined in De Bono's countless publications, is the limited range of names and overlapping content of these tools. For example, there is the tool called *Concept fan,* as well as a tool called *Concept extraction* (both outlined above), that work in a very similar ways. Another example is the similarly named tools *Random entry* (as outlined above) and *Change of entry point,* with the subtle difference being the former uses random words and objects as triggers while the latter does not. Yet another example is the similarity of content between the tools called *Challenge* and *Avoidance devices* (as outlined above) – both block the current ideas. This may become confusing to learners during training for Lateral thinking.

Perhaps the most serious disadvantage of Lateral thinking is that it lacks a set sequence and as such the possibility exists that the best tool for the problem may not be used at the most advantageous time.

2.11.10 Six thinking hats

Six thinking hats is another group method developed by Edward De Bono and involves six different modes of thinking represented by six coloured hats (Dingli, 2009). De Bono (2009) emphasized that the purpose of the six hats is parallel thinking, meaning that the hats ensure that the whole group is thinking in the same mode simultaneously. Specifically, Puccio et al. (2010) noted that parallel thinking is achieved by the entire group adopting a particular hat or manner of thinking at the same time. As with Lateral thinking, De Bono (2009) did not prescribe a set sequence in which the hats must be used, but stipulates the modes of thinking for each hat.

However, the blue hat is usually utilized at the start of the thinking hats session to elicit a discussion on the sequence of hats to be used, as well as at the end to summarize the outcomes and action plans (De Bono, 2009). Throughout the meeting the facilitator also dons the blue hat to re-establish the thinking mode whenever group members disregard the specific hat that is in use at that moment. This is closely related to meta-cognitive thinking as this hat concerns itself with the sequence of thinking modes (Puccio et al., 2010).

When the white hat is in use, information possessed and required is determined by asking questions. No argument is allowed under the white hat condition, even when conflicting information is offered. Such information is simply recorded in parallel and discussed when the need to for its use arises (De Bono, 2009).

The red hat is often used for brief periods where all participants are asked to offer their feelings or intuition on the matter without justification (De Bono, 2009). Under this condition logical explanations for feelings are not required.

Under the black hat, critical thinking is elicited from participants (Puccio et al., 2010). Limitations and risks associated with an idea are identified and recorded during this condition.

When the yellow hat is in operation, the group's focus is on positivity. The benefits of an idea are identified. According to De Bono (2009), the yellow hat emphasizes value sensitivity, meaning the ability to find value in ideas, even those that do not appeal to us. The yellow hat is grounded in constructive thinking, asking how something can be achieved, and represents a positive form of analysis (Puccio et al., 2010).

The green hat is the creative mode of thinking, encapsulated by its specific instruction to participants to make a creative contribution or be silent (De Bono, 2009). This hat encourages generating new ideas, considering alternatives, and modifying suggested ideas. The use of lateral thinking tools is permitted during this condition.

Seelig (2012) suggested that most people have a dominant role with one or two secondary roles during everyday problem-solving. Logical, fact-driven people often gravitate toward the white hat and such people are often most active during this mode. The green hat is mostly enjoyed by people who are adept at idea-generation. The red hat works for intuitive individuals. The blue hat is suited to those that are process-oriented and organized. The yellow hat is often most easily worn by people who spread happiness among others. The typical devil's advocate wears the black hat with aplomb, because these people are skilled at discovering that which will not work. According to Seelig (2012), the Thinking Hats method illustrates the benefits of multi-disciplinary or cross-functional teams and forces individuals to appreciate the contributions of people who wear other hats in life.

An advantage of this method as proffered by De Bono (2009), albeit through his real-world *anecdotes,* is the reduction in problem-solving time. A drawback of the Six thinking hats method is the lack of a prescribed sequence in which hats should be used, which some participants and groups may find problematic. In addition, the use of lateral thinking tools during the green hat condition adds another layer of complexity to the training of an otherwise relatively simple thinking hats method as Lateral thinking itself does not provide strict guidelines for its use.

2.11.11 The universal traveller

Two lecturers from the School of Architecture and Environmental Design at the California Polytechnic State University, Don Koberg and Jim Bagnall (1976), developed the *universal traveller* as creative problem-solving methodology from a design viewpoint. Although, it is often depicted in a sequential, linear process, the universal traveler may be conceived as a cyclical process or a process with feedback loops between consecutive stages. This methodology includes a set of tools that may be used for each stage. The rule in tool selection is to choose the tool that works for you. For brevity's sake, only a few of the most prominent or unique tools per stage will be discussed. The method can be broken down into seven broad stages:

Stage 1: Accept the situation

One of the unique aspects of the Universal Traveller is its first step, which entails *accepting the situation* as a challenge and as your responsibility (Koberg & Bagnall, 1976). This corresponds with historical findings about great creators and inventors placing great personal importance on problems before problem-solving commenced (Weisberg, 1993). Koberg and Bagnall (1976) advise that to take responsibility for a problem, the problem-solver must first determine if he/she has the ability, interest, energy, and the time to tackle it. They outlined 15 tools, ranging from the more mundane, such as the tools described below, to the more extreme tools, such as self-hypnotism, each of which can get the prospective problem-solver to the stage of acceptance.

The tool called *I am the Victim* entails imagining suffering the consequences yourself if the problem were to go unsolved. According to Claxton and Lucas (2007), such empathy is a vital ingredient in problem-solving where win-win solutions are needed and imagining a personal stake in the consequences can give a problem-solver confidence to take creative risks in solutions.

What's holding you back is a tool that can be used to identify which of the following causes of non-acceptance (besides lack of skill) are keeping the prospective problem-solver from getting motivated to solve the problem (Koberg & Bagnall, 1976):

- The perception that accepting the situation will be a punishment;
- The perception that it will be more beneficial to undertake something other than solving the problem;
- The problem is not isolated and related problems must also be solved before the identified problem can be addressed;
- The relevance of accepting responsibility for the problem is not clear.
- Once the cause is identified, the solver must devise methods of rewarding his/her desirable behaviours and punishing his/her undesirable actions.

Stage 2: Analyse (to discover the "world of the problem")

This stage involves discovering more about the problem situation and clarifying the given knowledge of the problem. It should be emphasized that care must be taken to avoid spending too much time during this stage. A total of 16 tools that may aid in this analysis stage are highlighted by the authors.

The Sensitivity Game involves analysing the problem via the senses of sight, hearing, smell, touch, and taste when possible and appropriate.

Stage 3: Define (the main issues and goals)

The purpose of this stage is to use what we have learned in the analysis stage to build a definition of the problem that will affect all subsequent decisions regarding the problem (Koberg & Bagnall, 1976). Eight tools are offered to help problem-solvers in this regard. Definition statements can be thought of as destinations on the problem-solving journey. A high degree of specificity is needed in this regard. For example, if you have to meet someone, a specific venue such as *the Aquarium at the V & A Waterfront in Cape Town* is better than a general one such as simply *Cape Town*.

"Whys" guy is a tool that involves asking and answering a successive series of questions starting with the word Why to uncover the essence statement. Koberg and Bagnall (1976) recommend asking and answering at least ten why questions before settling on a statement.

Key-word distillery entails writing a statement encompassing all important elements of the problem, describing your objectives, as well as any concerns relevant to the problem. Then, the problem-solver must go through the statement marking all the phrases and words that he/she rates as more essential than the rest. Using only the marked words, draft another statement that represents the crux of the problem.

Stage 4: Ideate (to generate options)

Continuing the journey metaphor, Koberg and Bagnall (1976) view ideas as means to reach the destination (definition or defined objectives) uncovered in the previous stage. Nine tools are provided to aid ideation.

Manipulative verbs is an extension of another tool called SCAMPER, which was developed by Robert Eberle (Calwell, n.d.) and has been applied to diverse settings ranging from psychological counselling (Buser, Buser, Gladding, & Wilkerson, 2011) to engineering (Chulvi, Mulet, Chakrabarti, López-Meza, & González-Cruz, 2012). The tool works by the problem-solver asking whether he/she can apply the verbs to elements of the problem and seeing which unique ideas are worth pursuing. To briefly illustrate, the original SCAMPER verbs are briefly listed below:

- S - Substitute
- C - Combine

- A - Adapt or Adopt
- M - Modify
- P - Putting something to other uses
- E - Eliminate
- R - Reverse or Rearrange

Morphological forced connections is possibly the most well-known of the tools contained within the universal traveller method due to its ease of application in invention and new product development settings (Calwell, n.d.). The tool works as follows:
First, the attributes of the problem situation are listed (usually as column headings);
Then, various alternatives are written under each attribute heading;
Finally, the problem solver must make random connections across the columns to produce new forms (ideas).

The tool called *Seeds of ideas* capitalizes on analogical thinking and abstraction (i.e. going from the specific to the general). Analogical thinking occurs when a problem familiar to the problem-solver is used to solve a new problem with similarities to the familiar problem (Gassman & Zeschky, 2008). In fact, research has found that similarity of problem elements at any level of abstraction between the new problem and the familiar problem is a necessary prerequisite for the identification of analogies (Holyoak & Thagard, 1997). The tool works as follows:

- First, the problem solver must identify the principles he/she suspects are integral to the problem situation;
- Then, existing ideas from other problems using those principles must be applied to the current situation.

Stage 5: Select (to choose among options)
This stage involves choosing the most suitable idea, the ease of which is determined by the work done during the previous stage (Koberg & Bagnall, 1976). Six tools are suggested for use during the idea selection stage.

Ideas-objectives comparison is a simple tool that starts with itemizing your objectives, goals and intentions on one axis and the various ideas on the other axis to form a matrix. Next, these ideas are

rated on how well these ideas meet the listed objectives, intentions and goals. Scoring may be simplified by using YES, NO, MAYBE for less complex problems or by using more sophisticated numerical means when problems are more complex.

Potpourri, on the other hand, caters to instances where multiple ideas all have merit and outright idea selection is difficult. The tool simply combines all the benefits of all of your ideas into one idea.

The tool called *the Indian scout* helps the problem solver answer the question, "What will happen if you implemented this idea?" Imagination or other means of simulation must be used to try out the idea.

Stage 6: Implement (to give physical form to the idea)

Implementation encompasses starting to translate your chosen idea into action and can be thought of as the tactical phase of the problem-solving journey (Koberg & Bagnall, 1976). The authors recommend 22 tools that may be of use during the implementation stage.

The time-task schedule is a tool that can be used to start the implementation of a solution, but could also be seen as an operating manual for use throughout the implementation process (Koberg & Bagnall, 1976). Its steps are as follows:

- First, delineate all the tasks that are involved in implementing the chosen idea;
- Then, determine the realistic amount of time available to implement the idea;
- Next, allocate portions of the total time available to the tasks identified in the first step;
- A graph depicting time-task relationship is then prepared;
- Throughout the rest of the implementation process, this graph must be used as a guide or roadmap.

The tool named *advocacy* is a more indirect approach at creating momentum or support for the chosen idea. This may involve devising other ideas that facilitate the chosen idea or getting the beneficiaries of the chosen idea to become more actively involved in implementation.

Stage 7: Evaluate (to review and plan again)

Due to the flexibility of the Universal Traveller method (linear or cyclical or with continuous feedback between stages), the evaluation stage can take place during, as well as at the end of the problem-solving journey. Koberg and Bagnall (1976) offer five tools to utilise during the evaluation stage. Most

of these tools are generic, ranging from measuring progress based on personal opinion, to surveys, to grades, to the time-task schedule graph.

The only unique evaluation tool in their toolkit is called the *letter to your best friend method* that consists of the following steps:

- Write a letter, addressed to your best friend or yourself, describing the progress made in terms of implementation of the chosen idea, as well as your initial goals.
- Elaborate on the importance of these two aspects, both specifically and in a more general sense.
- The letter may be kept for a few days and then re-read, or the problem-solver may choose to send it to his/her actual best friend for real feedback. In case of the latter, it could be beneficial if a creative friendship is cultivated with someone that the problem-solver trusts and has the right expertise for this problem (Claxton & Lucas, 2007). Still, it should be remembered that the problem-solver has a greater stake in the problem than the enlisted friend. Given this, it is also important that the problem-solver must decide when feedback from the friend is requested as implementation must be at a stage where problem-solver will be receptive to criticism and such criticism will have utility (Claxton & Lucas, 2007).

To its credit, the Universal Traveller combines the benefits of multi-stage sequential methods (i.e. the provision of guidance due its structured nature) with the benefits of non-sequential multi-tool methods (i.e. flexibility).

However, a slight criticism is that after the Acceptance stage where taking responsibility for the problem is the aim, there are self-explanatory tools, such as the *expert consultant method* (during the Analysis stage), *talk-it-out method* (during the Definition Stage), *essence-finding by consensus* (also during the Definition stage), *go to the library method* (during the Ideation Stage), and *user-chooser method* (during the Selection stage) that *outsource* responsibility for crucial parts of the problem-solving process. The current researcher is of the opinion that it is only during the final stage of Evaluation that it is acceptable or at times perhaps even preferable to elicit outside help. Of course, if the selection of these outsourcing tools is avoided, the above criticism is rendered moot. In fact, it must be stated that with the range of alternative *solver-operated* tools available for selection within each stage, this weakness may be minimized rather easily.

A more serious criticism is that the universal traveller offers a staggering array of 81 tools across 7 stages, yet gives ‘use the tool that works for you’ as the only advice for choosing specific tools to use

during each stage. Perhaps this is not problematic for experienced users of this method, but newcomers will find this daunting and are likely to make sub-optimal tool selections.

2.11.12 Creative Problem Solving (CPS)

The original model of Creative Problem Solving (CPS for short), distinguished from the lowercase term *creative problem-solving* denoting the body of methods and models developed by researchers, practitioners and consultants to solve problems creatively, is the brainchild of the late Alex Osborn and was first publicized in his 1952 book, *Wake up your mind* (Isaksen & Treffinger, 2004). The original CPS method was an extension of the four-stage Wallas model of the creativity, discussed earlier in this chapter, adding more deliberate stages of orientation, analysis, hypothesis, and synthesis.

The steps to the original seven-stage CPS model can be summarized as follows (Isaksen & Treffinger, 2004):

1. Orientation: Drawing up the problem;
2. Preparation: Collecting relevant information;
3. Analysis: Decomposing the relevant material;
4. Hypothesis: Generating multiple alternatives or ideas;
5. Incubation: Stopping to invite illumination;
6. Synthesis: Creating new combinations of ideas;
7. Verification: Judging the resultant ideas.

However, in 1963 Osborn streamlined his original CPS model into a three-stage model, consisting of Fact-finding (problem definition and preparation), Idea-Finding (idea production and development), and Solution-Finding (evaluation and adoption) to reflect his practical advertising experience, as well as his study of tools used by highly creative individuals (Isaksen & Treffinger, 2004). This would prove to be the first of many refinements of the CPS model over its 60-year history.

As Puccio and Cabra (2009) noted, the CPS was created to elicit deliberate creativity. Specifically, Osborn was particularly interested in achieving this end in the sphere of education. It was during this time that Osborn collaborated with Sidney Parnes at the Buffalo State College of the State University of

New York on an academic programme based on CPS, as well as refinements that would eventually become known as the Osborn-Parnes model of CPS (Isaksen & Treffinger, 2004), outlined below:

1. Fact finding: Fact finding involves observing carefully while collecting and exploring objective facts and subjective experiential information about the problem situation.

2. Problem finding: This stage involves considering different ways of viewing the problem and thinking about those possibilities.

3. Idea Finding: Idea finding entails searching for a variety of ideas, approaches, options, routes, ways of creating, and tools. Here, potential ideas will be tentatively selected.

4. Solution finding: This stage involves exploring the ideas in various ways, from other perspectives and using different criteria. Then, the implications and reactions to the selected ideas must be assessed. Selecting ideas and developing an action plan conclude this stage.

5. Acceptance finding: Acceptance finding involves deciding how to implement the action plan. Then, thinking of ways to increase the strength, attractiveness, effectiveness, acceptability, and benefits of your chosen solution. Finally, a working plan for implementation is developed.

CPS has undergone eight refinements to date based on research and development. However, according to Puccio, Cabra, Fox, and Cahen (2010), two aspects have remained unchanged. First, CPS balances divergent and convergent thinking as each step starts with a divergent phase (characterised by the search for alternatives) followed by a convergent phase (hallmarked by the development of the most promising ideas). This ‘dynamic balance’ separates creative and critical thinking by generating ideas and delaying their evaluation. Second, Puccio and Cabra (2009) noted that the structure of every CPS version to date closely follows the natural stages of thought that individuals use when confronted with ill-structured problems, namely Identification (forming an understanding of the problem), Development (of possible solutions), and Selection (or the decision regarding the best solution).

The current version is known as the Thinking skills model (Table 2.5), which consists of three phases that align with individuals’ natural creative processes (Puccio & Cabra, 2009). In the Thinking skills model the phases are named Clarification, Transformation, and Implementation with each consisting of two steps.

Table 2.5

The CPS Thinking Skills Model

Executive step	Phase	Step
Assessing the Situation	Clarification	*Exploring the Vision:* A vision of the desired outcome is developed. *Formulating the Challenges:* Challenges to be overcome are identified.
	Transformation	*Exploring Ideas:* Novel ideas to address challenges are generated. Formulating Solutions: Ideas are developed into practical solutions.
	Implementation	*Exploring Acceptance:* Here, the problem solvers must consider factors in their context that will affect whether others will adopt the solution. *Formulating a Plan:* An implementation plan is developed.

Note. Adapted from "Creative problem solving: Past, present and future," by G.J. Puccio and J.F. Cabra, 2009, *The Routledge companion to creativity,* p. 331-332. Copyright 2009 by Routledge.

The model always starts with *assessing the situation*, which is an executive step as it occurs throughout the model, allowing problem-solvers to fast-forward or revisit steps and determine their own progression through the model (Puccio & Cabra, 2009). During this step, information relevant to the problem is identified and the next step in the CPS process is determined (Puccio & Cabra, 2009). This step has added a meta-cognitive element to CPS as it allows the problem-solver to monitor and regulate his or her thinking in relation to his or her cognitive objectives. The inclusion of this meta-cognitive step has also made CPS even more non-linear and flexible in practice.

The CPS Thinking skills model derives its name from the seven main thinking skills involved with each step delineated (Puccio & Cabra, 2009). During the first step, assessing the situation, diagnostic thinking (i.e. making a careful examination and description of the problem) is involved. When reaching the second step, exploring the vision, the problem-solver must use visionary thinking (i.e. articulating a vivid image of the desired outcome). During the third step, formulating the challenges, strategic thinking (i.e. identifying the critical aspects that must be overcome and routes toward the desired outcome) is

involved. At the fourth step, exploring the ideas, the problem-solver is required to use ideational thinking (i.e. creating original mental images to address challenges). During the fifth step, formulating solutions, evaluative thinking (i.e. judging ideas on the basis of reasonableness and quality in order to create a usable solution) is needed. When the sixth step, exploring acceptance, is entered, contextual thinking (i.e. thinking about those conditions in the environment that will help or hinder the success of the solution) gains importance. The final step, formulating a plan, requires tactical thinking (i.e. creating a plan or roadmap with specific and measurable steps to the desired outcome as well as ways of monitoring progress).

Perhaps the most serious disadvantage of CPS is that it has developed into a large framework within which any number of tools can be used with no consistent set of tools. For example, if it possible to use seven tools for one of the steps in CPS, this must cause great variability in its efficacy and user opinions of its efficacy. In the current researcher's opinion, another consequence of this is that truly comprehensive CPS training should include a contingency approach. In other words, training should offer guidelines in a '*during step two, it is best to use tool Y under condition A, but under condition B tool Z should be used'* manner. With such a large number of tools to choose from for each step, training requirements in terms of time may be taxing.

Another limitation is related to the non-linearity and flexibility in the Thinking skills model brought about by the inclusion of the step, *assessing the situation*. This researcher is of the opinion that the fact that CPS is continually refined and developed, based on research, has left it susceptible to the modern academic obsession with non-linearity, this despite the practical need for guidance via structure in problem-solving methods. The originators of the thinking skills model tout this non-linearity and flexibility as an advantage. Up to a point, the current researcher sees the benefit of flexibility. However, the fact that a problem-solver may choose to *fast forward* through some steps must raise questions about the depth of thinking during, as well as the outcomes of such 'skimmed' steps.

2.11.13 TRIZ

TRIZ is the Russian abbreviation for the *Theory of Inventive Problem Solving* and was first formulated shortly after World War II in the former Soviet Union by Genrich Saulovich Altshuller while doing research on patents (Rantanen & Domb, 2008). Altshuller noticed that there were common patterns of evolution inherent in many of the successful inventions and theorized that if these patterns could be applied during the process of invention, problem-solvers could use this accumulated knowledge to reduce typical trial and error (Rantanen & Domb, 2008).

As the name and origin suggests, TRIZ is primarily used by inventors, engineers and natural scientists to technical problems and functions as follows (Moehrle, 2005):

1. The specific problem in question must be analysed in detail (e.g. current state, available resources, goals to be fulfilled, intended state).
2. The problem-solver must search for an abstract problem that matches his specific problem.
3. An abstract solution to the abstract problem must then be found.
4. If found, the abstract solution must be transformed into a specific solution that solves the original specific problem.

Altshuller has not outlined a strict sequence for the TRIZ methodology. Consequently, many practitioners have suggested their own sequence of steps. Petković, Issa, Pavlović, and Zentner (2013) suggest a sequence similar to the four steps outlined by Moehrle (2005), but add transformation phases pointing to prominent TRIZ that may assist during these phases. Figure 2.10 depicts the problem-solving process using TRIZ as envisioned by these authors.

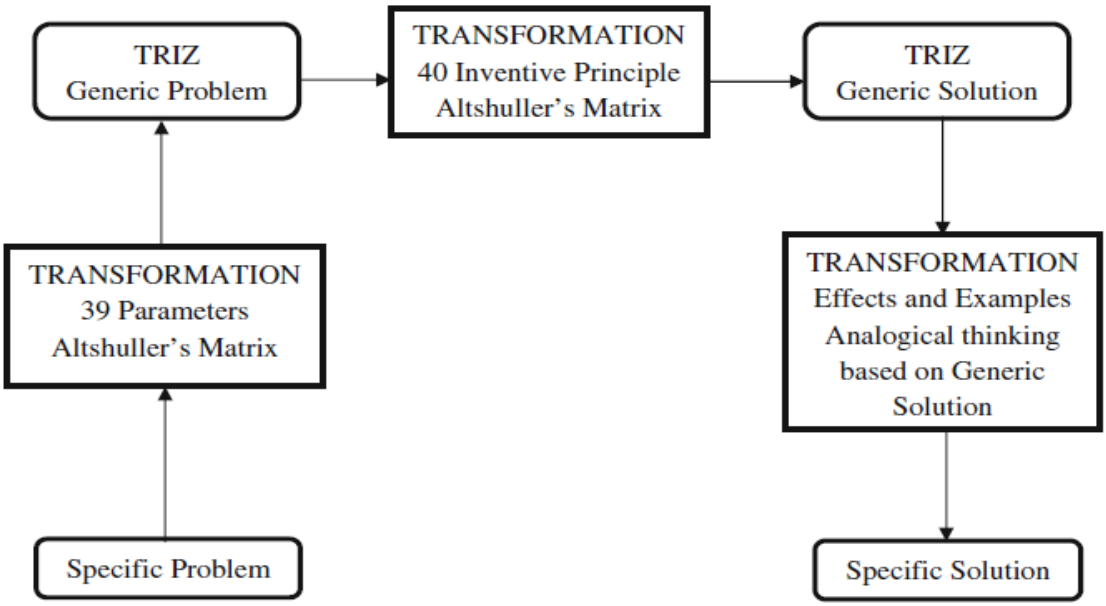

Figure 2.10. Problem-solving process using TRIZ. Reprinted from "Application of the TRIZ creativity enhancement approach to design of passively compliant robotic joint," by D. Petković, M. Issa, N.D. Pavlović, and L. Zentner, 2013, International Journal of Advanced Manufacturing Technology, 67, p. 867. Copyright 2013 by Springer.

To facilitate the TRIZ methodology, Altshuller developed a vast array of tools that a problem-solver may apply. The sheer number of tools contained within TRIZ and the depth of many of these tools can be overwhelming. As alluded to in Figure 2.10, two of the most important tools are the *contradiction matrix* and *inventive principles* that are briefly explained below. Central to the TRIZ methodology is the identification and eventual resolution of conflicts inherent to problems for which the *contradiction matrix* is used (Su, Lin, & Chang, 2008). The matrix consists of 39 rows containing desired functions of a system and 39 columns containing harmful factors of a system (Moehrle, 2005). The key is to transform the desired function into a specific row and the harmful factor into a specific column of the matrix. Then, cross-referencing the row and column, several inventive principles are offered that may be applied to solve the problem. The inventive principles are the abstract solutions referred to in the simplified four-step overview of the TRIZ methodology above. Altshuller found that tens of thousands of solutions were the result of only 40 principles (Rantanen & Domb, 2008). Table 2.6 lists these forty inventive principles.

Table 2.6

Forty Inventive Principles of TRIZ

Inventive Principles	
1. Segmentation	21. Rushing Through
2. Extraction	22. Convert harm into benefit
3. Local conditions	23. Feedback
4. Asymmetry	24. Mediator
5. Consolidation	25. Self-service
6. Universality	26. Copying
7. Nesting	27. Disposable object
8. Anti-weight	28. Replacement of a mechanical system
9. Prior Counteraction	29. Pneumatic or hydraulic construction
10. Prior Action	30. Flexible ‘shells’ or thin films
11. Cushion in advance	31. Porous material
12. Equipotentiality	32. Change the colour
13. Inversion	33. Homogeneity
14. Spheroidality	34. Rejecting or regenerating parts
15. Dynamicity	35. Transforming the physical/chemical state
16. Partial or excessive action	36. Phase transition
17. Shift to a new Dimension	37. Thermal expansion
18. Mechanical vibration	38. Strengthen oxidation
19. Periodic Action	39. Inert environment
20. Continuity of useful action	40. Composite Materials

Note. Adapted from “What is TRIZ? From conceptual basics to a framework for research.” By M.G. Moehrle, 2005, *Creativity & Innovation Management, 14*, p. 8. Copyright 2005 by Blackwell Publishing.

Some of the other prominent tools within TRIZ include the following (Ilevbare, Probert, & Phaal, 2013):

- *76 Standard solutions.* Not all problems are a result of contradictions. At a systemic level, a problem may simply occur due to an undesired interaction between two system parts. In such cases, one of the 76 standard solutions must be applied;
- *Ideal Final Result (IFR).* This tool represents the aspiration or idealized goal-state and is viewed as all parts of a system working at their best or maximum capacity;
- *Analysis of system resources.* This tool entails the search for and stock-taking of resources (both internal, as well as external to the system) that can be utilised in the problem situation. Analysis of system resources attempts to answer the question: What resources can I use that will get us closer to the Ideal Final Result?
- *Fitting.* This tool entails taking a more realistic view of the Ideal Final Result and working towards an achievable solution, given the problem's real-world constraints;
- *Nine windows*. It is often necessary to understand a problem or system within its environment. The nine windows tool (also known as multi-screen diagram of thinking or inventive system thinking) is primarily used to add such context, as well as to map how the problem changes over time. This may lead to successful solutions;
- *Function analysis*. Using function analysis provides an understanding of how all system components interact and highlights problems originating within those interactions;
- *Substance field (Su-field) analysis*. Another analysis tool to understand the whole system and pinpoint the exact problem without being weighed down by superfluous details.
- *Effects database.* The effects database comprises 2500 problem solving concepts, distilled from science and engineering.
- *Smart Little People.* Here, the problem solver must imagine that the system under analysis consists of clever little people that are capable of making decisions alone or as a group. This helps breaking a large problem into smaller parts. After analysing the system in such a way, the smart little people must be asked how they would solve the problem in an individual or collective manner. Altshuller developed this tool to reduce psychological inertia.
- *Size-time-cost.* Imagine your system at extremes of size (minute or non-existent versus infinitely large), time (no time versus infinitely long time), and cost (free versus infinitely expensive). As another tool developed to reduce psychological inertia, size-time-cost will help the problem solver on what is wanted from the system and eliminate false constraints.

- *Nine laws of engineering systems evolution.* These laws describe how technical systems evolve over their lifecycles and are intended to be used for efficient problem-solving (Cavallucci, Rousselot, & Zanni, 2009).

For space-saving considerations, only a portion of a problem will be used to illustrate the use of TRIZ. Globally, consumers are increasingly demanding a higher standard of food safety and quality. Food traceability systems are invaluable as such systems facilitate recall of unsafe food when food safety incidents occur, prevents unnecessary losses resulting from recalling products not affected, and protects products from fraud.

In Taiwan, a core problem was that consumers are unfamiliar with aquatic food products marked with such traceability information and, although more beneficial, traceable products do not have superior sales when compared to untraceable products (Lee, Hsu, Dadura, & Ganesh, 2013). First, the problem-solver may choose to use the 39x39 parameter contradiction matrix. Note that since this problem is not a technical problem, but a consumer behaviour problem, there may be a need to translate or stretch the meaning of parameters. What is the desired parameter in this problem? Parameter 14 (Strength): The strength of promotional efforts for aquatic products with traceability information can be increased. What is the harmful or worsening parameter for this problem? Parameter 21 (Power): Just as technical devices need continuous power to operate, so promotional efforts require continuous information to be effective. If promotional information is not available continuously, consumers are likely to forget easily.

Cross-referencing the two parameters, the contradiction matrix points to the following inventive principles: Principle 10 (prior action), principle 26 (copying), principle 28 (replacement of a mechanical system) and principle 35 (transformation of the physical and chemical states of an object). Next, the problem-solver may choose the principle that sparks an idea. Principle 28 refers to the use of a sensor (of sound, hearing, sight, smell, touch, or light) instead of the current method (Lee et al., 2013).

Through analogical thinking, the problem-solver can develop a strategy or solution to the core problem. Just as there are various types of sensors, there are various types of promotions that could increase awareness and knowledge regarding aquatic food products with traceability information. For example, traceability systems can be promoted via the internet, radio, print media, demonstrations in shopping malls, and presented during expos. This should be done continuously to increase consumers' knowledge of traceability information and confidence in aquatic food products, which in turn should increase sales (Lee et al., 2013).

One unique benefit of the TRIZ methodology is that it lends itself to forecasting and predicting how technology will evolve, particularly when applying the *laws of engineering systems evolution* and *nine windows* tools (Ilevbare et al., 2013). In addition, if applied correctly, TRIZ may lead to more rapid problem-solving as the methodology can zero in on the exact problem quickly. However, these benefits are heavily contingent on the precise application of TRIZ, much more so than any of the other creative problem-solving methods reviewed in this chapter. This is because few TRIZ tools, such as *size-time-cost* and *smart little people*, are intuitive in nature. Instead, the majority of TRIZ tools are analytic in nature.

TRIZ has a number of limitations as a problem-solving method. The main limitation of TRIZ is that it is very complex to learn and use as a result of the high number of principles, steps, standard solutions, and tools contained within the methodology.

There are many tools to use at each juncture of the problem-solving process causing many users of TRIZ to experience difficulty in selecting the correct tool. Rutitsky (2010) found that the incorrect selection of TRIZ tools leads to squandered effort and time. An elaborate, step-by-step process guide called *ARIZ* (Algorithm for Inventive Problem solving) was developed to help navigate the TRIZ process and direct the use of the multitude of TRIZ tools. However, critics have noted that it does not contain all of the TRIZ tools and is too complex to apply to most problems (Ilevbare et al., 2013).

Another major drawback is that there are limits to the application of TRIZ. Although attempts have been made to apply TRIZ to non-technical domains, such as service quality (Su et al., 2008), human factors problems (Akay, Demiray, & Kurt, 2008), and management problems (Mueller, 2005), the method and its most potent tools are best suited to engineering, manufacturing, and invention problems.

In a survey involving respondents from a multinational company, Ilevbare et al. (2013) found that training people to use TRIZ is problematic as only a small portion of learners become TRIZ practitioners. This echoes Altshuler own observations, noting that despite training his students extensively, only a small percentage applied TRIZ in their working lives.

Another limitation raised in this study is the effect of cultural differences on the meaning of the TRIZ methodology. Russian and Western thinking differs markedly. In addition, the specific metaphoric nature of Altshuler's original writing style may have obscured some meaning in translation (Ilevbare et al., 2013). In addition, respondents found that TRIZ was very word-centric and not suited to learners that are more visual or intuitive in their thinking. Finally, there are high time demands placed both on

instructors and learners undertaking TRIZ training, such as the time needed to get used to its terminology, cover all the material, and gain a true understanding of TRIZ.

The current researcher is of the opinion that TRIZ is so complex that its use (including choosing which tools to utilise, recalling the correct layout of several complex tools, etcetera) may increase cognitive load to such a degree that it leaves little cognitive capacity to think about the problem.

2.12 Broad insights gained from the Literature Review

Beyond the specific theories and research illuminated in the preceding literature review, there are broader insights flowing from the literature that are of importance for the purposes of the current research endeavour. Specifically, there are three broad insights that can be gleaned from the overall discussion, namely:

1. The psychological study of creativity is robust and the four Ps (i.e. person, process, product, and press) provides a coherent framework through which to examine theories of creativity. Although creative person theories focus on traits and developmental aspects, some findings suggest how creativity can be enhanced when individuals are not endowed with traits that are highly correlated with creativity. Such findings can be useful when developing a systematised method, as is the case in this current research effort. Similarly, creative press theories address environmental factors conducive to creativity, but broadly point to the notion that creativity can be cultivated. This insight can be transplanted into the internal mental environment, meaning that an individual should engage in mental preparation before starting creative efforts. For the current study's purposes, the review of creative product theories has highlighted the need to refine your ideas and to tend to aspects beyond the mere novelty of ideas. As most would expect, creative process theories provided many specific guidelines that could be systematised within a creative problem-solving method.

2. There is a substantial disconnect between the four Ps of creativity and creative problem-solving methods that have been developed. For example, one would expect that such methods would be based on creative process theories and to a lesser degree on creative press or person theories. However, few of the existing creative problem-solving methods reviewed in this chapter are based on any psychological theories of creativity. This should not be surprising, because most popular creative problem-solving methods were not created by researchers. It is worth noting that of the twelve methods only one (i.e. CPS) is receiving any consistent scholarly research and development attention.

3. Research on the effectiveness of existing creative problem-solving methods is scarce. When such research has been undertaken, it has often occurred decades after the method has been marketed to consumers. The ample research on brainstorming is the one exception to this state of affairs. However, this body of research has primarily highlighted brainstorming's many shortcomings. Unfortunately, brainstorming is not the only existing method with multiple deficiencies.

2.13 Summary

This chapter commenced with the differentiation between the focal construct, creativity, and related concept of innovation, which are often conflated in literature.

In the bulk of this chapter, a range of theories addressing central questions in creativity research were discussed and critiqued. Broadly, these questions were the following: How does creativity work in the mind of the individual? What makes a product creative? What makes a person creative? How does the environment affect creativity? In the rest of this chapter, approaches to the deliberate development of individual creativity were discussed. Finally, thirteen of the most well-known creative problem-solved methods were discussed and critiqued.

Two things should be evident from the preceding literature review. One, although there is a mass of psychological research on creativity, the development of very few of the popular creative problem-solving methods are based on this research. Two, even decades after their introduction, the effectiveness of some creative problem-solving methods is unknown due to a lack of evaluation research. This should be a worrisome state of affairs to both researchers and users of these methods in practice.

In light of the literature review presented, specifically the gap between theory and creative problem-solving methods in practice, as well as the limitations of existing methods, it is therefore argued that a new creative problem-solving method based on research should be developed for use by individuals. Furthermore, a training intervention should be utilised to train participants on the use of the proposed creative problem-solving method that in turn will enhance their creative problem-solving performance. Chapter 3 will describe the development of the proposed creative problem-solving method.

CHAPTER 3:

THE DEVELOPMENT OF THE SPATIAL PLAYMAKER METHOD OF CREATIVE PROBLEM-SOLVING

3.1 Introduction

The purpose of this chapter is to provide an overview of the development of the Spatial Playmaker method of creative problem-solving undertaken by the current researcher. A delineation of areas of potential application of the proposed Spatial Playmaker method is presented. Thereafter the broad philosophical stance adopted by the current investigator during the development of the Spatial Playmaker is described. Next, the utility of play in creativity is spotlighted. The bulk of this chapter is taken up by outlining the theoretical underpinnings of each of the tools that constitute the Spatial Playmaker method. Finally, the development of the training intervention to teach learners how to use the Spatial Playmaker method is described.

3.2 Areas of Application of the Spatial Playmaker Method

The purpose of the Spatial Playmaker method is to facilitate the generation of creative solutions to problems by individuals in varied contexts including, but not limited to:

1. Employees who have been tasked to or voluntarily decide to attempt to solve a pressing problem relating to their own job, their unit, their department, or their organisation as a whole;
2. Managers facing problems affecting their function or their organisation as a whole;
3. Organisational leaders or business owners wrestling with problems related to the survival of their organisation;
4. Individual members of the public or consumers who, out of their own volition, take it upon themselves to solve particular problems of organisations, or those participating in various forms of crowdsourcing where organisations outsource problem-solving work to an undefined collection of people via an open call on the internet (Brabham, 2008; Howe, 2006).
5. Representatives of organisations such as the *Club of Rome* that aim to address increasingly interconnected problems of global society (Warfield & Perino, 1999). Specifically, organisations

such as the Club of Rome may potentially use the Spatial Playmaker to tackle paradoxes, such as the rapid development of technology occurring simultaneously with the increasing breakdown of societies. At an academic level, broader social issues have become an increasing priority for Industrial Psychology, as the boundaries between the organisation and its wider societal context cease to cordon off the field's area of study.

At a global level, the development of the Spatial Playmaker may be seen as a small part of a larger endeavour to develop creativity (with its emphasis on changing ways of thinking) as a way to encourage democratic attitudes (UNESCO, 2006).

It will become evident throughout this chapter that the Spatial Playmaker method goes beyond merely idea generation. Figure 3.1 elucidates where the Spatial Playmaker lies in the larger innovation process.

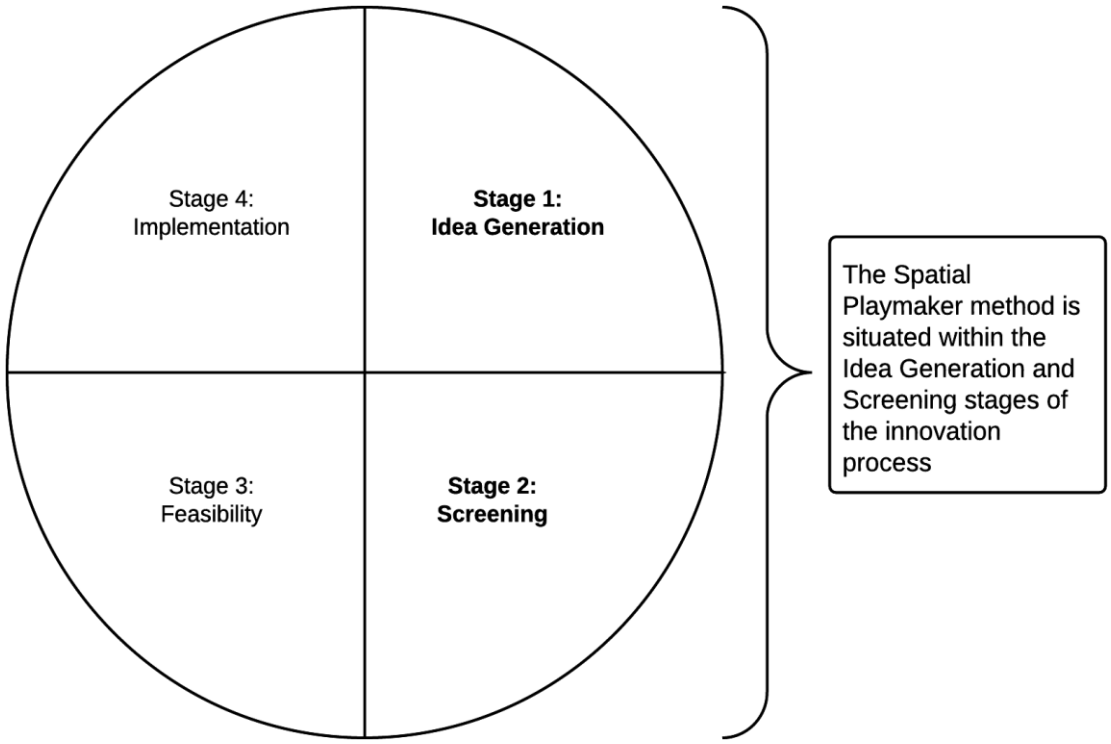

Figure 3.1 The Spatial Playmaker method's location within the innovation process. Adapted from "Individual and team-based idea generation within innovation management: Organisational research agendas," by R. McAdam, and J. McClelland, 2002, European Journal of Innovation Management, 5, p. 87. Copyright 2002 by Emerald Group Publishing Limited.

As Figure 3.1 reveals the Spatial Playmaker ventures into the realm of idea screening that is so often an afterthought, or left to people outside of the creative problem-solving effort.

3.3 Theoretical Stance during the Development of the Spatial Playmaker Method

Prior to the development of the Spatial Playmaker method, the current researcher developed his own principles that would guide the creation and inclusion of specific tools within the Spatial Playmaker method. The principles that were kept in mind during the development of the Spatial Playmaker method are as follows:

1. Flexibility (i.e. the number of idea categories) is more important than fluency (the raw number of ideas) in the initial stages of problem-solving;
2. Flexibility must be inculcated into tools and the problem solver's own internal resources should be the source of such flexibility;
3. Flexibility should not equal lack of structure or sequence;
4. Cognitive load must be minimised by means of externalisation (writing down or diagramming) after each stage.

In the preceding two chapters, the pitfalls of group creative problem-solving methods were elucidated. However, it should be noted that this is not a blanket dismissal of collaborative efforts at all stages of the innovation process. On the contrary, group or collaborative methods may prove useful at the implementation stage of the innovation process after the idea generation stage. The latter is the focus of the proposed Spatial Playmaker method and the current study. For example, in larger organisations with multiple departments, the creation of a *team formation plan* may prove crucial to successfully implementing solutions generated by methods such as the Spatial Playmaker (Kumar, 2013). A team formation plan helps create teams to implement the solution by determining the departments and individuals required, as well as providing a picture of their respective roles.

Kumar (2013) outlines the steps involved in a *team formation plan* as follows:

1. Translate proposed solutions as initiatives (composed of action items). Initiatives are proposed solutions described as projects.
2. Create a matrix of initiatives (as row headings) versus departments (as column headings).
3. Choose appropriate people from various departments for the team based on skills. At the end of this step, there will be a team outlined for each initiative.

4. Assign roles (of primary, secondary and tertiary importance) and leadership. During this step, the team goals and deliverables will be described.
5. Discuss the plan (in terms of how each initiative will be launched and coordination across teams) and extend the plan (in terms of future changes to initiatives and how these changes will affect team composition).

3.4 The Importance of Play

In Chapter 2 (and specifically the section on creative process theories), the importance of the concept of space was repeatedly highlighted via concepts and terminology used. This section will highlight why play is important for creative problem-solving.

Brown (2009) identified seven properties of play, namely:

- Play is apparently purposeless. It is done for its own sake and is not connected to immediate or practical survival motives.
- Play is voluntary. Play is not a responsibility people must fulfil. Individuals only engage in it when or if they desire to do so.
- Play possesses inherent attraction. The psychological arousal play provides via fun and the positive state of mind it provides is alluring to human beings.
- Play offers freedom from time. Those immersed in play often lose track of time.
- Play causes diminished consciousness of self. There is significantly less time spent worrying about how stupid or awkward we appear during play.
- Play possesses improvisational potential. There is often multiple ways of playing and thinking that are free from rigid guidelines. The act of play may open up new insights as a result.
- Play elicits a continuation desire. Since play is pleasurable, people want to continue playing.

However, two types of play have been identified. According to Carroll (2009), playful play refers to engaging in an activity simply for enjoyment, while productive play is aimed at achieving a specific outcome and goals beyond pleasure. The latter may be integrated into work, such as when we progress toward developing a tangible innovation.

The link between play and creativity may lie in their similar paradoxical natures. Both creativity and play utilize imagination, but are grounded in a degree of reality (Brown, 2009). In addition, play and creativity depend on knowledge of existing rules, while being open to chance and improvisation (Brown, 2009).

Another concept, similar to productive play, called *serious play* has recently emerged in organisational research. The concept was originally introduced by Plato to contrast frivolous play, meaning playing for fun (Verity & Pinault, 2012). In platonic terms, serious play refers to playing through questioning to attain the truth and excellence in one's education. In modern organizational literature, serious play refers to instances where people deliberately behave playfully with the aim of achieving work-related goals (Statler, Heracleous, & Jacobs, 2011). The outcomes of serious play include the surfacing of implicit knowledge, the development of shared understanding, the communication of new insights, and the facilitation of analogical thinking in strategy (Statler et al., 2011).

In the product design context, serious play may also refer to adopting a non-directional, playful attitude while prototyping possible solutions. Serious play also encompasses a range of approaches that include using the physical body to develop meaning, such as in role-playing and improvisational theatre exercises, or the use of props such as Lego bricks in the workplace (Statler et al., 2011; Watson, 2011).

In fact, serious play is the core concept of an intervention technique developed by the Lego Learning Institute dubbed *Lego Serious Play*, which is primarily aimed at generating strategic insights and broadly outlined as follows (Verity & Pinault, 2012):

1. Gathered stakeholders with relevant knowledge build 3D Lego models of the strategic problem;
2. Individuals explain their models through metaphorical storytelling;
3. A process of negotiation is started to craft a bigger picture, encompassing all the created models. This is where strategic insights may be observed.

The methodology's underlying theory is that this 3D, hands-on approach demystifies strategy and sparks creative strategic ideas faster than 2D conversation and documentation approaches involving spreadsheets, flipcharts and diagramming (Verity & Pinault, 2012).

It should be noted that the utility of play in organisational context is not a completely new concept. One has only to consider scenario planning, role-plays, and simulations, which all possess an element of play (Mainemelis & Ronson, 2006; Statler, Roos, & Victor, 2009). Furthermore, some of the greatest

innovations have been created through play. For example, Dr. Jack Kilby, attributed his invention of the integrated circuit to being free to play around in the lab, because he started work at Texas Instruments when most other employees were on holiday (Browning & Boudés, 2005). Organisations, such as Google, have taken note of the potential benefits of 'play time' and allow employees up to 20% of their work day to play with ideas that interest them (Mainemelis & Ronson, 2006; Martens, 2011).

These research streams, taken together with the playfulness dimension of Ekvall's creative organisational climate model (Ekvall, 1997; Ekvall & Ryhammar, 1999; Isaksen et al., 2001), as well as West's (2014) research on the playful mindset at work, clearly suggest that the importance of play for creativity is an idea whose time has come.

3.5 Theoretical Underpinnings and Rationale of the Spatial Playmaker tools

This section will explain the selection of the specific tools that comprise the Spatial Playmaker method. First, the relevant theories underpinning each tool will be explained. Next, the tool in question will be described. Finally, the rationale for its inclusion will be outlined. The theories, tools, and rationales will be organised according to the six stages of the Spatial Playmaker, namely (a) *Stand off from the problem*, (b) *Pivot the problem*, (c) *Break the problem into sub-problems*, (d) *Playbook a solution*, (e) *U-WIN the front page*, and (f) *Wrap it up and around*.

3.5.1 Stage 1: Stand off from the problem

This stage is concerned with getting the problem solver into a mental state conducive to problem-solving. This stage contains one tool called Imaginary journalism, the inclusion of which is informed by the broaden-and-build theory of positive emotions and construal level theory.

3.5.1.1 Broaden-and-build theory of positive emotions

Most theories of emotion agree on the following basic emotions, namely happiness, sadness, fear, anger, and disgust (Niedenthal, Krauth-Gruber, & Ric, 2006). In addition to happiness or joy, other positive emotions include interest, contentment and love. The action tendencies and skills or outcomes related to positive emotions are outlined in Table 3.1.

Table 3.1

Summary of Action Tendencies and Resulting Skills or Social Outcomes associated with four Positive Emotions

Emotion	Action Tendency	Outcome
Joy	Free activation/play	Motor skill acquisition
Interest	Exploration	Knowledge acquisition
Contentment	Mindful broadening of ideas	Knowledge integration and elaboration
Love	Attachment and bonding	Social relationships

Note. Adapted from "*Psychology of emotion: Interpersonal, experiential, and cognitive approaches," by P.M.* Niedenthal, S. Krauth-Gruber, and F. Ric, 2006, p. 73. Copyright 2006 by Psychology Press.

It is evident that joy, interest, and contentment produce action tendencies and outcomes that are useful during creative problem-solving. For example, interest encourages exploration as an action tendency. During problem-solving, both the initial problem and alternative ideas need to be explored. Another example is contentment, which produces knowledge integration and elaboration as outcomes. During problem-solving, ideas are often combined with others or expanded to produce better ideas.

The broaden-and-build theory of positive emotions holds that positive emotions "broaden peoples' momentary thought–action repertoires and build their enduring personal resources" (Fredrickson, 2004, p.1369). Figure 3.2 provides a summary of the broaden-and-build theory of positive emotions.

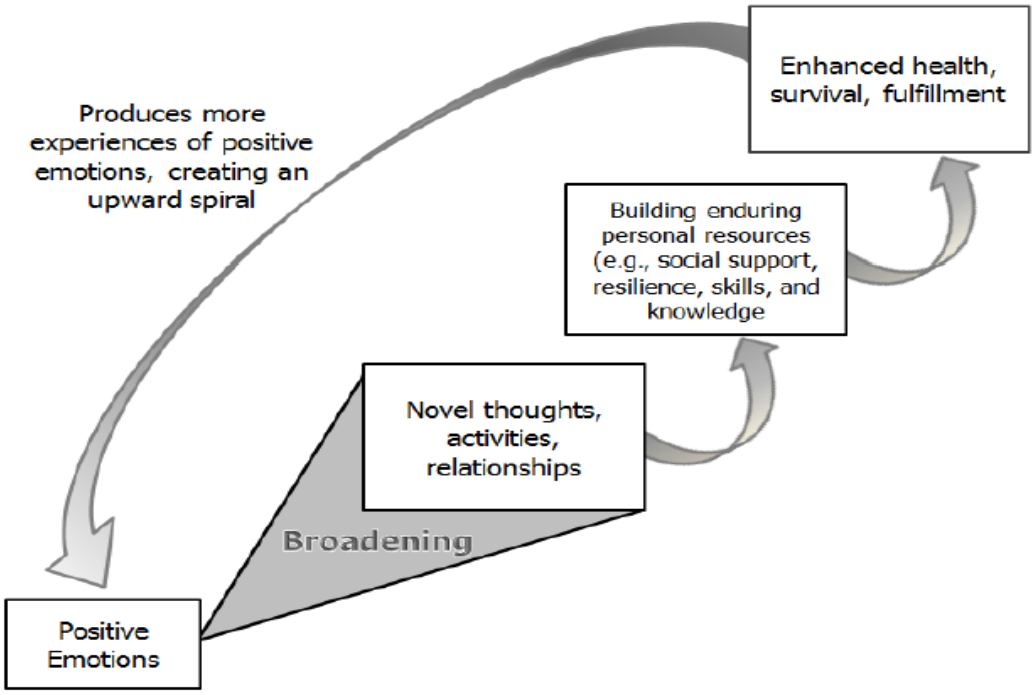

Figure 3.2 The broaden-and-build theory of positive emotions. Adapted from "Positive emotions," by B.L. Fredrickson, and M.A. Cohn, In M. Lewis, J. Haviland-Jones, & L. F. Barrett (Eds.), Handbook of Emotions (3rd edn.), p. 783. Copyright 2002 by Guilford Press.

The *broaden hypothesis*, drawn from the broaden-and-build theory, states that positive emotions, unlike negative emotions and neutral states, broaden the array of thoughts, perceptions, and action urges that come to mind (Fredrickson & Branigan, 2005).

During positive emotional experiences, a person's awareness stretches open and enables the individual to make connections between disparate ideas. In other words, positive emotions enable people to act flexibly and creatively (Fredrickson, 2004; Fredrickson & Cohn, 2008).

3.5.1.2 Construal level theory

Psychological distance is the central construct in construal level theory, which can be defined as a subjective perception that an object or an event is near or distant from the self, here, and now (Trope & Liberman, 2010). Psychological distance may be viewed as a subjective experience of *when* an event occurs, *where* it occurs, to *whom* it occurs, and *whether* the event occurs. Thus, psychological distance can be divided into four dimensions, namely temporal distance, spatial distance, social distance and

hypotheticality (Trope & Liberman, 2010). Temporal distance refers to the perception of whether an event occurs near or distant in time. Spatial distance refers to the perception of whether an object is or an event is located near or distant in space. Social distance refers to the perception of whether other people are socially near or distant to the self. Hypotheticality is defined as the distinction between real and imagined objects and between probable and improbable events.

Construal level theory posits that thinking about psychologically distant objects activates an abstract mindset in people, while thinking about psychologically near objects activates a concrete mindset in people (Trope, Liberman & Wakslak, 2007). People who are in abstract mindsets focus on more abstract (i.e. long-term, goal-relevant) features of objects or events. People who are in concrete mindsets focus on concrete (i.e. short-term feasibility) features. According to Trope and Liberman (2010), construal level refers to the perception of *what* will occur and gives rise to a person's representation of the event itself. The basic premise of Construal Level Theory is that more distant objects will be construed at a higher level, and high-level construal will bring to mind more distant objects. Förster, Friedman, and Liberman (2004) found that creativity is related to high-level construal. Therefore, it is theorized that asking someone to imagine that the problem will occur and needs to be solved at a future date, should activate high-level construal and creativity.

After an extensive search through various thinking tool literatures, the tool called Imaginary journalism was located. It was theorised that it could harness the effects described in the Broaden-and-build theory of positive emotions and Construal level theory. Below is the step-by-step description of the tool in question.

3.5.1.3 Tool (description): Imaginary journalism

When you are faced with a challenging problem:

- Imagine that you are a journalist writing an article for your favourite newspaper (Whiteley, 1991).
- Write a story (4 or 5 sentences long) vividly describing the success that you as the problem solver will have achieved with your solution (without describing the idea/solution itself) at a future time (e.g. 6 months from now). It is important to imagine that the problem will occur and will be solved at a future date.

3.5.1.4 Rationale for the 'Imaginary journalism' tool's inclusion within the Spatial Playmaker

The researcher has modified Imaginary Journalism in two ways to more easily fit into the Spatial Playmaker. Firstly, the hypothetical situation has been changed from imagining workgroup/team success in the future (Whiteley's original formulation) to the success of a solution to a problem (as adapted for the Spatial Playmaker). Secondly, the purpose of Imaginary Journalism has also been changed from a visioning exercise for teams or organisations (Whiteley's original formulation) to a tool aimed at putting the problem-solver in a positive frame of mind (as adapted for the Spatial Playmaker).

Imaginary Journalism is a tool that will both engender positive emotions and increase the temporal distance. Both of these effects are hypothesized to increase the creativity of users of the Spatial Playmaker method.

It is theorized that Imaginary Journalism will stimulate hope and interest in the problem. According the Fredrickson (2013), *hope* creates the urge to plan for the future using one's own inventiveness, while *interest* drives people to explore novelty and learn. The current researcher is of the opinion that when the desired future is mentally visualized, a modicum of joy and contentment may be experienced by the problem solver. *Joy* activates the play instinct and a readiness to get involved in whichever situation presents itself (Fredrickson, 2013). *Contentment* creates the urge to savour the moment (in this case a desired future) and integrate this current circumstance into new priorities and sense of self.

It should also be noted that because the outputs (short article) of Imaginary Journalism is externalised (written down), the article can be read at any time during the Spatial Playmaker process as a reinforcement whenever the problem solver gets stuck or blocked.

3.5.2 Stage 2: Pivot the problem

This stage is concerned with getting the problem solver to gain multiple perspectives by using his/her imagination. This stage contains two tools called Board of directors and Multiple redefinition respectively. Solution-focused brief therapy provides the support for the inclusion of the Board of directors tool. Representational change theory underscores the inclusion of the multiple redefinition tool.

3.5.2.1 Solution-focused brief therapy

Solution-focused brief therapy is an 'intervention therapy' that is grounded in the belief that clients have the knowledge to solve their own problems and therefore focuses on clients' strengths (Kim, 2008). Since the client is the expert, he/she can find enduring solutions more rapidly than in therapist-directed helping relationships. Another central tenet of this therapy is that multiple perspectives on any given situation exist and all views are equally valid (Bannick, 2007). This implies that the therapist must not become overly attached to their own mental models. During solution-focused brief therapy, the therapist attempts to help the client uncover their own expertise regarding what works in a collaborative fashion. The key to achieving such outcomes is getting the client to mobilize resources within his/her mind.

After an extensive search through various thinking tool literatures, the tool called Board of directors was located. It was theorised that it could harness the effects described in Solution-focused brief therapy. Below is the step-by-step description of the tool in question.

3.5.2.2 *Tool (description): Board of directors*

- Select and list at least two people, living or dead, real or fictional, who you admire (e.g. business leaders or athletes or scientists or inventors or artists or family members or book characters from books or movies) (Michalko, 2006).
- Write down the characteristic that you admire about them next to their name as a reminder. Note: It is important that each director has a different characteristic.
- Whenever you are stuck in the creative process, imagine how each of your heroes would overcome the mental block (e.g. during next tool) or a specific sub-problem (e.g. during later stages).

3.5.2.3 Rationale for the 'Board of directors' tool's inclusion within the Spatial Playmaker

The researcher has modified 'Board of directors' in three ways to more easily fit into the Spatial Playmaker. Firstly, the heroes have been expanded beyond the domain of business leaders to include

athletes, family, etcetera. Secondly, the researcher has also removed the steps requiring clipping of pictures, researching the heroes, and putting up of passages detailing obstacles they overcame. Lastly, the current version focuses more on the trait of the creative hero that the problem-solver already knows of and admires (or to which he/she aspires).

Board of directors is a tool that directly acknowledges that the problem solver possesses the internal resources to solve the problem. As Jackson (2003) asserted, such tools invite the problem solver to access his/her own wisdom by consulting heroes or board members that are easily mentally called up. Furthermore, some people may find it difficult to articulate their personal insights on demand, never mind infusing these insights into a creative problem-solving endeavour. It is theorised that the '*board of directors'* tool may elicit the problem solver's insights more easily, because people may view their heroes as more confident and creative.

3.5.2.4 Representational change theory

Insight refers to a problem solver's subjective experience of a sudden 'aha' moment when solving a problem, after being unable to solve it (Ohlsson, 1992). In psychological literature problems used to study the insight phenomenon are called insight problems (Gibson, Dhuse, Hrachovec, & Grimm, 2011). An insight problem initially produces an impasse for the problem solver (not being able to solve it) and, prior to solving it, does not give any clue whether the problem solver is getting closer to the solution (Chronicle, Macgregor, & Ormerod, 2004).

Representational change theory posits that when a person is confronted with an insight problem, prior knowledge used for solving past problems is activated in memory (Öllinger, Jones, & Knoblich, 2008). This forms an incorrect or biased representation of the current problem that will hinder problem-solving.

According to this theory, there are two mechanisms to change the initial representation, namely *chunk decomposition* and *constraint relaxation*. Chunk decomposition refers to the process of breaking a problem into meaningful subcomponents or chunks to consider new relationships between these chunks that may serve as solution paths (Öllinger, Jones, Faber, & Knoblich, 2012). Constraint relaxation refers to relaxing an unnecessary constraint associated with the initial representation of the problem. This involves decreasing the activation of the prior knowledge that has hindered problem-solving (Jones, 2003). In other words, the problem solver must ignore the successful knowledge from past problem-solving efforts and start afresh. A constraint that affects the whole problem is more difficult to relax than

a local constraint related to only part of the problem, as the former implies that the entire problem representation must be reworked.

After an extensive search through various thinking tool literatures, the tool called Multiple redefinition was located. It was theorised that it could harness one of the effects described in Representational change theory. Below is the step-by-step description of the tool in question.

3.5.2.5 Tool (description): Multiple redefinition

Can you think of any redefinitions of the problem based on any of the following statements (Rickards, 1974)? If you are stuck and cannot think of a redefinition based on a particular statement, move on to the next statement.

Statements:

- *Empathic:* 'There is usually more than one way of looking at problems. You could also define this one as ….'
- *Analytic:* '.. but the main point of the problem is….'
- *Motivational:* 'What I would really like to do is….'
- *Magical:* 'If I could break all laws of reality (physical, social, etc.) I would try to solve it by ….'
- *Metaphorical:* 'The problem put in another way could be likened to …'
- *Off-beat:* 'Another, even stranger, way of looking at it might be….'

Afterwards, return to your original definition of the problem. Have any of the redefinitions helped? Can you see the problem from a different angle? Write down any thoughts or ideas that this tool has sparked.

3.5.2.6 Rationale for the 'Multiple redefinition' tool's inclusion within the Spatial Playmaker

The researcher has modified Multiple Redefinition to more easily fit into the Spatial Playmaker. For example, to reduce time spent and cognitive load, the researcher has recommended that if the problem-

solver gets stuck and cannot think of a redefinition based on a particular statement, he/she may move on to the next statement.

Multiple redefinition is a mechanism to try out multiple ways to relax constraints within the initial problem representation. In addition, the analytic statement is a form of chunk decomposition focussing on what the problem solver believes is the most important part of the problem.

3.5.3 Stage 3: Break the problem into sub-problems

This stage is concerned with making the problem more manageable by breaking it into smaller parts. This stage contains a single tool also called Break the problem into sub-problems. This tool's inclusion is backed by representational change theory (discussed in the previous section), as well as research on fixation effects.

3.5.3.1 Fixation effects

The fixation effect is defined as an unconscious blind adherence to a small number of unvaried ideas during the creative process (Agogué, Poirel, Pineau, Houdé, & Cassotti, 2014). For example, when people are asked to draw fantasy animals, they tend to design creatures with heads, eyes, and legs (Hatchuel, Le Masson, & Weil, 2011). This is despite the absence of any instruction stipulating the inclusion of such elements. Another variation of this phenomenon is called functional fixedness, where problem-solving is inhibited when people are unable to generate novel uses for an object once the typical uses for that object are brought to mind (Agogué et al., 2014).

Overcoming fixation effects is particularly important for generating varied alternatives and increasing flexibility (i.e. the number of idea categories) in creative problem-solving. Agogué et al. (2014) suggested resisting restrictive heuristics that lead to automatic fixated thinking and developing expansive heuristics that open up new possibilities. In a similar fashion, the current researcher is of the opinion that expansive creativity tools should actively fight fixation effects in this way.

After a fruitless search through various thinking tool literatures, the tool called Break the problem into sub-problems was created by the current researcher. It was theorised that it could harness chunk

decomposition as described in Representational change theory. Below is the step-by-step description of the tool in question.

3.5.3.2 Tool (description): Break the problem into sub-problems

Two Options:

(i) Break the problem into a Big sub-problem and small sub-problem(s)

Here you may use the *Analytic restatement* you wrote using the Multiple Redefinition tool as the Big sub-problem and use aspects not covered in that restatement as smaller sub-problems.

(ii) Break the problem into sequential phases

This is useful if problem is a whole process or involves multiple actors.

3.5.3.3 Rationale for the 'Break the problem into sub-problems' tool's inclusion within the Spatial Playmaker

Break the problem into sub-problems is a tool aimed at chunk decomposition. The tool makes analysis more manageable as smaller parts of the problem can be considered instead of the whole problem.

3.5.4 Stage 4: Playbook a solution

This stage is concerned with analysing the sub-problems and devising solutions to these sub-problems. This stage derives its name from the single tool it contains, namely Playbook a solution. The rationale for the inclusion of this tool is provided by diverse areas of research, such as human needs, resistance to change, intuition, analysis and planning, as well as visualization.

3.5.4.1 Human needs theory

The most well-known needs theory is Maslow's hierarchy of needs, which categorise needs into five categories namely physical, security, belongingness, esteem, and self-actualisation needs (Lester,

2013). Other motivational theories include Alderfer's *ERG theory* (Arnolds & Boshoff, 2002), which classifies needs into existence, relatedness, and growth need categories, as well as McClelland's *learned needs theory* (Van Emmerik, Gardner, Wendt, & Fischer, 2010) that focuses on achievement, affiliation and power needs. These aforementioned models are all broad motivational theories that describe the needs that underlie behaviour. These theories were developed by psychologists and are mostly used in the area of human motivation. However, there are equally broad motivational theories developed by non-psychologists that have more specialised areas of application. Examples of these theories are Max-Neef's *Human-scale development* in the area of sustainable development (Cruz, Stahel, & Max-Neef, 2009) and Rosenberg's *Nonviolent communication*, which aims to improve communication between individuals and groups (Marlow et al., 2012; Nosek, 2012).

One such model used in the area of conflict resolution within international relations has been proffered by Burton and colleagues (Marker, 2003). According to these theorists, conflict is due to universal needs not being satisfied. This model includes a set of nine need categories that are more discrete than Maslow's five categories or Alderfer's three categories. The nine categories range from the familiar *security*, *belongingness*, *self-esteem*, and *personal fulfilment* that resemble needs of Maslow to additional need categories such as *identity*, *freedom*, *cultural security*, *distributive justice*, and *participation*. The current investigator is of the opinion that the discreteness of Burton's needs make these needs easier to recognise and identify in problem situations for the non-psychologically versed individual. It is also theorised that using recognisable sources of conflict (i.e. unmet needs) will allow problem solvers to get an empathic understanding of why other people may be contributing to the problem situation or are not motivated to solve the problem. Definitions of all the human needs are presented in Table 3.2 in the subsection detailing the description of *playbook a solution* tool.

3.5.4.2 Drivers of resistance to organisational and systems change

To answer the question why an organisation or a system is contributing to the problem situation, one has to delve into the drivers of resistance to change. This is a complex issue that can be viewed in many ways. For example, Gilley, Godek, and Gilley (2009) likened resistance to organisational change to the immune response of the human body. Just as the immune system attacks bacteria and foreign bodies largely without analysis, so too may organisations reject new ideas, even when these new ideas may lead to positive outcomes. Organisational members often depend on existing goals, norms, policies and procedures as sources of security and may resist change in an attempt to maintain stability. This resistance can occur across organisational levels from entry level employees to top management. For

example, according to Agócs (1997), institutionalized resistance occurs when organizational leaders act to reject, repress, and refuse to implement change proposals.

Branson (2008) asserted that resistance to organisational change is due to change initiatives not including a value-alignment process for all people, teams, and departments affected. Organisations with unaligned values often struggle with issues of collective identity and their members have little awareness of the values that inform change efforts. The sources of such resistance include attitudinal causes (Sim & Rogers, 2008; Meier, Ruiz Ben, & Schuppan, 2013), technology acceptance issues (Kwahk & Kim, 2008; Meier et al., 2013), the influence of subcultures (Carlstrom & Olsson, 2014), and many other intra-organisational factors.

The current researcher views systems as including cultural practices, work procedures, intra-organisational processes, product markets, industries, interorganisational relationships, government policies, systems of governance, and a myriad of other multi-actor networks of relationships, incentives, and disincentives. Atun and Olynik (2008) presented the case of resistance to policy change regarding the treatment of Tuberculosis in Ukraine, where existing policies are outdated and encourage lengthy, costly hospital stays for patients. This is in contrast to the global standard where self-medicated out-patient approaches are accepted and produce the highest cure rates among patients. Such progressive policies are resisted due to the regulatory framework, inherited payment systems, stakeholder scepticism, lack of leadership, and cultural barriers (Atun & Olynik, 2008). Clearly, much of this resistance is inherited from the past.

However, after summarising the literature regarding resistance to change across organisational and broader systems contexts, including the review by Pardo del Val and Martínez Fuentes (2003), drivers such as *cost*, *time*, *habit*, *trends*, and *competition* became salient to the current researcher. These drivers are defined in Table 3.3 in the subsection detailing the description of *playbook a solution* tool.

The current investigator believes that an understanding of why organisations or broader systems resist change can be gained by considering the above drivers. These drivers can provide answers to the question: Why are organisations or systems contributing to a problem situation?

3.5.4.3 Intuition

Eubanks, Murphy, and Mumford (2010) define intuition as the emergence of a vague, unconscious pattern that steers complex problem-solving and decision-making during difficult tasks. Intuition is particularly important when the problem is ill-structured, and the problem solver possesses insufficient or incomplete information (Policastro, 1995; Pretz, 2008). In popular parlance, intuition is often mentioned as the opposite of logic. However, Policastro (1995) emphasized that logic and intuition are not mutually exclusive. Specifically, it is possible for a creator to have an intuitive sense about a future creative product that influences the logical plan that he/she uses for creating that product.

During creative problem-solving, intuition may play a similar role to heuristics by setting initial boundaries for explorations and consequently making the search more efficient (Policastro, 1995). However, the key distinction is that heuristics are explicit rules of thumb while intuition involves implicit or tacit knowledge that is difficult to articulate. Eubanks et al. (2010) found that intuition is positively related to creative problem-solving. However, it was specifically found that intuition is more strongly correlated to the elegance and quality of solutions than to the originality of solutions. Claxton and Lucas (2007) noted that from 1970 to 1986 Nobel laureates in the sciences were invited to participate in a discussion of the role of intuition in their work. Each one of the 83 scientists noted intuitive experiences that they described as being essential to the success of their research.

From an individual difference perspective, it can be argued that some people are more intuitive than others. Fortunately, Eubanks et al. (2010) found that positive affect may substitute for intuitive ability. In other words, if non-intuitive people can be placed into a positive affective state, they may solve problems as creatively as their intuitive counterparts.

Other factors, such as experience, also influence how intuition affects creative problem-solving. Pretz (2008) found that when faced with complex problems, less experienced participants performed better when using an intuitive strategy, while more experienced participants fared better when utilising an analytic strategy. It is suggested that an experienced problem solver is better able to pinpoint and subsequently analyse relevant information in a presented problem. When asked to rely on intuition, an experienced individual may get distracted by irrelevant information. In contrast, a novice cannot as readily identify the critical information and subsequently struggles when he/she relies on analysis. However, an intuitive strategy is more holistic and can be likened to a wide-angle camera that captures more information for novices to consider. It is perhaps because an inexperienced individual ‘does not know what to look for’ that an intuitive strategy suits novices. Essentially, if an inexperienced individual

becomes aware of more information in a holistic way, as Pretz (2008) suggested is the case with intuition, he/she is less likely to miss a vital clue due to omission as might be the case in the more focused, pared down analytic strategy. This is an important finding as our familiarity or experience with problems may vary. The current researcher is therefore of the opinion that is preferable to use tools that balance analysis and intuition.

3.5.4.4 Analysis and planning

Planning refers to the mental simulation of future behaviours to aid the attainment of specific objectives (Osburn & Mumford, 2006). It facilitates the refinement and reshaping of ideas so that these ideas can be successfully developed. It may also stimulate the exploitation of new opportunities and development of new approaches to overcome anticipated obstacles. For these reasons, planning is crucial for creative problem-solving. Mumford, Schultz, and Van Doorn (2001) identified two skills as particularly important for planning performance. First, and rather obviously, *forecasting skills* are paramount for planning. Second are the more analysis-oriented *penetration skills,* which refer to the identification of constraints, resources, causes, and contingencies (Mumford et al., 2001).

Recent research (Hester et al., 2012; Marcy & Mumford, 2007) has shown that training people in more effective strategies to analyse causes of problems stimulates the creation of problem solutions that are more original, more elegant, and of higher quality. These causal analysis strategies include the following: (a) identify and use causes that have large effects, (b) identify and use causes that can be manipulated, (c) identify and use causes that affect multiple outcomes, (d) identify and use causes that have synergistic effects, (e) identify and use causes that have direct effects, and (f) identify and use causes that combine to create an effect (Marcy & Mumford, 2007).

3.5.4.5 Visualization

As mentioned in the *Geneplore model* and alluded to in the *Cognitive network model,* discussed in Chapter 2*,* externalizing part of the creative process is advisable to handle complexity and reduce cognitive load. One mode of externalization is visually representing ideas by sketching. Sketching refers to the production of a paper drawing that depicts a subject or object in an informal and provisional manner (Eckert, Blackwell, Stacey, Earl, & Church, 2012). In addition to externalization, sketching extracts the essential elements of the depicted subject, concretizes abstract concepts, stimulates

discovery and inference, helps information processing, and allows for the representation of the specific, as well as the vague (Pfister & Eppler, 2012; Tversky, & Suwa, 2009). Van der Lugt (2002) suggests that drawing multiple sketches encourages a diversity or fluency of ideas, while further drawing on the same sketch represents idea development. Sketches may also lend a *work-in-progress* status to depicted ideas and, subsequently, encourage reflection on and further refinement of these ideas (Pfister & Eppler, 2012).

After an extensive search through various thinking tool literatures, no tool that adequately pulled together the diverse research streams discussed above could be found. Consequently, the tool called Playbook a solution was created by the current researcher. It was theorised that it could be a useful synthesis of the various research streams. Below is the step-by-step description of the tool in question.

3.5.4.6 Tool (description): Playbook a solution

1. Write the whole, original problem at the top of the page (landscape orientation).
2. Draw sub-problems as circles beneath the problem (use keywords). Use the top third of the page.
3. If one or more of the sub-problems are people-centred, then the following questions must be asked:
    - What are these people doing to contribute to the sub-problem?
    - Who are these people?
    - Why are they doing it? To answer why, you must speculate about which human needs their current actions are satisfying.
    - Table 3.2 outlines various human needs that people may be satisfying.

Table 3.2

Marker's (2003) Definitions of various Human Needs

Human Need	definition
Distributive Justice	The need for the fair allocation of resources among all members of a community.
Safety/Security	The need for structure, predictability, stability and freedom from fear and anxiety.
Belongingness/Love	The need to be accepted by others and to have strong ties to one's family, friends, and identity groups.
Self-esteem	The need to be recognised by oneself and others as strong, capable, competent and able to have an effect on his/her environment.
Personal fulfilment	The need to reach one's full potential in all areas of life.
Identity	The need for the sense of oneself in relation to the outside world to be recognised as legitimate or not to be viewed as inferior or be threatened by others.
Cultural security	The need for recognition of one's language, traditions, cultural values, religion, ideas and concepts.
Freedom	The need for having no physical, political, and civil constraints while having the capacity to exercise choice in all aspects of one's life.
Participation	The need to actively partake and influence civil society.

Note. Adapted from "Unmet human needs," by S. Marker, 2003, http://www.beyondintractability.org/m/human_needs.jsp. Copyright 2003 by S. Marker.

A sub-problem is process-, organisation-, or systems-centred if it involves multiple actors, relationships, and exchanges. If one or more of the sub-problems are process-, organisation-, or systems-centred, then the following question must be asked:

- Which process, organisation, or system is involved?
- What is this process, organisation, or system doing to contribute to the sub-problem?
- Why does the process, organisation, or system contribute to the sub-problem?
- To answer why, you must speculate about what is driving the manner of operating.

Table 3.3 outlines various drivers of resistance to change that may be in operation.

Table 3.3

Drivers of Resistance to Organisational and Systems Change

Driver	definition
Cost	This driver refers to the quest to minimize the monetary resources allocated to any activity.
Time	This driver refers to the quest to minimize the time allocated to any activity.
Habit and tradition	This driver refers to practices that are done the way they have always been done and for which no incentive to change has to date existed.
Trends and fads	This driver refers to the infatuation with an idea or principle or practice that is currently popular.
Competition	This driver refers to perceptions of competitors and what is required to remain competitive.

4. Once you have identified the need or driver in question, try to create a sub-solution to satisfy/address the identified need or driver. Devise sub-solutions for each sub-problem by asking whether each sub-problem can be solved by direct confrontation (directly neutralizing the sub-problem), pin-balling (if one solution can be devised for two or more sub-problems), or side-stepping (devising a solution that makes a sub-problem irrelevant by altering the *what, where, why, who* and *how* aspects of the sub-problem). Please note that side-stepping is mostly used for systems or organisation-centred sub-problems (as human needs cannot be side-stepped) and is particularly useful for Habit, Trend, and Competition drivers. Divide the lower third of the page into panels (the number equal to however many sub-solutions you have thought up) and write out or draw each sub-solution in a separate panel. Draw an arrow from each sub-solution panel to each sub-problem circle to indicate method of solution (direct confrontation = a straight arrow up; pin-balling = an arrow hitting a sub-problem and ricocheting into another sub-problem; or side-stepping = an arrow making a 90 degree turn and missing sub-problem). It should be noted that sub-solutions must not be mutually exclusive or lessen the effectiveness of other sub-solutions.

3.5.4.7 Rationale for the 'Playbook a solution' tool's inclusion within the Spatial Playmaker

The current researcher views this tool as a novel way to analyse the sub-problems identified using human needs and drivers of systems change resistance as lenses. The 'Playbook a solution' tool also utilises visual thinking, intuition, and a planning approach in the formulation of sub-solutions.

3.5.5 Stage 5: U-WIN the front page

This stage is concerned with evaluating the solution before doing the final write-up and revising it, if necessary. This stage contains three tools, namely U-WIN, ULTIC, and the front-page test. Support for the inclusion of the U-WIN tool originates from research on the auto-evaluation of ideas during the creative process. The rationale for the ULTIC tool is based upon research on the effect of constraints on creativity. The tool named the front-page test gains its support from research on ethics, reputation, and the Pygmalion effect.

3.5.5.1 Auto-evaluation of ideas during the creative process

Bilton (2015) argued that 'uncreativity', defined as resistance to novelty or novel ideas, is necessary for the creative process as it encourages individuals to refine existing ideas instead of continually generating new ideas. During creative problem-solving, uncreative thinking can take the form of reflection, self-criticism, doubt, or self-censorship that pushes the problem solver towards the resolution and completion of ideas. Furthermore, Bilton (2015) asserted that uncreativity at the individual level forces problem solvers to turn a novel solution into a solution that is novel as well as valuable (i.e. useful). Following these arguments, the auto-evaluation of ideas (i.e. the evaluation of ideas by the creator of those ideas) during the creative process is a form of uncreativity.

Mumford, Lonergan, and Scott (2002) theorised that idea evaluation involves the appraisal of both the forecasts of resources required for and the consequences of idea implementation. If appraisals do not meet set standards, then an idea will be abandoned or revised. If appraisals are favourable, then the idea will be implemented. Dailey and Mumford (2006) highlighted the possibility of such appraisals being inaccurate, specifically that appraisals tend to be too optimistic. However, they also found that when individuals consider the usefulness of an idea, they become engaged and actively analyse the idea.

This results in more accurate appraisals of potential outcomes and required resources. This mirrors work by Armor and Taylor (2003) who found that inducing an implementation mindset produced more accurate forecasts regarding time requirements than inducing a deliberative mindset. Another factor in the utility of auto-evaluations of ideas may be timing, as much of the preceding research suggests that evaluating ideas *during* the creative process produced more creative products than evaluating ideas *after* or at the end of the creative process. This is in contrast to rules of brainstorming where judgement is deferred until much later in the process. These findings support the use of auto-evaluation tools that encourage thinking about idea implementation.

After an extensive search through various thinking tool literatures, no tool that adequately pulled together the diverse research streams discussed above could be found. Consequently, the tool called U-WIN was created by the current researcher. It was theorised that it could capitalise on the positive effects of the auto-evaluation of ideas during the creative process. Below is the step-by-step description of the tool in question.

3.5.5.2 Tool (description): U-WIN

Does your solution have any ***Undesirable*** consequences or side effects?

- If yes, refine solution
- If no, continue.

Does your solution solve the ***Whole*** Problem?

- If no, refine solution
- If yes, continue.

In your opinion, is your solution ***Instructive*** for others to use/implement?

- If no, refine solution
- If yes, continue.

Is your solution ***New*** to the problem?

- If no, refine solution
- If yes, continue.

3.5.5.3 Rationale for the 'U-WIN' tool's inclusion within the Spatial Playmaker

U-WIN allows the problem solver to evaluate the draft or rough solution and assess whether refinement of the solution is required. The tool not only focuses on auto-evaluations of effectiveness of the solution, but also often overlooked aspects such as undesirable consequences and ease-of-use considerations.

3.5.5.4 Creativity and constraints

Much creativity advice and many creative problem-solving methods call for relaxing the constraints of the problem situation, especially if those constraints are self-imposed such as assumptions. According to Lombardo and Kvålshaugen (2014), this trend equates minimizing constraints to maximizing creativity, as if constraints are always obstacles to creative thinking. However, as discussed in Chapter 2, the geneplore model highlights setting constraints as an essential part of the creative process (Finke et al., 1992; Van der Lugt, 2002). Still, even among those that accept constraints as inherent to creative thinking, there is a tendency to use constraints of the problem situation solely as evaluative criteria for the solution's usefulness. However, Stokes (2007; 2008) found that setting constraints such as limiting search among previous solutions can help generate novelty. The current researcher hypothesizes that setting constraints in the latter stages of a creative problem-solving method (i.e. *after* auto-evaluation) can be useful for refining a proposed solution.

After an extensive search through various thinking tool literatures, no tool that adequately pulled together the diverse research streams discussed above could be found. Consequently, the tool called ULTIC was created by the current researcher. It was theorised that the tool could assist problem-solvers to utilise constraints to refine a creative solution. Below is the step-by-step description of the tool in question.

3.5.5.5 Tool (description): ULTIC (Under Less Than Ideal Conditions)

Using the answers gained from the U-WIN tool, use any of the refinements suggested for each of the specific U-WIN answers as can be seen in Table 3.4.

Table 3.4

ULTIC (Under Less Than Ideal Conditions)

Answers read from U-WIN	Suggested refinements
When your solution has *Undesirable* consequences or side effects	• Involve fewer individuals or departments in implementation; • Revise (increase) timescales of the solution. • Scale down solution; • Simplify solution; • Use existing, unused resources.
When your solution does not solve the *Whole* Problem	• Rethink the smaller sub-solutions; • Rethink the sub-solutions for latter phases of the problem (i.e. the latter sub-problems); • Consider other users as well;
When your solution is not *Instructive* for others to use/implement	• Scale down solution; • Simplify solution; • Consider other users as well; • Use existing, unused resources. • Change the 'how' of the solution or sub-solution.
When your solution is not *New* to the problem	• Improve any single sub-solution; • Use existing, unused resources; • Change any element of the solution or sub-solution (e.g. who, what, when, where, or how).

3.5.5.6 Rationale for the 'ULTIC' tool's inclusion within the Spatial Playmaker

It is human nature to think that a solution that we have developed ourselves will be easily implemented or accepted in practice or that there will be no unforeseen consequences (Bastardi, Uhlmann, & Ross, 2011; Mannes & Moore, 2013). This is perhaps why problem solvers often ignore the dynamic nature of the broader environment when devising solutions. However, once the U-WIN pinpoints the way in which

the solution requires refinement, the problem solver can improve the solution or any of its sub-solutions by one or more of the listed refinements.

3.5.5.7 Ethics and creativity

There is a popular belief that creativity only leads to socially desirable outcomes (Cropley & Cropley, 2011). However, creativity is not always beneficial to society at large. Gino and Ariely (2012) highlighted this century's series of well reported corporate accounting scandals as highly creative yet destructive endeavours. An obvious way creativity may fuel unethical behaviour is that creativity allows people to generate more novel methods of dishonesty. In addition, Gino and Ariely (2012) found that high levels of creativity may help individuals devise self-serving justifications for unethical actions. For example, when individuals misreport income tax deductions, perpetrators may tell themselves that the less tax they pay, the more money they have to spend and thus stimulate their local economy! Alternately, individuals might reason that the government will eventually receive the money (that they would have paid in income tax) in an indirect manner via value added tax when they buy goods with that money. The list of these justifications can be diverse, even when people are merely asked to think creatively about misreporting tax deductions.

At times the potential consumers may reject unethically produced creative products when creators have failed to act ethically. For example, Runco and Nemiro (2003) cited the case of the *New England Journal of Medicine* that decided not to publish experimental research on hypothermia conducted by the Nazis due to the objectionable manner the data were obtained. However, it would be preferable for individuals and organisations themselves to take responsibility for ethical concerns. In the educational domain, Kaufman and Beghetto (2013) have suggested the development of *creative metacognition*, defined as a synthesis of creative self-knowledge (an awareness of one's creative strengths and weaknesses) as well as contextual knowledge (an awareness of where, when, why, and how creativity was required). In particular, it is the development of contextual knowledge that may be especially important in recognizing ethical issues and deciding whether creativity is appropriate.

In a study comparing employee attitudes toward unethical behaviour, Mujtaba and Sims (2006) found that formal socialisation (i.e. involving induction and training) was more effective than informal socialisation (i.e. involving peer observation) in socialising ethical values. This finding supports the contention that it is preferable to provide workers with more *explicit* ethical guidelines rather than hope they 'pick up' ethical values from the work environment.

Strangely, integrating *explicit* ethical checks and balances within creative problem-solving methods has received little attention in both research and practice. This is a troubling state of affairs given the preceding discussion. Perhaps this is due to the prevalence of 'creativity can only benefit society' rhetoric highlighted at the start of this sub-section. Alternately, developers of creative problem-solving methods may believe that it is the exclusive duty of potential investors, implementers, and other decision-makers to evaluate the ethical standing of creative solutions.

3.5.5.8 Reputation and self-image

Impression management is defined as a tactic of influence by which individuals or organisations attempt to control the images other people have of them (Provis, 2010). Part of this may be done by framing information in a positive fashion. However, another method is to always act as ethically as possible so that there is no need to frame your behaviour or ideas in a more desirable light. In this vein, Canevello and Crocker (2011) found that when individuals pursue goals related to having their positive attributes recognized by others, it leads to a decreased self-esteem and decreased regard from others. Goals aimed at supporting others led to increased self-esteem and increased regard from others. These findings are echoed at the organisational level, where Chun's (2006) findings suggest that the innovative reputations of firms are positively related to integrity. In other words, firms can only maintain such positive reputations when they act honestly, sincerely, and in a socially responsible manner. Sustaining an innovative reputation is not possible through acting ambitiously alone, because people also consider the firm's ethical track record when holding such images of an organisation.

3.5.5.9 *Pygmalion effect*

The Pygmalion effect is defined as in increase in an individual's performance as a result of positive expectations held by others (Karakowsky, DeGama, & McBey, 2012). Research has generally been supportive across various domains ranging from education (where raised teacher expectations lead to enhanced learner performance) to business (where raised supervisor expectations lead to enhanced employee performance), sport, and military contexts (Inamori & Analoui, 2010).

The current researcher is of the opinion that such raised expectations extend to the others expecting ethical behaviour from individuals. In turn, affected individuals may do their best not to commit ethical

violations that would disappoint those that expect better from them. Therefore, it would be beneficial to capitalise on any such Pygmalion effects that may in operation for problem solvers.

After an extensive search through various thinking tool literatures, the tool called the front-page test was identified. It was theorised that it could harness the effects of ethics, reputation, and the Pygmalion effect on creative efforts. Below is the step-by-step description of the tool in question.

3.5.5.10 Tool (description): Front page test

- Imagine a front-page headline article outlining your solution (Kidder, 1995).
- Would you be comfortable if your name is mentioned as the creator of the solution in the article knowing that the public (including your family, friends, acquaintances, and colleagues) would read the article?
- Would you be comfortable if your business or place of work's name and your family members were mentioned in the same article knowing that the public (including your family, friends, acquaintances, and colleagues) would read the article?
- If no, refine solution
- If yes, write up your final idea (in the next stage)!

3.5.5.11 *Rationale for the 'Front page test' tool's inclusion within the Spatial Playmaker*

Originally created as part of Rushworth Kidder's ethical checkpoints (Johnson, 2007; Kidder 1995), the *front-page test* has been adapted as part of the Spatial Playmaker method as creativity without ethics may lead to unacceptable or even illegal ideas being produced. The researcher has modified the front-page test in two specific ways. Firstly, the current researcher has made the hypothetical audiences more explicit by naming these specific audiences. Secondly, the current researcher has changed the subject matter in the hypothetical front-page article from a person's actions (Kidder's original formulation) to a problem-solver's solution to a problem (as adapted for the Spatial Playmaker).

To reiterate, the front-page test addresses that fact that ethical checks and balances have been largely omitted from creative problem-solving methods. The front-page test may also activate a Pygmalion effect, where such an influence exists.

3.5.6 Stage 6: Wrap it up and around

This stage is concerned with how to communicate the final formulated solution in a persuasive manner. This final stage contains a single tool called the motivated sequence. The rationale for the inclusion of this tool is derived from research on the role of expertise, trustworthiness, and loss framing in persuasion.

3.5.6.1 Knowledge and expertise

The role of knowledge and expertise in the creative process has already been highlighted in Chapter 2. However, it is equally as important when communicating a solution to an audience. People are more likely to trust the opinion of an expert. Dillard and Pfau (2002) cited the examples of captains operating passenger aeroplanes and medical doctors working within hospital environments as people whose titles create perceptions of expertise and authority. However, how does one project such expertise without a title? One option is to demonstrate the breadth and depth of your understanding of a topic within your message. This shows that you have explored and thought about a topic extensively. Audiences are more likely to trust knowledgeable communicators.

3.5.6.2 Trustworthiness

Trustworthiness can be defined as a communicator's lack of bias and honesty (Dillard & Pfau, 2002). However, in many instances the communicator will not have an existing relationship with the audience. This begs the question: How can a communicator appear trustworthy in the absence of a prior relationship with an audience? One method that a communicator can use is to use two-sided arguments. In other words, both sides (the pros and the cons) of an argument are provided. This gives the impression that the communicator is more honest.

3.5.6.3 Loss framing

Nobel prize-winners, Tversky and Kahneman (1981), found that people are more motivated by the possibility of losing something of value than the thought of gaining something of equal value. In fact, in many areas of decision-making, human beings operate according to a 'no loss' rule. This has the implication that communicators should include the consequences of *not* making the desired decision or *not* choosing the desired option in persuasive messages.

After an extensive search through the literature of persuasion, the tool called the Motivated sequence emerged as a viable option. It was theorised that it could be modified to capitalise on findings on the role of expertise, trustworthiness, and loss framing in persuasive messages. Below is the step-by-step description of the tool in question.

3.5.6.4 Tool (description): Motivated sequence

Your final solution must be communicated and structured in the following manner (Benoit & Benoit, 2008; Monroe, 1935):

1. *Attention:* Pose a provocative question: "Wouldn't it be great not to be faced with problem x?"
2. *Need:* State the need for action by demonstrating the severity, extensiveness of the problem and how it relates to the audience.
3. *Satisfaction:* State how your solution will respond to the need (emphasize uniqueness) and briefly summarize how your solution works (focusing on who, what, where, when, why, and how). If any possible cons to your solution exist, mention these cons and how they can be minimized.
4. *Visualization:* Describe the positive consequences of implementing the solution. "Imagine…" Relate to human needs and drivers. Describe the negative consequences of not implementing the solution.
5. *Action:* State the action you want the audience to take to make the solution happen. Make the action very specific and straightforward.

3.5.6.5 Rationale for the 'Motivated sequence' tool's inclusion within the Spatial Playmaker

Organisational plans are templates for structuring messages clearly so that the audience understands and is persuaded (Benoit & Benoit, 2008). One such organisational plan, Monroe's *motivated sequence*, was adapted to increase perceptions of trustworthiness and include loss framing. This organisational plan was chosen to effectively communicate the proposed solution to people who make decisions regarding adoption and implementation of solutions, financiers, or potential clients. It can be thought of as an elevator pitch, as solutions need to be communicated succinctly when initially presented. In its current form, it has been adapted in three ways. Firstly, this version of the motivated sequence always begins with a provocative question as this will engage the minds of the audience. Secondly, the cons of the idea and how these can be handled are explained. Lastly, loss framing has been integrated into the visualization step of the organisational plan. The current investigator theorises that the adapted motivated sequence is superior to popular organisation plans such as AIDA (Attention, Interest, Desire, Action), because it demonstrates that the speaker/writer has thoroughly analysed the problem and increases perceptions of trustworthiness as it presents a balanced view as evidenced during Need, Satisfaction, and Visualization steps. In addition, the motivated sequence situates the problem in the audience's lives more rapidly and therefore creates relevance during the initial Attention and Need steps.

3.6 Content Validity of the Spatial Playmaker Method

The content validity of the Spatial Playmaker method (including its goals, rationale, and the rationales of the tools contained within) was evaluated by four external researchers or trainers in the area of creativity development. These evaluators read and evaluated the material supplied independently. Each content evaluator concluded that the Spatial Playmaker method will accomplish the goals set. The complete sequence of Spatial Playmaker method is summarised in Figure 3.3.

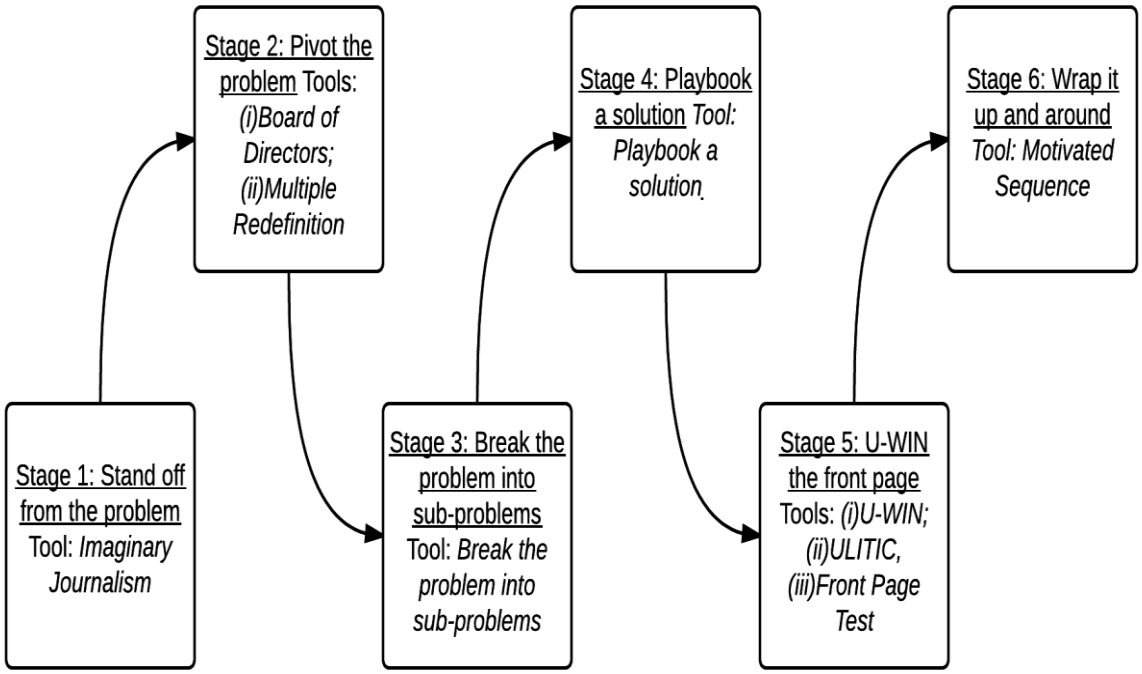

Figure 3.3. The complete sequence of the Spatial Playmaker method

Please refer to **APPENDIX A** for a full example of the Spatial Playmaker method of creative problem-solving.

3.7 Development and Description of a Training Intervention

This section outlines the development of the training intervention aimed at preparing learners to use the Spatial Playmaker method and important aspects of the proposed training intervention.

3.7.1 Programme title and description

Programme title: How to use the Spatial Playmaker method of creative problem-solving

Programme description: This half-day training programme will teach participants to use this powerful technique to solve problems in a creative manner. The instructor will guide participants through the process of preparing mentally to tackle a problem creatively, creating resources for use during problem-

solving, generating potential solutions, refining those ideas into final, effective solutions. Participants will learn how to apply tools within the Spatial Playmaker method to overcome business problems.

3.7.2 Instructional design of the training programme

The current investigator used the ADDIE model to design and develop the training programme. ADDIE is an instructional design process and refers to stages in the design process, namely Analysis, Design, Development, Implementation, and Evaluation (Chan, 2010). Due to space considerations and practicality, this sub-section will only describe questions pertaining to the Analysis, Design, and Development stages. The Implementation and Evaluation stages will be described in Chapter 4.

The *Analysis* phase is concerned with aspects related to the targeted learners of the training intervention. Selected questions considered during the Analysis phase are outlined in **Table 3.5**.

Table 3.5

Questions answered during the Analysis phase of the ADDIE model

Questions	Answers
Who are the learners? What jobs do they do?	All of the learners are small business owners in diverse industries.
What's their relationship to one another?	They are all beneficiaries of a number of small business development organisations.
How large is the training group/target audience?	It is a pilot study. Therefore, it is anticipated that the training group will be small.
Where are the learners located?	The Cape Winelands region of the Western Cape province.
How much time do learners have available for training?	Entrepreneurs generally experience a scarcity of time. To balance this scarcity with time required for training, the training intervention will be run as a half-day training workshop.

Table 3.5 (continued)

Questions answered during the Analysis phase of the ADDIE model

Questions	Answers
Why will learners participate in this training?	Operating a small business involves facing multiple problems without benefit of standard operating procedures that large organisations may have developed or the resources to spend on buying a solution. Given these constraints, the ability to solve problems creatively is important for the survival of small businesses.
Are there any prerequisites for this training?	A reasonable command of the English language; The ability to recognise a problem in their business.
What are learners' previous experiences learners have had with training? What type of training? Were these training courses well attended?	The learners have previously attended courses related to small business financial management and business planning (M. Brinkhuis, personal communication, April, 30, 2016). Generally, these previous training courses were well attended (regardless of course length). However, these training courses have generally been organised by small business development organisations and not by lone researchers.

The *Design* phase is concerned with gaining clarity with regard to the requirements, content and objectives of the proposed training intervention. Selected questions considered during the *Design* phase are outlined in Table 3.6.

Table 3.6

Questions answered during the Design phase of the ADDIE model

Questions	Answers
What is the training programme intended to accomplish?	To improve learner's creative problem-solving ability by using the Spatial Playmaker method.
What is the learners' starting level w.r.t. the subject?	The Spatial Playmaker is a new method and therefore learners have no previous experience or even familiarity regarding the subject matter.
What is to be taught in the training programme?	Within the KSA (Knowledge, Skill, Attitudes) framework, the training programme will focus on *Knowledge* (in this case learning and applying the steps in using the Spatial Playmaker method). However, there are elements of *Skill* and *Attitude* that are implicit in these tools and need to be addressed.

Learning objective:

- Given a business case study problem, use the Spatial Playmaker method to solve the case problem creatively (i.e. in a novel and useful way);

Enabling objectives:

- Use the *Imaginary Journalism* tool to prepare mentally (visualise) when first faced with a problem to be solved;
- Use the *Board of Directors* tool to utilise your internal mental resources and imagination in problem-solving;
- Use the *Multiple Redefinition* tool to change perspective on a problem to be solved;
- Use the *Break into Sub-problems* tool to analyse a problem to be solved;
- Use the *Playbook a Solution* tool to identify and utilise human needs or process drivers to solve sub-problems;
- Use the *U-WIN* tool to determine whether proposed solution or idea is in need of refinement;
- Use the *ULTIC* tool to refine your proposed solution or idea;

- Use the *Front-Page Test* tool to determine whether proposed solution or idea is ethical;
- Use the *Motivated Sequence* tool to communicate your proposed solution or idea;

During the *Development* phase, specific reference is given to the 'how' of the training intervention. This is especially important in selecting a delivery method for the training (Chan, 2010). Selected questions considered during the Development phase are outlined in **Table 3.7**.

Table 3.7

Questions answered during the Development phase of the ADDIE model

Questions	Answers
What is the urgency of the training?	From an urgency point of view, developing an e-learning programme or a self-paced programme would be too time-consuming (due to outsourcing of programming and software expertise).
What resources are available for this training programme?	Developing a sophisticated e-learning programme or videos or podcasts is not within the limited budget for this pilot study.
Where are the learners located?	Learners are dispersed within the Cape Winelands area of the Western Cape province. It is a pilot study and it is believed that it is possible for this small number of learners to be trained at a single central location.
Does the type of learning require interaction, or can it be done via self-paced instruction?	Although the proposed training programme does not require high levels of group interaction as would be required for a team-building or interpersonal communication skills training, it is thought that learners would benefit from asking questions to the instructor. The Spatial Playmaker method is a complex mental method and requires explanation by the subject matter expert. It may also be advantageous for learners to be exposed to the questions posed by other learners. It is therefore not suitable for self-paced instruction via print or electronic materials only.

Given the above answers, *an interactive trainer-led workshop* is the preferred delivery method for this training programme as it is a cost-effective way to train a small group of learners and allows for immediate feedback when required.

Please refer to **APPENDIX B** to see the scripted lesson plan and sample training activities.

3.8 Summary

This chapter began with an overview of the potential areas of application of the Spatial Playmaker method. A brief description of the current researcher's theoretical stance during the development of the Spatial Playmaker method followed. Next, the importance of play in creativity was illuminated. The bulk of this chapter described the theoretical underpinnings and rationales of each tool included in the Spatial Playmaker method. In addition, each tool was fully described in the sequence that it will be used within the Spatial Playmaker method. Finally, the design and development of the training intervention to teach learners how to use the Spatial Playmaker method was described.

Considering the information supplied within this chapter, the logic behind both the Spatial Playmaker method and its supporting training intervention should be apparent. Chapter 4 will describe the methods involved in implementing and evaluating the training intervention, which forms the focus of the current research study.

CHAPTER 4:

RESEARCH METHODOLOGY

4.1 Introduction

Chapter 3 detailed the theoretical underpinnings, development, and description of the Spatial Playmaker method of creative problem-solving. The chapter culminated in the development of a training intervention to support the use of the Spatial Playmaker. It was proposed that the Spatial Playmaker could assist the practitioner in avoiding the disadvantages of a group-based method of creative problem solving discussed in Chapter 1 (i.e. groupthink, the Abilene paradox, evaluation apprehension, social loafing, production blocking, downward performance matching, relational loss, the common knowledge effect and cognitive narrowing) while providing internal mental resources conducive to individual creative problem-solving.

To reiterate, the Spatial Playmaker is a creative problem-solving method to be used by individuals. It is not a group-based, collaborative method. However, after sufficient briefing or training in the use of the Spatial Playmaker, multiple individuals could use the method independently and then share their outputs afterwards. This represents a significant benefit in an organisational context where such an arrangement would constitute *employees as multiple problem-solving engines working in parallel* versus traditional group methods where employees form part of *a single session-based problem-solving engine,* which suffers the aforementioned group-based disadvantages. Clearly, the former parallel individual approach holds more promise for organisations, especially if one considers the number of potential problem-solvers in their employ.

The current chapter will detail the methodology the current study employed to evaluate the effectiveness of the Spatial Playmaker method of creative problem solving. First, the dependent (outcome) variables will be defined and research questions stated. Next, the substantive research hypotheses tested in this study will be stated. Thereafter, the research design and its implications will be discussed. Then, the research hypotheses will be stated statistically. The proposed statistical analyses of the data and sample are next to be outlined. Finally, the experimental procedure, measurement instruments, debriefing, and rating procedure are outlined.

4.2 Research Questions

There are several approaches to evaluate the effectiveness of a creative problem-solving method, but the most logical approach is to evaluate the output of the method. In other words, the ideas produced using the method need to be evaluated. The current study utilised a multi-attribute approach to measuring the creativity of ideas, instead of adopting a unidimensional novelty-based definition of creativity, which ignores the usefulness and practicality of ideas.

For the purposes of the current study, the creative ideas produced were evaluated by independent judges using the following dependent variables developed by Dean, Hender, Rodgers, and Santanen (2006):

- ***Originality:*** The degree to which the idea is not only rare, but is also ingenious, imaginative, or surprising.
- ***Acceptability:*** The degree to which the idea is socially, legally, or politically acceptable.
- ***Implementability:*** The degree to which the idea can be easily implemented.
- ***Effectiveness:*** The degree to which the idea will solve the problem.
- ***Completeness:*** The number of independent subcomponents into which the idea can be decomposed, and the breadth of coverage with regard to who, what, where, when, why, and how.

This has led to the formulation of the following specific research questions:

- Will the use of the Spatial Playmaker method produce ideas that are higher in *originality* than ideas produced without the aid of it?
- Will the use of the Spatial Playmaker method produce ideas that are higher in *acceptability* than ideas produced without the aid of it?
- Will the use of the Spatial Playmaker method produce ideas that are higher in *implementability* than ideas produced without the aid of it?
- Will the use of the Spatial Playmaker method produce ideas that are higher in *effectiveness* than ideas produced without the aid of it?
- Will the use of the Spatial Playmaker method produce ideas that are higher in *completeness* than ideas produced without the aid of it?

4.3 Research Design

From the above research questions, it should be evident that the current study is evaluation research (i.e. studying whether the training intervention based on Spatial Playmaker is effective). Considering the fact that both the Spatial Playmaker method and the training intervention are newly created, a pilot study was deemed most appropriate. The pilot study will enable the current researcher to gauge the interest among potential participants, the feasibility of research studies with larger samples, and the need for any changes to the intervention before the commencement of such future research studies.

The current researcher has approached this evaluation research study from a quantitative positivist paradigm. As such, the *pretest-posttest control group design* is deemed to be the most appropriate and practical research design for this study. This design allows for the measurement of the effect of the treatment on the intervention group by comparing that group to the comparison group. It also possesses the added benefit of being able to reveal the degree of change within the intervention group scores, because it includes a pre-test measurement for baseline purposes. Table 4.1 outlines the Pretest-posttest Control Group Design.

Table 4.1

The Pretest-posttest Control Group Design

Group	Pre-test	Intervention	Post-test
Experimental (R)	O_1	X	O_2
Control (R)	O_3		O_4

Note. O_1 & O_3 = Pre-tests. X = Intervention. O_2 & O_4 = Post-tests.

Threats to internal validity, if not controlled, hamper the researcher's ability to state that an intervention had an impact on dependent variables in question. Major threats to internal validity of experiments include selection, history, maturation, and testing. *Selection* is a threat when results are caused by differences in participants at the start of an experiment instead of by the intervention (Shadish, Cook, & Campbell, 2002). *History* refers to when participants experience events (outside of the experimental treatment) that occur during the time between the start of the intervention and the post-test that influences post-test scores (Shadish, Cook, & Campbell, 2002). *Maturation* refers to the biological or

psychological changes that affect research participants due to the passage of time during the experiment and influence their post-test scores (Goldstein, 1993). The threat of *testing* refers to where the changes in scores from pre-test to post-test may be a result of repeated testing instead of the intervention (Goldstein, 1993). Testing was controlled by the fact that the pre-test and post-test were not identical. All four of these threats were controlled by the use of comparison group and random assignment of participants to intervention and comparison groups. These threats are assumed to affect the intervention and comparison groups equally.

History and, to a lesser degree, maturation were both further controlled by selecting the sample of participants from the same general geographic area, so that different local secular trends do not affect participants differentially (Shadish, Cook, & Campbell, 2002). The treat of testing was further minimised by using different open-ended test problems for pre-tests and post-tests so that participants would not be able to seek external related study material (Goldstein, 1993). *Regression* is a threat when participants are selected for an experiment based on extreme scores on a measure (Shadish, Cook, & Campbell, 2002). Regression did not play a role in the current study, because participants were not selected on the basis of scores attained prior to the study.

The threat of *experimental mortality* refers to participants who drop out during the course of an experiment, usually after the pre-test but before the post-test (Shadish, Cook, & Campbell, 2002). Goldstein (1993) suggested that individuals who performed poorly on the pre-test may drop out due to feelings of discouragement. In the current study, scores were assigned only after the posttest. Therefore, participants could not become discouraged as a result of their pre-test performance. Furthermore, it was emphasized that it was the Spatial Playmaker method under evaluation not participants. In addition, the current researcher clearly communicated time commitment requirements for study participation prior to the study, which led to participant dropout before the commencement of the study proper (i.e. before the pre-test). Although it was communicated that they could cease their participation at any time during the study, opting out prior to the commencement of the study (i.e. before the pre-test) was framed as preferable to the researcher. Participants were given multiple opportunities prior to the pre-test to confirm or withdraw their participation in the study. This may have decreased experimental mortality that would have negatively affected internal validity.

The threat of *instrumentation* occurs when there is change in the measuring instruments between the time of pre-test and post-test, which may produce differences in scores that may be erroneously attributed to the intervention (Shadish, Cook, & Campbell, 2002). In the current study, instrumentation was controlled by using the same measuring instruments (i.e. rating scales used by the independent

judges) to measure the dependent variables for pre-tests and post-tests. To minimise another aspect of instrumentation, changes in rater behaviour due to increased experience, is controlled by the use of a comparison group and random assignment. In other words, this latter aspect of instrumentation is assumed to affect the intervention and comparison groups equally, because raters (termed solution judges in this current study) rate all intervention and comparison group solutions. The selection and training of these judges will be discussed in the Rating Procedure section of this chapter.

Diffusion or imitation of treatments occurs when participants from the intervention and comparison group know each other and intervention group members discuss information regarding the intervention with comparison group members (Borg, 1984; Goldstein, 1993). This threat effectively hampers the researcher's ability to manipulate the independent variable, which is crucial in experimental research.

Compensatory rivalry by participants receiving the less desirable treatment occurs when comparison group members actively compete against intervention group members. Comparison group participants may give extra effort in order to reduce or reverse expected differences attributed to the intervention (Borg, 1984).

Resentful demoralization of comparison group participants occur when comparison group members become demoralized, because they view the intervention group participants as receiving something special while they receive something of less value (Borg, 1984; Goldstein, 1993). This may lead to comparison group participants not performing to the best of their abilities. This threat may result in the false conclusion that the intervention was more effective than it actually was.

The preceding three threats to internal validity cannot be controlled by use of a control group and random assignment (Borg, 1984). However, the choice and nature of the sample of participants played a fortuitous role in this regard. The sample consisted of small business owners and not employees of a single organisation. These three threats are more likely when participants are fellow employees and/or socialise frequently (Goldstein, 1993). Consequently, participants could not interpret their assignment to the comparison group as a sign that they are not valued by management. The current researcher also explained that the assignment of participants to intervention and comparison groups was done randomly. In other words, there was no judgement or ranking of participants by the researcher to determine which participants underwent which treatment/condition.

Overall, the pretest-posttest comparison group design is one of the strongest research designs in terms of internal validity (Goldstein, 1993). In other words, the design is effective at determining the effect of

an intervention on the dependent variables studied. Where this research design was vulnerable to threats to internal validity, the researcher attempted to reduce the effect of these identified threats.

In terms of threats to external validity, the *reactive effect of pretesting* comes into play with this research design. This threat occurs when the pre-test sensitizes subjects to respond differently to the treatment than would be the case without a pre-test (Goldstein, 1993). This threat is likely when questions or tasks in the pre-test cause participants to pay attention to a certain part of the treatment intervention.

Reactive effects of experimental settings are especially difficult to control, because participants are aware that they are participating in an experiment due to the obtrusive nature of the study (Goldstein, 1993). This may lead to differences in participant behaviour that cannot be generalised to people who attend the intervention (i.e. the training course entitled 'How to use the Spatial Playmaker method') outside of a research study. The current researcher has implemented some of the remedies suggested by Rosenthal and Rosnow (as cited in Shadish, Cook, & Campbell, 2002) to partially reduce this particular threat. Firstly, these authors suggested standardizing experimenter interactions with participants, which was accomplished in the current study to some degree by adhering to a scripted lesson plan, the researcher maintaining a level of visible enthusiasm or energy, and matching pre-test and post-test procedures. Secondly, although no overt deception was employed, the exact nature and description of the dependent variables in the current study were not made obvious to participants. Thirdly, as will be described in the Experimental Procedure section of this chapter, by ensuring confidentiality and anonymity, the study was made less threatening to participants.

Therefore, with regard to external validity, care should be taken in attempting to generalize findings from the current study. However, it is generally accepted that external validity of findings is best assessed over many replicated studies and since the study in question is the first of its kind (Shadish, Cook, & Campbell, 2002), it would be premature to judge the generalizability of its results.

4.4 Research Hypotheses

The following research hypotheses (tested during the current study) were developed using the above research questions:

- *Hypothesis 1:* The *originality* of the post-test ideas produced by the intervention group will be higher compared to the ideas produced by the comparison group.

- *Hypothesis 2:* The *acceptability* of the post-test ideas produced by the intervention group will be higher compared to ideas produced by the comparison group.
- *Hypothesis 3:* The *implementability* of the post-test ideas produced by the intervention group will be higher compared to the ideas produced by the comparison group.
- *Hypothesis 4:* The *effectiveness* of the post-test ideas produced by the intervention group will be higher compared to the ideas produced by the comparison group.
- *Hypothesis 5:* The *completeness* of the post-test ideas produced by the intervention group will be higher compared to the ideas produced by the comparison group.

The variables of interest in the current study are summarised in Table 4.2 below.

Table 4.2

Variables and Operationalisation

Independent variable	Operationalisation
Training intervention based on the Spatial Playmaker method	Half-day workshop
Dependent variables	**Operationalisation**
Originality	Pre-test and post-test ratings of Originality
Acceptability	Pre-test and post-test ratings of Acceptability
Implementability	Pre-test and post-test ratings of Implementability
Effectiveness	Pre-test and post-test ratings of Effectiveness
Completeness	Pre-test and post-test ratings of Completeness

4.5 Sampling

A sample of 60 small business owners from South Africa's Cape Winelands area within the Western Cape Province were recruited to test the hypotheses generated. All of the selected small business owners are clients of small business development organisations. The current researcher is of the opinion that operating a small business requires continuous problem-solving due to the lack of resources and standard operating procedures in comparison to working within a large company. This is why creative problem-solving is crucial for small business and consequently makes small business owners a sound choice of sample.

4.6 Biographical Data Analysis

The gender data for the total sample reflected that 58% of participants were female, while 42% were male. The data for the comparison group reflected that 53% of participants were female, while 47% were male. The data for the intervention group reflected that 63% of participants were female, while 37% were male.

The race data for the total sample reflected that 53% of participants were coloured, 40% were black, and another 7% were white. The data for the comparison group reflected that 57% were coloured, 40% were black, and 3% were white. The data for the intervention group reflected that 50% were coloured, 40% were black, and 10% were white.

The age data for the total sample indicated the following: 35% of the participants were between the ages of 21 and 30, 20% of the participants were between the ages of 31-40, 30% of the participants were between the ages of 41 and 50, 13% of the participants were between the ages of 51 and 60, and 2% of the participants were between the ages of 61 and 70. The age data for the comparison group indicated the following: 33.33% of the participants were between the ages of 21 and 30, 20% of the participants were between the ages of 31-40, 33.33% of the participants were between the ages of 41 and 50, 10% of the participants were between the ages of 51 and 60, and 3.33% of the participants were between the ages of 61 and 70. The age data for the intervention group indicated the following: 36.66% of the participants were between the ages of 21 and 30, 20% of the participants were between the ages of 31-40, 26.66% of the participants were between the ages of 41 and 50, and 16.66% of the participants were between the ages of 51 and 60.

Home language data for the total sample reflected that 55% indicated Afrikaans to be their home language, 40% indicated that isiXhosa was their home language, and 5% indicated that English was their home language. Home language data for the comparison group reflected that 60% indicated Afrikaans to be their home language, while 40% indicated that isiXhosa was their home language. Home language data for the intervention group reflected that 50% indicated Afrikaans to be their home language, 40% indicated that isiXhosa was their home language, and 10% indicated that English was their home language.

Education level data for the total sample indicated the following: 33% of participants attained a level of education lower than grade 12 (matric), 43% of participants had obtained a matriculation only, and 12% of participants had obtained a certificate from a college or university of technology, and 7% of

participants had obtained a diploma from a college or university of technology. 3% of participants had obtained a bachelor's degree, while 2% of participants had obtained an honours degree.

Education level data for the comparison group indicated the following: 30% of participants attained a level of education lower than grade 12 (matric), 47% of participants had obtained a matriculation only, 13% of participants had obtained a certificate from a college or university of technology, and 10% of participants had obtained a diploma from a college or university of technology.

Education level data for the intervention group indicated the following: 37% of participants attained a level of education lower than grade 12 (matric), 40% of participants had obtained a matriculation only, 10% of participants had obtained a certificate from a college or university of technology, and 3% of participants had obtained a diploma from a college or university of technology. 7% of participants had obtained a bachelor's degree, while 3% of participants had obtained an honours degree.

The data for type of business for the total sample reflected that 13% of participants indicated that catering was their primary business activity, 8% of participants reported retail sales as their business type, 5% indicated their business type as construction, and a further 5% indicated that they were involved in child day-care. The remaining 69% of participants were fairly evenly distributed among a variety of small business types.

The data for type of business for the comparison group reflected that 20% of participants indicated that catering was their primary business activity, 10% of participants reported retail sales as their business type, and a further 7% indicated their business type to be construction. The remaining 63% of participants were fairly evenly distributed among a variety of small business types.

The data for type of business for the intervention group reflected that 7% of participants indicated that catering was their primary business activity, another 7% of participants reported retail sales as their business type, and a further 7% indicated that they were involved in day-care. The remaining 79% of participants were fairly evenly distributed among a variety of small business types.

The data reported above show that the participants are largely coloured or black, Afrikaans or isiXhosa-speaking, possessing a matric-level education. In terms of most biographical variables, however, the sample is fairly diverse. In other words, no other categories were observably more frequently endorsed than others. This is important when attempts are made to generalise the results of this study.

4.7 Experimental Procedure

Participants were randomly assigned to the two conditions, namely the intervention group and the comparison group. All participants (i.e. both the intervention and comparison groups) were given a short demographic questionnaire to complete, asking respondents to supply personal information such as race, age, gender, highest qualification and industry (business type).

Next, all participants were asked to complete a pre-test (an open-ended business problem to solve creatively) before the start of the intervention. Both the intervention and comparison groups were given the same problem to solve. For the purposes of the pre-test, each participant was given two blank workbooks where only details, such as the participant number were completed before the problem is introduced. One workbook was marked *Rough Work* and, as the name suggests, participants were required to use this book for any initial rough sketches, diagrams, doodles, calculations or any process they might do before documenting their final solution. The other workbook was marked *Final Solution*, in which participants wrote down their final solution in as detailed a manner as possible. Both groups had one hour in which to solve the problem and document their idea in the *Final Solution* workbook.

The intervention group then underwent the training intervention, which involved a half-day training workshop named 'How to use the Spatial Playmaker method of creative problem-solving' as detailed in **Appendix B**. In addition, all intervention group participants were asked to complete a voluntary post-intervention questionnaire. The post-intervention questionnaire consisted of a number of closed-ended questions using a 5-point ordinal scale (ranging from Strongly Agree to Strongly Disagree) and open-ended questions. Given that the study's aim was to evaluate the effectiveness of the Spatial Playmaker method, the current researcher decided to focus the open-ended items on suggestions to improve possible future versions of each tool contained within the Spatial Playmaker method.

After the training intervention, all participants (i.e. both the intervention and comparison groups) were asked to do a post-test (i.e. another open-ended problem to solve creatively). For the purposes of the post-test, each participant was given identical materials to those supplied for the pre-test: two blank workbooks. One workbook was again marked *Rough Work* and used for any initial rough sketches, diagrams, doodles, calculations or any process they might do before documenting their final solution. The other workbook was marked *Final Solution* and used to document their final solution. Once again, both groups had one hour in which to complete the post-test. The pre-test problem is contained in **Appendix C** and the post-test problem is contained in **Appendix D**. The pre-test problem involves

attracting visitors to a bed and breakfast establishment, while the post-test problem involves the challenge posed by 3D-printing for a handcrafted curio shop.

To repeat, for all intents and purposes both the intervention and comparison groups underwent the same procedure except that the comparison participants did not undergo the training intervention and did not complete the post-intervention questionnaire.

4.8 Measuring Instruments

The current study utilised five rating scales as developed by Dean et al. (2006). According these authors, the scales produced good reliability between judges on each of the five facets of idea evaluation when using Cronbach's Alpha. The two sample problems used were related to developing ideas for increasing sales for a restaurant and increasing tourism within a specific state. The inter-judge reliabilities of the rating scales measuring each of these five facets are outlined in Table 4.3 below.

Table 4.3

Inter-judge Reliability on Rating Scales

Construct	Restaurant ideas	Tourism ideas
Originality	.766	.713
Acceptability	.663	.684
Implementability	.713	.714
Effectiveness	.729	.667
Completeness	.693	.708

Note. Reprinted from "Identifying quality, novel and creative Ideas: Constructs and scales for idea evaluation," by D.L. Dean, J.M. Hender, T.L. Rodgers, and E.L. Santanen, 2006, *Journal of the Association for Information Systems, 7,* p. 668. Copyright 2006 by Association for Information Systems.

4.9 Ethical Considerations

Prior to the start of the study, signed declarations of informed consent were gained from all participants. Participants were informed of the nature and purpose of the study, as well as about their expected roles and activities. Special emphasis was given to fact that it is the method that was under evaluation, not the participants. These disclosures were facilitated by the fact that there was no deception used during the experiment. Participation was fully voluntary, and this fact was communicated to prospective

participants. They could also withdraw without any form of penalty. The current researcher is of the opinion that intervention group participants benefited significantly, because the current study aimed to improve their creative problem-solving ability. This benefit was extended to the comparison group by training them after the conclusion of the research study. As the training is provided free of charge, the cost to participants has been kept to a minimum. Risk of potential harm to participants has been minimised in several ways. First, the selection of a sample of small business owners precludes participants' possible fears that their study performance might influence their job security or prospects for promotion as the case might be with organisational studies using employees as participants. Secondly, great care was taken in developing the Spatial Playmaker method, as well as crafting its training intervention to avoid harm to participants' self-esteem and emotional well-being. In addition, they were not subjected to any embarrassment or any other discomfort of a psychological nature. Lastly, to further protect participants, confidentiality was maintained before, during, and after the completion of the study. In order to ensure that there is no way to trace the generated data to specific participants, each participant randomly drew their own unique learner number that they had to keep and remember for both the pre-test and post-test. This anonymity will not only apply to the participants, but to the organisation providing the sample in order to further strengthen confidentiality and anonymity measures. As mentioned in the experimental procedure section, the researcher undertook a subjective review of the experiences of intervention participants using questionnaires. This contributed to making those participating feel like valued study participants instead of research subjects or numbers.

4.10 Rating Procedure

In the current study the solutions generated by the participants were evaluated by utilising three judges. All three judges possess subject matter expertise in operating small businesses and were mentors working for small business mentorship programmes.

As a result of the budgetary constraints of the research study, monetary compensation for the idea judges was not possible. However, the current investigator arranged for incentives of a consumer product variety for judges. Still, some judges chose to forego the product incentive and donate their time to the research effort.

The training of these judges involved learning the definitions of the dependent variables. Next, judges needed to familiarize themselves with the rating scales for each dependent variable. Particular attention

was paid to level descriptions used for the rating scales, as well as the completed examples provided by Dean et al. (2006) to clarify each level.

The same judges rated all dimensions for all solutions and these ratings were distributed over a series of rating sessions to minimize fatigue. Each judge received the 60 solutions in a different order to avoid systematic effects of reading order as recommended by Baer (2003). Judges were instructed not to discuss their ratings with other judges during the evaluation period. All solutions were evaluated on one variable before rating began on a subsequent variable. This was done to help judges focus on one sub-dimension at a time and thereby avoid potential across-dimension rating problems (Dean et al., 2006).

Each judge independently scored the solutions using the descriptive anchors for each construct. For the variables of originality, acceptability, implementability, and effectiveness, scores ranged from 1 being the lowest level to 4 representing the highest level of achievement on a particular variable/dimension. For the variable labeled completeness, scores ranged from 1 being the lowest level to 3 representing the highest level of achievement.

To aid judges, they divided all solutions into three piles (low = 1, medium = 2, and high =3) or four piles (low = 1, low-medium = 2, medium-high = 3, and high = 4), depending on the number of scoring levels for each variable. They were permitted to move solutions around if they change their initial opinion of a solution. Only once a judge was satisfied that all solutions are in their correct pile, did they assign a final rating for a solution on that particular variable.

Then judges put the particular score sheet containing the ratings for the 60 solutions for the variable in question aside (and out of their immediate sight). After a sufficient break, each judge shuffled the order of the 60 solutions and used another score sheet set for a different variable. Judges were instructed not to consult ratings given for previous dependent variables while they are rating ideas on another particular dependent variable. The processes were repeated for all the pretest and posttest measurements of the five dependent variables.

4.11 Statistical Analysis

To test the hypotheses stated in the subsequent section, the statistical analysis procedures utilized were two-way mixed model ANOVAs with group and time as fixed effects, and the subjects nested in group as random effect. This enabled the assessment of the impact of two conditions (intervention versus

comparison) on the ratings of each dependant variable, across two time points (pretest and post-test). This was done using STATISTICA 64.

4.12 Statistical Hypotheses

The following is the main statistical hypothesis tested via the two-way mixed model ANOVA during the current study:

H_{O1}: The change in scores from pre- to post-test is equal for both groups.
H_{A1}: The change in scores from pre- to post-test is not equal for both groups.

If the main null hypothesis is rejected, then the following statistical hypotheses will be tested via post-hoc analyses:

H_{O2}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Originality** post-test scores.
H_{A2}: The intervention group (who used the Spatial Playmaker method) will significantly outperform the comparison group in terms of the **Originality** post-test scores.

H_{O3}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Acceptability** post-test scores.
H_{A3}: The intervention group (who used the Spatial Playmaker method) will significantly outperform the comparison group in terms of the **Acceptability** post-test scores.

H_{O4}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Implementability** post-test scores.
H_{A4}: The intervention group (who used the Spatial Playmaker method) will significantly outperform the comparison group in terms of the **Implementability** post-test scores.

H_{O5}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Effectiveness** post-test scores.
H_{A5}: The intervention group (who used the Spatial Playmaker method) will significantly outperform the comparison group in terms of the **Effectiveness** post-test scores.

H_{O6}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Completeness** post-test scores.

H_{A6}: The intervention group (who used the Spatial Playmaker method) will significantly outperform the comparison group in terms of the **Completeness** post-test scores.

4.13 Summary

This chapter discussed the methodology the current study employed to measure the effectiveness of the Spatial Playmaker method of creative problem solving. First, the dependent (outcome) variables were defined. A pretest-posttest control group design was considered the most appropriate research design and its implications regarding internal and external validity were discussed. Thereafter, the research questions and substantive research hypotheses to be tested were stated. In addition, the independent and dependent variables were operationalised. The details of the sample, experimental procedure, measuring instruments, ethical considerations, and rating procedure were discussed. Finally, the statistical analyses of the data and statistical research hypotheses were then outlined. Chapter 5 will discuss the results of the current study in terms of the statistical hypotheses and implications thereof.

CHAPTER 5:

RESULTS AND DISCUSSION

5.1 Introduction

The aim of this study was to evaluate the effectiveness of a training intervention detailing how to use the Spatial Playmaker method of creative problem-solving. This aim was accomplished by determining whether there are significant differences on the five dependent variables between the intervention and comparison groups after the former group had participated in a training intervention.

Chapter 5 begins by discussing the study's qualitative and quantitative results. Thereafter, the statistical hypotheses are evaluated. Next, an interpretation of the main results is offered. Subsequently, the research study's limitations are presented. Finally, a discussion of these results and recommendations for future research are explicated.

5.2 Discussion of the Results

In this section, the results of the statistical analyses shall be presented. Thereafter, an evaluation regarding the study's hypotheses will made based on the aforementioned results. Finally, this section concludes with an interpretation of the results.

5.2.1 The Quantitative Results

To assess statistical significance of the results, the current researcher used an alpha level of .05 as the significance criterion for all statistical tests.

The results of the two-way mixed model ANOVAs for each dependent variable yielded information about a group effect, time effect, and a group/time interaction effect. The group effect compares the combined pre- and post-test means of the intervention and control groups. The time effect compares the combined intervention and control group means of the pre- and post-tests. The group/time interaction effect indicates whether the difference between the pre-test and post-test means are the same for both

intervention and comparison groups. It should be noted that only the group/time interaction effect is of importance in order to assess the current study's main null hypothesis (i.e. the change in scores from pre- to post-test is equal for both groups). The results for all five two-way mixed model ANOVAs will be presented in the following sections.

5.2.1.1 Originality

The results derived from the two-way mixed model ANOVA for originality are presented in Table 5.1.

Table 5.1

Anova Results: Originality

Effect	F	p
Group	54.35	.00**
Time	0.21	.65
Group/Time	9.63	.00**

Note. *p < .05, **p < .01

The results of the two-way mixed model ANOVA showed that there was a highly significant group/time interaction effect on ratings of Originality, $F(1, 58) = 9.63$, $p < .01$. This means that the originality scores of one of the groups differed significantly from pre- to post-test, compared to the other group.

Post hoc comparisons using the LSD test (refer to Table 5.2) indicated that the mean originality scores of the intervention group increased from the pre-test to the post-test, although it failed to reach significance ($p > .05$). In contrast, the mean originality scores of the comparison group significantly decreased from the pre-test to the post-test ($p < .05$)

Table 5.2

LSD Results: Originality

1st Mean	2nd Mean	Mean Difference	Standard Error	p
Control/Pre	Control/Post	0.39	0.15	.01*
Control/Pre	Intervention/Pre	-0.54	0.16	.00**
Control/Pre	Intervention/Post	-0.83	0.16	.00**
Control/Post	Intervention/Pre	-0.93	0.16	.00**
Control/Post	Intervention/Post	-1.22	0.16	.00**
Intervention/Pre	Intervention/Post	-0.29	0.15	.07

Note. *p < .05, **p < .01

Figure 5.1 indicates changes in the means from the pre- to the post-test of the intervention and comparison groups respectively. As can be seen in the line graph, the change in the intervention group means (depicted by the red line) and comparison group means (depicted by the blue line) are non-parallel, which denotes the group/time interaction. However, for the intervention group letters do overlap between the pre- and post-test, indicating means do differ significantly on a 5% significance level *(p* < .05). The opposite effect is observed for the comparison group.

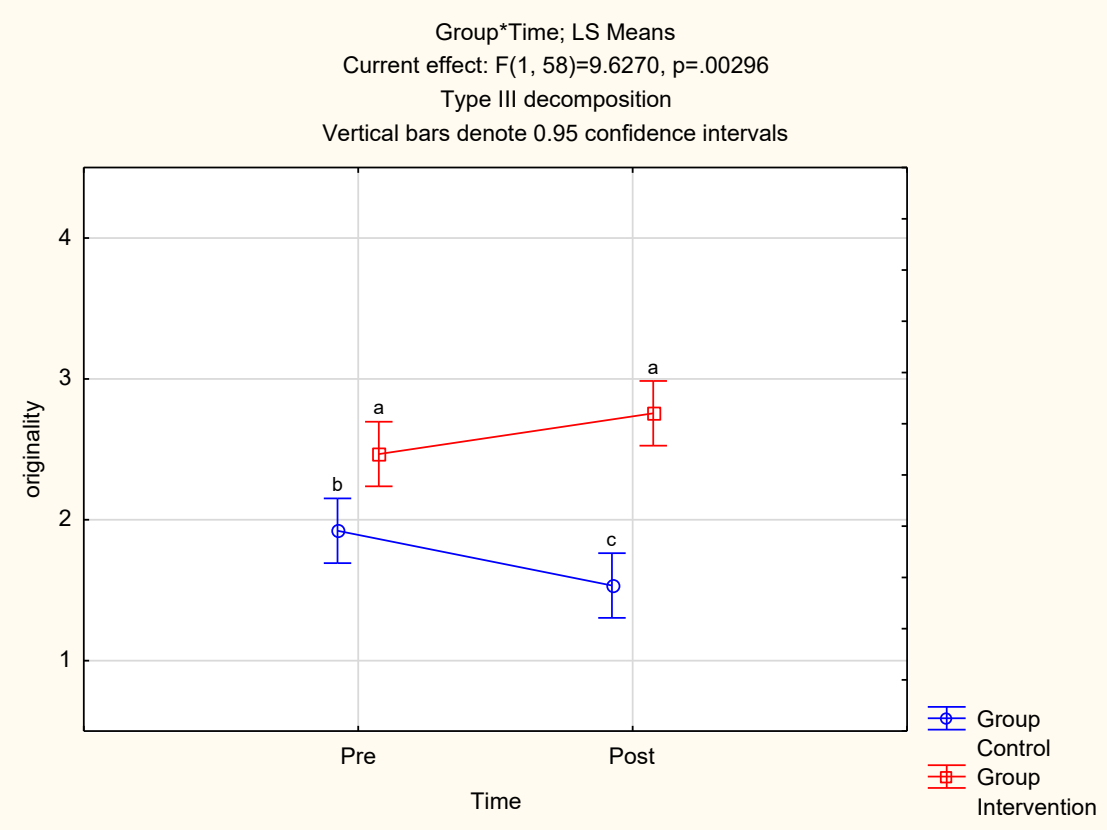

Figure 5.1. Changes in originality means of both groups from pre- to post-test.

Originality was rated on a four-point scale. Table 5.3 shows the mean Originality ratings achieved by participants according to group and time. Descriptive statistics showed that intervention group participants performed better in terms of originality on the post-test (*M* = 2.76, *SD* = 0.67) than comparison group participants (*M* = 1.53, *SD* = 0.46).

Table 5.3

Descriptive Statistics: Originality

Effect	Level of factor	Level of factor	N	Originality Mean	Originality Std. dev
Group/time	Comparison	Pre	30	1.92	0.64
Group/time	Comparison	Post	30	1.53	0.46
Group/time	Intervention	Pre	30	2.47	0.71
Group/time	Intervention	Post	30	2.76	0.67

Taken together, these results suggest that undergoing training on the use of the Spatial Playmaker method has an effect on the originality of solutions generated. Specifically, these findings suggest that when individuals use the Spatial Playmaker method, they generate more original solutions.

5.2.1.2 Acceptability

The results derived from the two-way mixed model ANOVA for acceptability are presented in Table 5.4.

Table 5.4

Anova Results: Acceptability

Effect	F	p
Group	1.59	.21
Time	411.77	.00**
Group/time	8.74	.00**

Note. *p < .05, **p < .01

The results of the two-way mixed model ANOVA showed that there was a highly significant group/time interaction effect on ratings of Acceptability, $F(1, 58) = 8.74$, $p < .01$. This means that the acceptability scores of one of the groups differed significantly from the pre- to post-test, compared to the other group.

Post hoc comparisons using the LSD test (refer to Table 5.5) indicated that, contrary to expectations, the mean acceptability scores of the intervention group significantly decreased from the pre-test to the post-test ($p < .01$). In a similar vein, the mean acceptability scores of the comparison group also significantly decreased from the pre-test to the post-test ($p < .01$). Despite the negative direction of the change in acceptability means for both groups, the intervention group still significantly outperformed the comparison group on the post-test ($p < .01$).

Table 5.5

LSD Results: Acceptability

1st Mean	2nd Mean	Mean Difference	Standard Error	p
Control/Pre	Control/Post	1.90	0.12	.00**
Control/Pre	Intervention/Pre	0.13	0.12	.27
Control/Pre	Intervention/Post	1.55	0.12	.00**
Control/Post	Intervention/Pre	-1.77	0.12	.00**
Control/Post	Intervention/Post	-0.35	0.12	.00**
Intervention/Pre	Intervention/Post	1.42	0.12	.00**

Note. *p < .05, **p < .01

Figure 5.2 indicates changes in the means from the pre- to the post-test of the intervention and comparison groups respectively. As can be seen in the line graph, the change in the intervention group means (depicted by the red line) and comparison group means (depicted by the blue line) are non-parallel, which denotes the group/time interaction. As can be seen in Figure 5.2, letters overlap between both groups at the pre-test, indicating means do not differ significantly ($p > .05$). At the post-test, letters do not overlap between both groups, indicating means do differ significantly on a 5% significance level ($p < .05$).

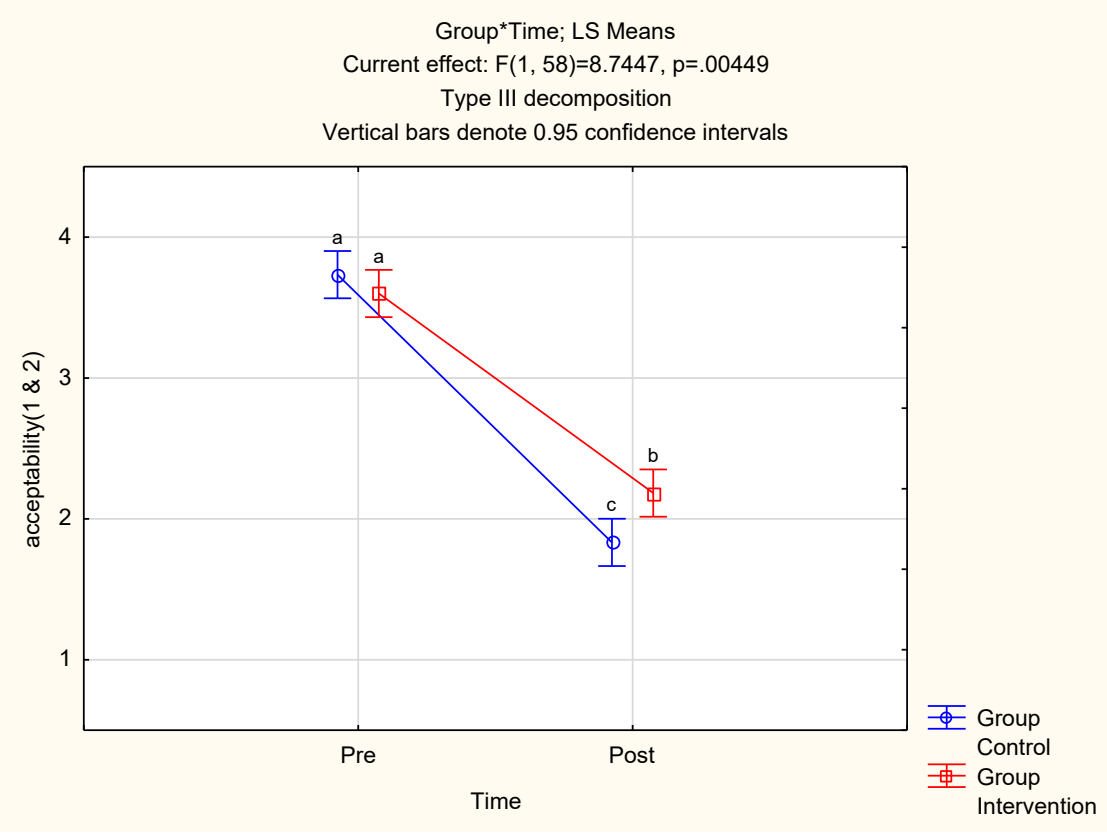

Figure 5.2. Changes in acceptability means of both groups from pre- to post-test.

Acceptability was rated on a four-point scale. Table 5.6 shows the mean Acceptability ratings achieved by participants according to group and time. Contrary to expectation, the descriptive statistics showed that comparison group participants performed better in terms of acceptability on the post-test (*M* = 3.72, *SD* = 0.34) than intervention group participants (*M* = 2.73, *SD* = 0.38).

Table 5.6

Descriptive Statistics: Acceptability

Effect	Level of factor	Level of factor	N	Acceptability Mean	Acceptability Std. dev
Group/time	Comparison	Pre	30	3.73	0.34
Group/time	Comparison	Post	30	1.83	0.56
Group/time	Intervention	Pre	30	3.60	0.44
Group/time	Intervention	Post	30	2.18	0.46

Taken together, these results suggest that undergoing training on the use of the Spatial Playmaker method has an effect on the acceptability of solutions generated. Even though both intervention and comparison means decreased from the pre-test to post-test, these findings still suggest that when individuals use the Spatial Playmaker method, they generate solutions that are more socially, legally, and politically acceptable. Possible reasons for the unexpected pattern of changes in acceptability means will be explored in the section named interpretation of results.

5.2.1.3 Implementability

The results derived from the two-way mixed model ANOVA for implementability are presented in Table 5.7.

Table 5.7

ANOVA Results: Implementability

Effect	F	p
Group	0.43	.51
Time	2.41	.13
Group/time	2.05	.16

Note. *p < .05, **p < .01

The results of the two-way mixed model ANOVA showed that there was a group/time interaction effect on ratings of Implementability, $F(1, 58) = 2.05$, $p > .05$. This means that the implementability scores of one of the groups differed from pre- to post-test compared to the other group, but it was not significant.

Post hoc comparisons using the LSD test (refer to Table 5.8) indicated that the mean implementability scores of the intervention group significantly decreased from the pre-test to the post-test ($p < .05$). In contrast, the mean implementability scores of the comparison group did not differ to any degree from the pre-test to the post-test and failed to reach significance ($p > .05$)

Table 5.8

LSD Results: Implementability

1st Mean	2nd Mean	Mean Difference	Standard Error	p
Control/Pre	Control/Post	0.01	0.13	.93
Control/Pre	Intervention/Pre	-0.07	0.14	.63
Control/Pre	Intervention/Post	0.21	0.14	.13
Control/Post	Intervention/Pre	-0.08	0.14	.57
Control/Post	Intervention/Post	0.20	0.14	.15
Intervention/Pre	Intervention/Post	0.28	0.13	.04*

Note. *p < .05, **p < .01

Figure 5.3 indicates changes in the means from the pre- to the post-test of the intervention and comparison groups respectively. As can be seen in the line graph, the change in the intervention group means (depicted by the red line) and comparison group means (depicted by the blue line) are non-parallel, which denotes the group/time interaction. As can be seen in Figure 5.3, letters overlap between groups at the pre-test as well as the post-test, indicating means do not differ significantly ($p > .05$). However, for the intervention group letters do overlap between the pre- and post-test, indicating means do differ significantly on a 5% significance level ($p < .05$).

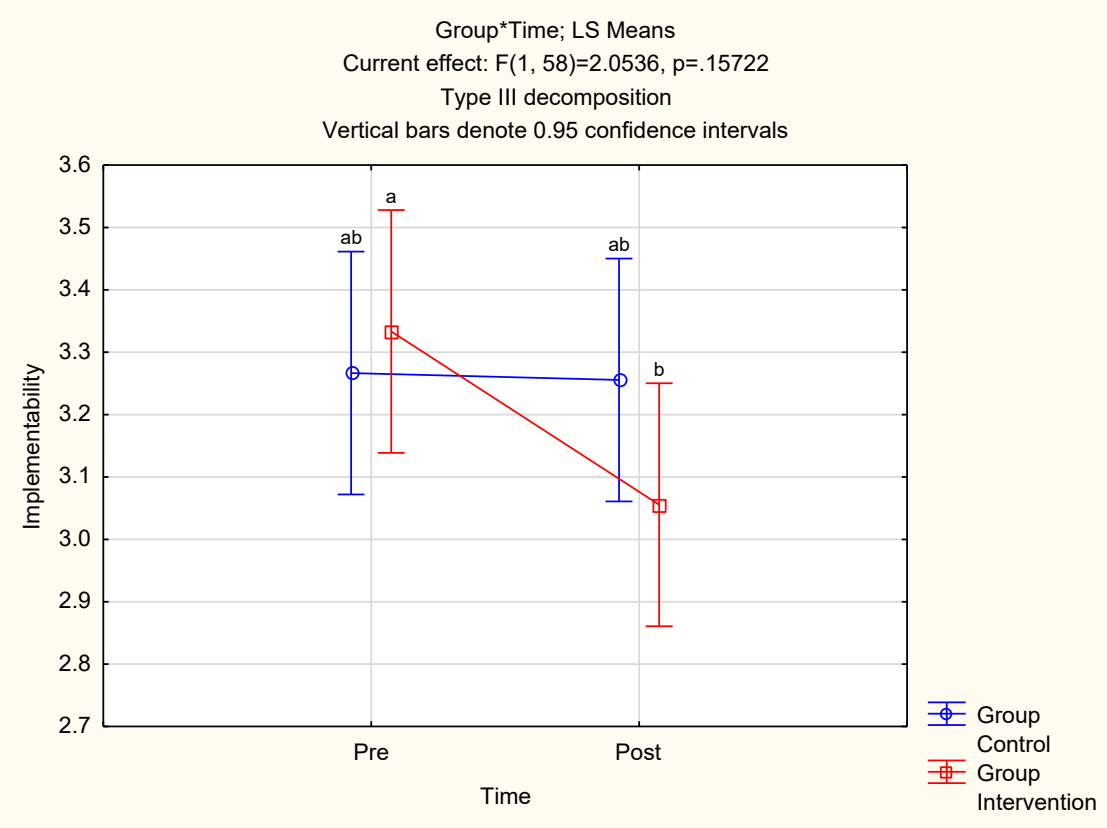

Figure 5.3. Changes in implementability means of both groups from pre- to post-test.

Implementability was rated on a four-point scale. Table 5.9 shows the mean Implementability ratings achieved by participants according to group and time. Descriptive statistics showed that the intervention group (*M* = 3.27, *SD* = 0.52) and comparison group participants (*M* = 3.33, *SD* = 0.46) performed fairly evenly in terms of implementability on the pre-test. Descriptive statistics showed that comparison group participants performed better in terms of implementability on the post-test (*M* = 3.26, *SD* = 0.58) than intervention group participants (*M* = 3.06, *SD* = 0.56).

Table 5.9

Descriptive Statistics: Implementability

Effect	Level of factor	Level of factor	N	Implement. Mean	Implement. Std. dev
Group/time	Comparison	Pre	30	3.27	0.52
Group/time	Comparison	Post	30	3.26	0.58
Group/time	Intervention	Pre	30	3.33	0.46
Group/time	Intervention	Post	30	3.06	0.56

Although these results suggest that undergoing training on the use of the Spatial Playmaker method has an effect on the implementability of solutions generated, the direction of the effect is the reverse of the current researcher's expectation. Specifically, these findings suggest that when individuals use of the Spatial Playmaker method, they generate solutions that are more difficult to implement.

5.2.1.4 Effectiveness

Results derived from the two-way mixed model ANOVA for effectiveness are presented in Table 5.10.

Table 5.10

ANOVA Results: Effectiveness

Effect	F	p
Group	35.88	.00**
Time	2.01	.16
Group/time	11.22	.00**

Note. *p < .05, **p < .01

The results of the two-way mixed model ANOVA showed that there was a highly significant group/time interaction on ratings of Effectiveness, $F(1, 58) = 11.22$, $p < .01$. This means that the effectiveness scores of one of the groups differed significantly from pre- to post-test, compared to the other group.

Post hoc comparisons using the LSD test (refer to Table 5.11) indicated that the mean effectiveness scores of the intervention group increased from the pre-test to the post-test, although it failed to reach significance ($p > .05$). In contrast, the mean effectiveness scores of the comparison group significantly decreased from the pre-test to the post-test ($p < .01$).

Table 5.11

LSD Results: Effectiveness

1st Mean	2nd Mean	Mean Difference	Standard Error	p
Control/Pre	Control/Post	0.41	0.12	.00**
Control/Pre	Intervention/Pre	-0.30	0.13	.03*
Control/Pre	Intervention/Post	-0.47	0.13	.00**
Control/Post	Intervention/Pre	-0.71	0.13	.00**
Control/Post	Intervention/Post	-0.88	0.13	.00**
Intervention/Pre	Intervention/Post	-0.17	0.12	.18

Note. *p < .05, **p < .01

Figure 5.4 indicates changes in the means from the pre- to the post-test of the intervention and comparison groups respectively. As can be seen in the line graph, the change in the intervention group means (depicted by the red line) and comparison group means (depicted by the blue line) are non-parallel, which denotes the group/time interaction. As can be seen in Figure 5.4, letters do not overlap between groups at either the pre-test or the post-test, indicating means differ significantly ($p < .05$). Interestingly, letters repeat for the intervention group (at the pre-test and post-test), indicating means do not differ significantly on a 5% significance level ($p > .05$). The opposite effect between measurement opportunities is observed for the comparison group.

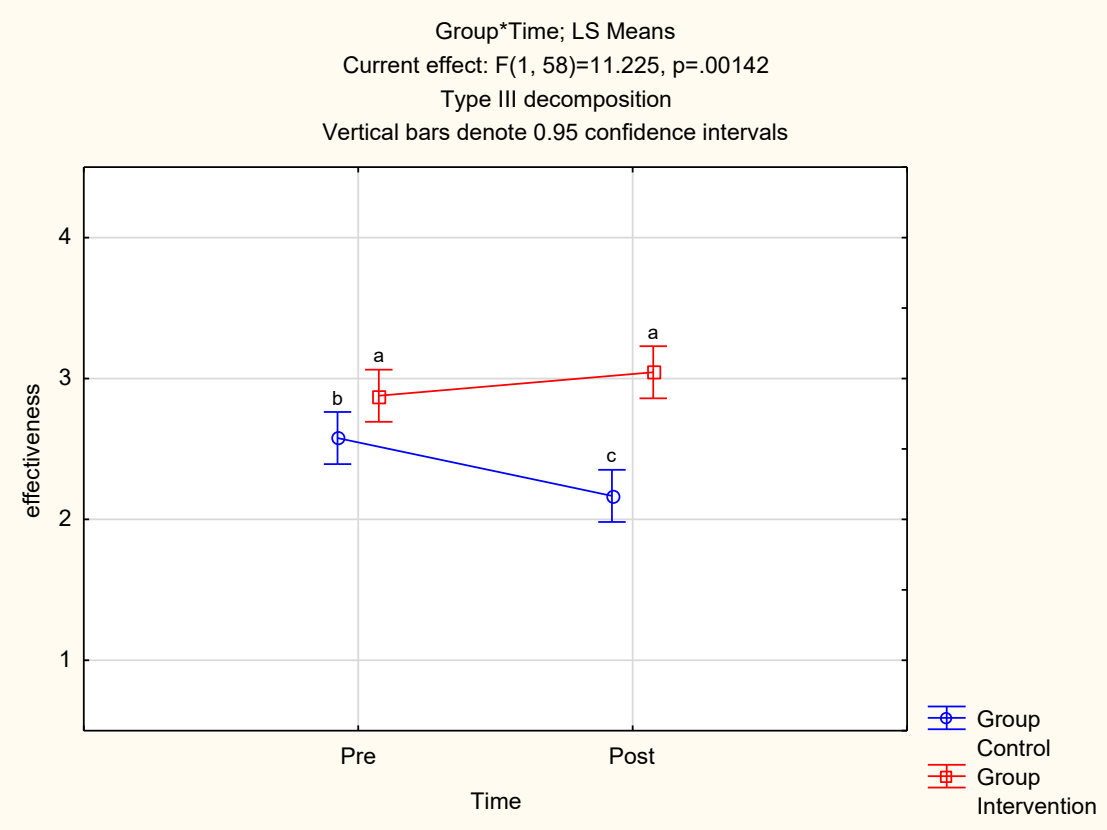

Figure 5.4. Changes in effectiveness means of both groups from pre- to post-test.

Effectiveness was rated on a four-point scale. Table 5.12 shows the mean Effectiveness ratings achieved by participants according to group and time. Descriptive statistics showed that the intervention group participants performed better in terms of effectiveness on the post-test ($M = 3.04$, $SD = 0.58$) than comparison group participants ($M = 2.17$, $SD = 0.52$).

Table 5.12

Descriptive Statistics: Effectiveness

Effect	Level of factor	Level of factor	N	Effectiveness Mean	Effectiveness Std. dev
Group/time	Comparison	Pre	30	2.58	0.39
Group/time	Comparison	Post	30	2.17	0.52
Group/time	Intervention	Pre	30	2.88	0.51
Group/time	Intervention	Post	30	3.04	0.58

Taken together, these results suggest that undergoing training on use of the Spatial Playmaker method has an effect on the effectiveness of solutions generated. Specifically, these findings suggest that when individuals use the Spatial Playmaker method, they generate more effective solutions. In other words, these solutions are more likely to solve the problem.

5.2.1.5 Completeness

The results derived from the two-way mixed model ANOVA for completeness are presented in Table 5.13.

Table 5.13

ANOVA Results: Completeness

Effect	F	p
Group	45.23	.00**
Time	9.85	.00**
Group/time	20.40	.00**

Note. *p < .05, **p < .01

The results of the two-way mixed model ANOVA showed that there was a highly significant group/time interaction on ratings of Completeness, $F(1, 58) = 20.40$, $p < .01$. This means that the completeness scores of one of the groups differed significantly from pre- to post-test, compared to the other group.

Post hoc comparisons using the LSD test (refer to Table 5.14) indicated that the mean completeness scores of the intervention group increased from the pre-test to the post-test, although it failed to reach significance ($p > .05$). In contrast, the mean completeness scores of the comparison group significantly decreased from the pre-test to the post-test ($p < .01$).

Table 5.14

LSD Results: Completeness

1st Mean	2nd Mean	Mean Difference	Standard Error	p
Control/Pre	Control/Post	0.56	0.10	.00**
Control/Pre	Intervention/Pre	-019	0.11	.08
Control/Pre	Intervention/Post	-0.29	0.11	.01*
Control/Post	Intervention/Pre	-0.74	0.11	.00**
Control/Post	Intervention/Post	-0.84	0.11	.00**
Intervention/Pre	Intervention/Post	-0.10	0.10	.33

Note. *p < .05, **p < .01

Figure 5.5 indicates changes in the means from the pre- to the post-test of the intervention and comparison groups respectively. As with previous dependent variables, lines are non-parallel, which denotes the group/time interaction. As can be seen in Figure 5.5, letters overlap between groups at the pre-test, indicating means do not differ significantly ($p > .05$). At the post-test, letters do not overlap between groups, indicating means do differ significantly on a 5% significance level ($p < .05$). Once more, letters repeat for the intervention group (at the pre-test and post-test), indicating means do not differ significantly on a 5% significance level ($p > .05$). The opposite effect is observed for the comparison group.

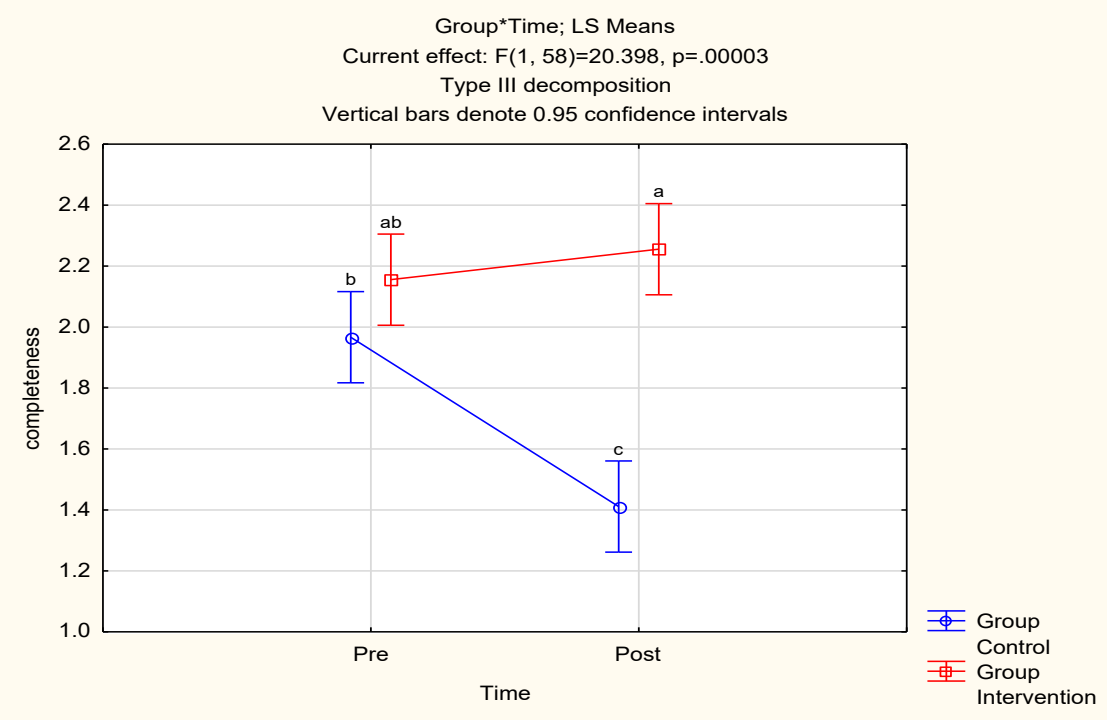

Figure 5.5. Changes in completeness means of both groups from pre- to post-test.

Completeness was rated on a three-point scale. Table 5.15 shows the mean Completeness ratings achieved by participants according to group and time. Descriptive statistics showed that intervention group participants performed better in terms of completeness on the post-test (M = 2.26, SD = 0.48) than comparison group participants (M = 1.41, SD = 0.35).

Table 5.15

Descriptive Statistics: Completeness

Effect	Level of factor	Level of factor	N	Completeness Mean	Completeness Std. dev
Group/time	Comparison	Pre	30	1.97	0.39
Group/time	Comparison	Post	30	1.41	0.35
Group/time	Intervention	Pre	30	2.16	0.42
Group/time	Intervention	Post	30	2.26	0.48

Taken together, these results suggest that undergoing training on use of the Spatial Playmaker method has an effect on the completeness of solutions generated. Specifically, these findings suggest that when individuals use the Spatial Playmaker method, they generate more complete or detailed solutions.

5.2.2 The Qualitative Results

The qualitative data in the current study was generated by the intervention group participants who completed the open-ended items of an anonymous post-intervention questionnaire. Due to the nature of the study, specifically that it is evaluation research and a pilot study, it was decided to focus the open-ended items on each tool contained within the Spatial Playmaker method. Specifically, the aim of these open-ended items was to elicit from intervention group participants suggestions for the future improvement of each tool.

Below is a sample open-ended item from the post-intervention questionnaire. Since there are nine tools contained within the Spatial Playmaker, nine open-ended questions (identical except for the name of the tool) were asked. Sample item: *Please write down any comments you think could be helpful in improving future versions of the 'Imaginary journalism' tool.*

The questionnaire also contained closed-ended questions using a 5-point ordinal scale (ranging from Strongly Agree to Strongly Disagree). A portion of the intervention participants opted to only complete the closed-ended questions and forego completing the open-ended items. From the 22 questionnaires returned, only 14 participants completed any open-ended items.

For each open-ended item, the unusable comments were removed. Unusable comments were those comments that were unintelligible, did not answer the item, or answered a question that was not asked.

After a thorough reading of the usable comments, four categories of interest emerged, namely:

- Shorten the tool;
- Add more guidance to the tool;
- Combine with another tool;
- Add visualization;

Table 5.16 provides the definitions of the categories that emerged during the current researcher's reading of the comments.

Table 5.16

Definitions of emergent categories

Categories	Definitions
Shorten the tool	Comments that fit this category are the calls from respondents for a specific tool to be shortened.
Add more guidance	Comments that fit this category are the calls from respondents for more guidance to be added to a tool with regard to instructions.
Combine with another tool	Comments that fit this category are the calls from respondents for a specific tool to be combined with another tool.
Add visualization	Comments that fit this category are the calls from respondents for adding a drawing/sketching element to make the tool more memorable or usable.

Comments for each open-ended item were entered into a separate Excel file. Each file had five columns, namely *Comment, Shorten the tool, Add more guidance, Combine with another tool,* and *Add visualization*. One comment was entered per row.

Once all the comments for an item were entered, the current investigator then coded each comment into one of the three categories by asking: 'Which category fits this comment?' A number 1 was entered into the category column that fit the comment. Of course, there were comments that fit more than one category. However, the definitions of the three categories were so clear that such comments were easily

coded. In such cases, a number 1 was entered into both category columns. Coding was also assisted by the fact that the questionnaire only provided space for a maximum of three lines for comment per open-ended item, precluding longer comments that are more difficult to code. Thereafter, the Autosum function in Excel was used for each category column to give an indication of how many comments reflected each of the categories. These category totals were then converted into percentages.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'Imaginary journalism' tool'* categorized as follows: 33,33% of responses fit the Shorten the tool category, 33,33% of responses fit the Add more guidance category, while a further 33,33% fit the Add visualization category.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'Board of directors' tool'* categorized as follows: 100% of responses fit the Add more guidance category.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'Multiple Redefinition' tool'* categorized as follows: 100% of responses fit the Add more guidance category.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'Break the problem into sub-problems' tool'* categorized as follows: 66,66% of responses fit the Add more guidance category, while a further 33,33% fit the Add visualization category.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'Playbook a solution' tool'* categorized as follows: 83% of responses fit the Shorten the tool category, while 17% of responses fit the Add more guidance category.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'U-WIN' tool'* categorized as follows: 100% of responses fit the 'Combine with another tool' category. Specifically, the comment suggests combining U-WIN and ULTIC tools.

The comments related to the item '*Please write down any comments you think could be helpful in improving future versions of the 'ULTIC' tool'* categorized as follows: 33,33% of responses fit the Shorten

the tool category, 33,33% of responses fit the Add more guidance category, while a further 33,33% fit the ‘Combine with another tool’ category. Again, combining U-WIN and ULTIC tools were suggested.

No useful comments were received for either the ‘Front page test’ or the ‘Motivated sequence’ tools. This may be due to the fact that the ‘Front page test’ can be used 100% in the mind of the problem-solver. Participants may have enjoyed the fact this tool did not require any writing whatsoever. The lack of comments regarding the ‘Motivated sequence’ may be due to the fact that participants view it as a logical way of presenting their ideas.

The qualitative data presented above can be viewed as early user-experience feedback to the Spatial Playmaker method. Comments offered may be helpful in improvement of the efficacy of the method as well as its adoption by later users. As such, comments have provided useful clues to the further development of the Spatial Playmaker method. Suggestions proffered for the improvement of the Spatial Playmaker should be evaluated on a tool-by-tool basis and considered for future versions of the method.

Categories that have resonated with the current researcher include the comments that suggested that the ‘Playbook a solution’ should be shortened and the comments that suggested that U-WIN and ULTIC should be combined. In retrospect, these specific suggestions make sense. Specifically, ‘Playbook a solution’ is by far the largest and potentially most time-consuming tool. Therefore, calls for it to be shortened should not be surprising. Meanwhile, U-WIN serves an input to ULTIC and calls for the two tools to be combined appear logical.

Other comment categories that were sporadically observed across several sections such as ‘Add visualization’ and ‘Add more guidance’ may be more appropriate if a mobile app were based on the Spatial Playmaker. Such a development is beyond the scope of the current study and is a matter for future investigation.

5.2.3 Evaluation of Hypotheses Formulated

The two-way mixed model ANOVA results for the five dependent variables each yielded significant group/time interaction effects. This is strong evidence for rejecting the study’s main null hypothesis. Table 5.17 presents the results according to the study’s main null hypothesis.

Table 5.17

Summarised results according to the main null hypothesis

Null Hypothesis	Evaluation
H_{O1}: The change in scores from pre- to post-test is equal for both groups.	Reject **H_{O1}**

Post hoc comparison results provided adequate evidence to make determinations on whether to accept or reject the secondary null hypotheses. Table 5.18 summarises the results according to the hypotheses stated.

Table 5.18

Summarised results according to the secondary null hypotheses

Null Hypothesis	Evaluation
H_{O2}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Originality** post-test scores.	Reject **H_{O2}**
H_{O3}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Acceptability** post-test scores.	Reject **H_{O3}**
H_{O4}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Implementability** post-test scores.	Accept **H_{O4}**
H_{O5}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Effectiveness** post-test scores.	Reject **H_{O5}**
H_{O6}: The intervention group (who used the Spatial Playmaker method) will not significantly outperform the comparison group in terms of the **Completeness** post-test scores.	Reject **H_{O6}**

5.2.4 Interpretation of Results

The overarching result of this study was that a significant group/time interaction effect was found across all dependent variables. In other words, the change in scores from pre- to post-test was significantly

different for intervention and comparison groups. In practical terms, this finding means that the training intervention (i.e. How to use the Spatial Playmaker method) had an effect on the dependent variables (i.e. originality, acceptability, implementability, effectiveness, and completeness).

The same general pattern can be seen in the line graphs for most of the dependent variables. Specifically, the intervention group means increased from pre- to post-test, yet did not reach significance while the comparison group means decreased from pre- to post-test in a statistically significant manner. In lay terms, with the aid of the Spatial Playmaker, intervention group participants were able to solve the post-test problem, as well as, or slightly better than they did the pre-test problem. In contrast, without the aid of the Spatial Playmaker, comparison group participants performed significantly worse in solving the post-test problem than they did the pre-test problem.

In retrospect, the current researcher is of the opinion that this pattern can be explained by the fact that the post-test problem was more difficult to solve than the pre-test problem. The core of the pre-test problem is a straightforward call for strategies to attract visitors to a bed & breakfast during its low season. The post-test problem is more novel and complex in that it introduces the concept of 3D-printing, a special government subsidy, the threat of a new type of competition, and a moral aspect surrounding loyalty to employees. Although the increase in intervention group means was not significant, the fact that the intervention group outperformed the comparison group on a more challenging problem represents a feather in the cap of the Spatial Playmaker.

It is important to discuss the findings that conformed to research expectations (i.e. those related to originality, acceptability, effectiveness, and completeness) as well as those that defied research expectations (i.e. findings related to implementability). It also valuable to discuss instances where research expectations are met, but the pattern of the results are unusual (i.e. the results regarding acceptability).

The finding that the intervention group significantly outperformed the comparison group in terms of post-test *originality* scores can be interpreted in the following theoretical ways. This means that training small business owners in the use of the Spatial Playmaker method holds significant benefits in terms of the originality of solutions generated. This is not surprising as the theoretical rationales that underpin a portion of the tools within the Spatial Playmaker are directly aimed at enhancing originality (i.e. the broaden-and-build theory of positive emotions and construal-level theory). For example, the tool called Imaginary Journalism helps the problem-solver focus on positive emotions, which according to the broaden-and-build theory of positive emotions expands the array of novel thoughts (Fredrickson &

Branigan, 2005). This tool also exploits construal level theory in that the problem-solver must imagine the problem being solved at a future time, which also increases the originality of ideas (Trope & Liberman, 2010). The tool called Multiple Redefinition capitalises on both representational change theory (discussed in chapter 3) and the geneplore model (discussed in chapter 2). In terms of representational change theory, the tool relaxes constraints of the problem, which helps the problem-solver to look past the initial representation of the problem and may lead to novel insights. In terms of the geneplore model, the various statements contained within the Multiple Redefinition tool may activate generative processes such as mental transformation, analogical transfer, and categorical reduction. The aforementioned generative processes are less prone to fixation effects (i.e. being unable to view an idea outside of its initial context or use), which inhibit originality.

The finding that the intervention group significantly outperformed the comparison group in terms of post-test *effectiveness* scores can be interpreted in the following theoretical ways. Within the Spatial Playmaker, the 'Break the problem into sub-problems' tool is aimed at analysing the problem. This tool capitalises on chunk decomposition, a mechanism outlined in *representational change theory* described in chapter 3, to reveal previously unseen aspects of the parts of the problem as opposed to the whole problem. This decomposition of the problem into smaller parts facilitates analysis. Research has indicated that more effective analysis is related to solutions that are not only more original, but more elegant, and of higher quality (Hester et al., 2012; Marcy & Mumford, 2007). In addition, this tool also opens up new possibilities, which is a key requirement in overcoming fixation effects (i.e. the blind adherence to a limited number of ideas). Furthermore, the current researcher is of the opinion that other tools such as U-WIN and ULTIC helped the intervention group improve their initial ideas.

The finding that the intervention group significantly outperformed the comparison group in terms of post-test *completeness* scores can be interpreted in the following theoretical ways. The final tool within the Spatial Playmaker is called the motivated sequence. If followed, the motivated sequence emphasises being as detailed in your communication as possible. This emphasis on detail is aimed at enhancing perceptions of expertise and trustworthiness. This would have the impact of increasing completeness in terms of who, what, where, when, why, and how. Furthermore, in line with both the Geneplore and Cognitive Network Models discussed in chapter 2, the Spatial Playmaker emphasises externalising (i.e. writing or sketching) any ideas during the creative process to reduce cognitive load. This could also have had a logical consequence that once intervention group participants were ready to commit their final solutions to paper (i.e. towards the end of the spatial playmaker sequence), they had sufficient rough ideas to organise and expand into a final solution of enough detail.

As was the case with previous three dependent variables, the intervention group significantly outperformed the comparison group in terms of post-test *acceptability* scores. However, unlike the previous three dependent variables, the means of both groups declined from pre-test to post-test. The possible reasons for the difference in pattern of this result will be discussed together with the possible reasons for the finding that the comparison group significantly outperformed the intervention group in terms of post-test *implementability* scores. The current researcher is of the opinion that these possible causes of these two findings overlap.

In line with Sternberg's (2006) Propulsion Theory of Creative Contributions, discussed in chapter 2, the judges in the current study evaluated the ideas against the field (i.e. the context in the problem occurs). The experienced judges have likely encountered similar problems during the course of their business coaching and advisory work (outside of the current study). Therefore, it stands to reason that they are aware of common approaches to addressing such problems. They may even have experience-based preferences regarding which of these common approaches they would recommend to their clients. It may be that the more original ideas submitted by participants in the current study represented types of contributions that reject the current paradigms. For example, Sternberg (2006) outlined types such as Redirection (i.e. taking the field into a new direction), Reconstruction/Redirection (i.e. moving the field back to a previous starting point and moving it into a new direction), and Reinitiation (taking the field to a new starting point and moving forward from there) that may face greater obstacles in acceptance. Even ideas that move the field forward in the current direction but beyond where judges feel comfortable (i.e. Advanced Forward Incrementalism) may not be readily accepted. In addition, logic dictates that the further away from the current paradigm an idea is located, the more cumbersome its implementation may become.

The rating work performed by the judges in this study, especially pertaining to the implementability and acceptability of solutions, is in part an act of creative forecasting (i.e. predicting the success of new ideas). In a study comparing the accuracy of creators and managers in forecasting the success of the ideas of others, Berg (2016) found that creators were more accurate than managers. This may be explained by the fact that creators are focused on both idea generation and idea evaluation, while managers are focused solely on idea evaluation. It has been suggested that those that generate ideas more often create opportunities to practice idea evaluation as a by-product. Engaging in idea generation may make creators' evaluation of ideas - be it their own or those of others - more flexible. The disadvantage in forecasting accuracy that hampered managers in Berg's (2016) study may also have affected the judges in this current study as their work was also limited to idea evaluation.

Furthermore, people tend to feel ambivalence toward creative ideas (Mueller, Melwani, & Goncalo, 2012). On the one hand, people desire creative ideas in part because there is a strong social pressure to support creativity. On the other hand, people are generally driven to reduce uncertainty and creative ideas are accompanied by uncertainty (e.g. whether the idea will be successful or accepted by others). This leads to negative associations with creative ideas, which may lower evaluations of creative ideas (Mueller et al., 2012). The current researcher is of the opinion that this hidden bias may have affected judges and lowered acceptability and implementability ratings of more original ideas.

5.3 Research Limitations

A number of limitations of the current study need to be considered. These limitations range from those arising from the study to those related to the development of the Spatial Playmaker method.

A limitation of the current study is the sample size. There was a lower than expected response rate to recruitment efforts. However, in retrospect, this should not have been surprising since participation in the study included the possibility of being selected for the intervention group to be trained. There is literature to support that training tends to be a lower priority for smaller businesses than for larger organisations (Storey & Westhead, 1997; Westhead & Storey, 1996). These authors suggest that entrepreneurs often fail to take advantage of training opportunities, even when offered at an inexpensive price or for free. Storey and Westhead (1997) suggest two reasons for this phenomenon. First, it is suggested that small business owners may underestimate the value training programmes can add to their businesses. Second, even when small business owners recognize these benefits, the costs of participation may be higher for them than for large organizations. A clear illustration of this type of cost-benefit thinking can be found in the recruitment phase of the current research study. The reader is reminded of the fact that the training intervention was initially planned as a full-day programme, but was changed to a half-day intervention after canvassing potential participants who indicated that they were more likely to attend a shorter training intervention. Furthermore, those canvassed indicated that the opportunity costs of attending the training intervention included missing out on business opportunities or rescheduling essential operating activities.

Since a convenience sample was utilised in this study, the danger exists that the sample was not representative of the total population in question. This has a detrimental effect on the generalisability of the study's findings. However, the sample consisted of small business owners from various industries. The current investigator views this variance in industries as a positive when assessing the

generalisability of the study's findings. In addition, as the sample consisted of small business owners instead of employees of an organisation, the unspoken pressure from organisational management on employees to participate in the study did not exist.

Due to resource limitations, the current research study only evaluated the training intervention at the learning level of Kirkpatrick's four-level model of training evaluation (Van Dyk, Nel, Van Zyl Loedolff, & Haasbroek, 2001). This level was assessed via the pre- and post-tests. Due to constraints of time, practicality, and funding, level one (reaction), level three (*behaviour change* on the job), and level four (*results* to the organisation) were not evaluated. Instead of measuring level one (reaction), the qualitative questions focused on suggestions for improving the Spatial Playmaker itself. The latter two levels require research studies that are more longitudinal in nature than is feasible for the current investigator.

Another time-related limitation came into play after the small business owners were initially canvassed about their willingness to participate in the study. The majority of those asked indicated that they preferred attending a half-day intervention to a full day intervention. The brief duration of the training intervention may have a negative effect on the transfer of training. Transfer of training refers to the application of skills or knowledge mastered during training once the learner has returned to work (Burke & Hutchins, 2007). Although the half-day training intervention resulted in learning, a full day intervention (the current investigator's preference) could have enabled even greater retention of learning among intervention participants over a longer post-intervention period. Such a possibility seems probable if one considers that lengthier training interventions can accommodate more opportunities for learners to practice, which has been shown to be positively related to transfer of training (Burke & Hutchins, 2007; Holladay & Quinones, 2003).

Perhaps the reluctance of participants to commit to more than half a day in training reflected their openness to learning. Low openness to learning could be detrimental for small business owners, because openness to learning is assumed to be related to attained education level and the use of professional advisors. Both education level and the use of professional advisors have been identified as critical success/failure factors according to a business success versus failure prediction model (Lussier & Halabi, 2010). This model has been widely validated using samples from different countries such as the USA, Chile, Croatia, Singapore, and Sri Lanka (Lussier, Bandara, & Marom, 2016; Lussier & Halabi, 2010; Teng, Bhatia, & Anwar, 2011). A further irony is that the Spatial Playmaker could be applied to challenges regarding some of the other identified success/failure factors identified in the Lussier model, such as acquiring adequate capital, planning, staffing, and the marketing mix.

A further limitation was the uneven complexity of the pre- and post-test problems. Since both problems were created by the current researcher, the difference in complexity may be explained by the broaden-and-build theory of positive emotions (described in chapter 3). Specifically, the pre-test bed and breakfast problem was entirely from the current researcher's own experience as a guest of such establishments and local knowledge of the fictitious establishment's setting (i.e. the town of Paarl). On the other hand, the post-test problem dealt with 3D printing, a concept with which the current researcher was only superficially familiar when he decided to draft a 3D printing problem. This lack of knowledge sparked an intense interest on the part of the current researcher in the concept 3D printing. This interest, in turn, activated the broadening of novel thoughts as explained in the broaden-and-build theory of positive emotions (Fredrickson, 2004; Fredrickson & Cohn, 2008). Interest is also said to drive individuals to explore and subsequently leads to knowledge acquisition (Niedenthal et al., 2006). This is what happened to the current researcher, whose interest caused him to read up on the subject. This theory also explains the addition of other novel elements to the post-test (e.g. the 3D printer subsidy, the threat of new competition, and loyalty to employees), because positive emotions enables one to connect seemingly unrelated ideas. It is therefore quite possible that the post-test problems could be more complex than the pre-test problems.

Although judges delivered more than satisfactory work while complying with all the prescriptions within the judge's manual (i.e. self-training methods and rating procedures), the current researcher is not blind to the fact that more robust training in terms of rating could have assisted the judges in their work. For example, perhaps undergraduate students could have solved sample problems to provide the judges with rating practice.

Finally, the fact that no prior empirical research exists on the effectiveness of the existing tools included in the Spatial Playmaker method could be viewed as a weakness. However, the fact that the rationales for inclusion of these tools are based on empirical research should minimise this weakness. Still, the current study did not illuminate which constituent parts (i.e. tools) had more of an impact on formulating creative solutions.

5.4 Recommendations for Future Research

Further research is needed to establish the generalizability of the current study's findings. Specifically, studies should be undertaken with samples derived from the employees of organizations from various industries. In addition, longitudinal studies are required to evaluate the long-term impact of the

intervention introduced in the current study. Furthermore, the effectiveness of the Spatial Playmaker should also be compared with other creative problem-solving methods (e.g. TRIZ and Mind mapping). Moreover, qualitative evaluation methods could be used to determine the degree to which problem solvers using group creative problem-solving methods (e.g. Thinking hats and Brainstorming) suffer the detrimental effects of groupthink, social loafing, evaluation apprehension, production blocking, downward performance matching, relational loss, and cognitive narrowing in comparison to individuals using the Spatial Playmaker method.

Furthermore, research should be conducted to investigate the broader effects of the Spatial Playmaker method and its related training intervention. Examples of such research questions are listed in Table 5.19.

Table 5.19

R*esearch questions related to the Effects of the Spatial Playmaker Method and its related Training Intervention*

Research questions
• How does learning the Spatial Playmaker method facilitate the movement through pathways between Mini-c, Little-c, Pro-C, and Big-C levels of creative magnitudes? Between which levels does the Spatial Playmaker method facilitate the most rapid movement?
• To what extent does the Spatial Playmaker method enhance creative metacognition and creative self-efficacy?
• What is the effect of the Spatial Playmaker training on idea acceptance?
• What is the effect of the Spatial Playmaker training on Psychological Capital (i.e. hope, resilience, optimism, and self-efficacy)?
• How can technology be used to improve the effectiveness of Spatial Playmaker training?
• How long do training effects last?
• What is the effect of Spatial Playmaker training on outcomes in the latter stages of the innovation process (e.g. number of successful patent applications or number of ideas converted to realized products and projects)?

Table 5.19 (continued)

R*esearch questions related to the Effects of the Spatial Playmaker Method and its related Training Intervention*

Research questions
• Does Spatial Playmaker training lead to more incremental or radical innovations in organisations over time? • What is the effect of Spatial Playmaker training on core rigidities (i.e. the inability to abandon historically effective codified knowledge) in organisational knowledge management?

Likewise, further work is required to highlight the factors affecting the use of the Spatial Playmaker method. Selected examples of such research questions are listed in Table 5.20.

Table 5.20

Research Questions related to Factors Affecting the Use of the Spatial Playmaker Method

Research questions
• What is the effect of domain-specific expertise on the effectiveness of the Spatial Playmaker method? • What is the effect of learners' overexcitabilities (in terms of the Theory of Positive Disintegration) on the use of the Spatial Playmaker method? • Are Adaptors or Innovators better suited to using the Spatial Playmaker method? Do they excel at different stages of the Spatial Playmaker method? • Are Assimilators or Explorers better suited to using the Spatial Playmaker method? Do they excel at different stages of the Spatial Playmaker method? • Can reading biographies and watching biographical films based on the lives of eminent creators improve the effective use of the Spatial Playmaker method?

In addition, research studies should also include investigations into specific areas of application where the Spatial Playmaker method could be utilised. Selected examples of such research questions are listed in Table 5.21.

Table 5.21

Research Questions related to possible Areas of Application for the Spatial Playmaker Method

Research questions
• Can Spatial Playmaker training help boundary-spanning employees to resolve customer issues? • Can Spatial Playmaker training be used in change management efforts in terms of changing perspectives, ethical ideation, and communication of change? • Can customers be trained in the use of the Spatial Playmaker to solve product or service development problems? • Can Spatial Playmaker training be used in Authentic Leadership development with specific reference to its dimensions of self-awareness, relational transparency, internalised moral perspective, and balanced processing? • Can Spatial Playmaker training be used to design Corporate Social Responsibility projects? • Can Spatial Playmaker training be used in job (re)design? • Can the Spatial Playmaker method be used to identify or develop organisational strategy? • How can the Spatial Playmaker method be integrated into Blue Ocean Strategy framework (Wubben, Düsseldorf, & Batterink, 2012) to identify or create blue oceans (i.e. uncontested markets)? • If the Front page test tool were to be omitted or modified, could the Spatial Playmaker method be used by auditors to identify fraud risks?

Moreover, research should also include investigations into the possible technological integration of the Spatial Playmaker method. The reader will recall that some of the comments given by intervention group participants that were aimed at improving the Spatial Playmaker (as detailed in the Qualitative results section) seemed to more feasible if the Spatial Playmaker were to be developed into a mobile application (an app). Creating an app is not the only technological possibility that can be explored in future. Selected examples of technology-related research questions are listed in Table 5.22.

Table 5.22

Research Questions related to possible Technological Integration of the Spatial Playmaker Method

Research questions
• What is the feasibility of a mobile application (app) based on the Spatial Playmaker method? • What is the feasibility of an organizational intranet portal interface based on the Spatial Playmaker method for use by employees? • What is the feasibility of an internet portal interface based on the Spatial Playmaker method for use by the public for crowdsourcing?

It is hoped that the current study and the highlighted research questions will serve as a catalyst for future work in organisational settings.

5.5 Practical Implications of the Results

Bearing the aforementioned limitations in mind, the current researcher believes that the results of the current study have noteworthy implications. To begin, evaluation research focusing on the effectiveness of creative problem-solving methods is sparse. Such research is even rarer prior to the commercialisation and often claim-laden marketing of such methods. Broadly, the results demonstrated that utilising psychological theory and empirical research can greatly aid in the development of effective creative problem-solving methods. This has seldom been the case in this consultant-dominated field.

The finding that the intervention group (i.e. participants who underwent training in the use of the Spatial Playmaker) significantly outperformed the comparison group in terms of post-test originality scores holds several real-world implications. In a business context, increased originality could lead to a competitive advantage, which is more likely when no other competitor has thought of and implemented a particular idea. In addition, increased originality may decrease dependence on third party organisations. For example, more original ideas would decrease the need for an organisation to engage in benchmarking, which carries several risks as outlined in Chapter 1. Furthermore, increased originality in areas such as new product development can be emphasised in advertising to position and differentiate a product or brand in the minds of consumers. The more rare, ingenious, imaginative, or surprising an organisation's

products are, the more it is protected from imitator brands that depend on consumers not being able to distinguish between competing brands (Van Horen & Pieters, 2012).

The finding that the intervention group significantly outperformed the comparison group in terms of post-test acceptability scores has important implications. As acceptability is concerned with whether an idea is socially, legally, or politically acceptable, higher acceptability levels has a crucial impact on whether or not a solution is approved, supported, and ultimately implemented. Specifically, solutions created by individuals and groups alike only face the acid test when these ideas are exposed to the critical eyes of others outside of the creative process. Csikszentmihalyi (1988; 1999) has proposed a systems view of creativity in which the *person* (with his/her experiences) proposes ideas within a *domain* (i.e. a system of knowledge and symbols) guarded by the field (i.e. a social system). A creative idea must gain the acceptance of the field, which consists of experts in the domain in question. Experts often act as gatekeepers and wield political power regarding the future path of that domain. Sternberg (2006) noted that society often views disagreement to the status quo as undesirable and subsequently rejects even highly creative ideas. Taken together, this finding suggests that using the Spatial Playmaker method will produce solutions that will have a better chance of gaining the approval of both the watchdogs of society and experts of the particular domain. Solutions high in acceptability will likely not be radical enough to offend moral, ethical and legal sensibilities of the broader society. This societal approval is as important as and at times also a prerequisite for acceptance by the field of experts.

In the case of the solitary reversal of research expectations, this study revealed that the comparison group significantly outperformed the intervention group in terms of post-test *implementability* scores. This suggests that it may be advisable to assess feasibility of ideas generated via the Spatial Playmaker in a second separate stage of evaluation. Alternatively, individual employees could be informed of the constraints of the problem *before* using the Spatial Playmaker. These constraints may include financial resource availability, human resource availability, attitudes, timescales for implementation, etcetera (Rosenzweig & Grinstein, 2016). The ease of implementation is one of the first aspects that decision-makers and investors consider when evaluating whether or not to use proposed solutions. Simply put, if a solution requires a large additional outlay of financial resources, additional personnel, or the disruption of operations, such a solution is less likely to be implemented.

The fact that the intervention group significantly outperformed the comparison group in terms of post-test *effectiveness* scores suggests that the Spatial Playmaker assists individuals in tailoring solutions to fit the problems. It is the current investigator's contention that heightened effectiveness of solutions increases the likelihood of developing a competitive advantage as it decreases the need to purchase

custom-built solutions going forward. An often-overlooked implication in larger organisational contexts would be lower annual consultant fee expenses as several employees working in parallel might be able to solve previously insurmountable problems themselves. This, in itself, would increase the likelihood of competitive advantage as external consultants tend to operate within a few industries and market the same programmes to most clients.

The finding that the intervention group significantly outperformed the comparison group in terms of post-test completeness scores has important implications. *Completeness* is a measure of how well an idea outlines details of who, what, where, when, why, and how. It is no accident that old proverbs locate forces for good and evil in the details. Completeness tells us how well an idea can be communicated. Ideas possessing more details (i.e. who, what, where, when, why, and how) are more likely to stimulate consideration by decision-makers and investors. Such details give the impression that the problem solver has explored the problem sufficiently and given its related aspects some thought. Taken together, this result suggests that the use of the Spatial Playmaker produces more detailed solutions that in turn would engender greater consideration by audiences. Although the discussion of completeness thus far has largely focused on its persuasive 'solution selling' benefits, high completeness scores may also provide advantages beyond the acceptance of the solution. The current researcher is of the opinion that increases in completeness may be related to increases in individuals' attention-to-detail, which is important throughout the innovation process. For example, in a study focusing on new product innovation, Sok and O'Cass (2015) found that R&D department heads who engaged in creativity and attention-to-detail simultaneously created an environment that lead to fewer new product defects and consequently had a positive effect on financial performance. Since the current study indicated that using the Spatial Playmaker increases the completeness of solutions, it stands to reason that it also facilitates thinking about more details of the solution. Consequently, users of the Spatial Playmaker may be in a better position to detect errors or obstacles inherent in solutions before the latter stages of the innovation process. This, in turn, may lighten the error detection and correction workloads of those involved during the later implementation phase of the innovation process.

Readers should be reminded of the fact that this study is situated in the idea generation and idea screening phases of the broader innovation process, thereby precluding the later implementation phase. It should also be noted that the implementation of a creative idea in a real-world organisational setting is affected by factors that were not tested in the current research study. For instance, Baer (2012) suggested that maintaining strong social networks within the organisation can help facilitate support for implementing one's ideas. Furthermore, Litchfield, Gilson, and Gilson (2015) noted that ratings of ideas

are probabilistic predictions and therefore there is no certain way of knowing, in advance, which ideas will be valued enough to be implemented in practice.

5.6 Conclusions

The notion that the world is constantly changing and that such change requires organisations to innovate has become so accepted that it has almost reached the level of cliché. Similarly, it has been largely accepted that creativity is required for innovation to occur. However, in a recent review of 200 articles on creativity and innovation conducted by Forgeard and Kaufman (2016), 71% of the articles reviewed provided little or no explanation of why these constructs are worthy of readers' attention. In this light, it would be prudent to expand on why the current study's findings are important.

Although the importance of creativity goes without saying for many scholars, what is not a matter of consensus is at which the level organisations must focus their efforts to develop creativity – group or individual? Contrary to popular belief, group-based creative problem-solving approaches are severely flawed and as such the current researcher has opted for the individual level. The consequence of developing a creative problem-solving method for individuals is that group-based obstacles such as social loafing, evaluation apprehension, production blocking, groupthink, the Abilene paradox, downward performance matching, the common knowledge effect, relational loss, and cognitive narrowing are largely side-stepped. As such, the Spatial Playmaker can enable employees to avoid the numerous challenges of the strangely more popular group-based problem-solving methods.

Creative problem-solving methods, and the industry they have spawned, have to date largely operated with little or no research prior to marketing these tools to consumers. By basing the development of a new creative problem-solving method called the Spatial Playmaker on existing psychological research and then comparing solutions devised via its use to solutions without its use, this thesis has moved creative problem-solving closer to research-based practice. Specifically, the development of the Spatial Playmaker was a work of synthesis, integrating empirical research from varied bodies of psychological research.

This research has successfully achieved the specific research objectives as set out in chapter 1 of this thesis, namely:

1. Develop a creative problem-solving method based on psychological research for use by individuals;
2. Implement the new creative problem-solving method in a preliminary trail run; and

3. Evaluate the effectiveness of the new creative problem-solving method;

This research has shown that the use of the Spatial Playmaker has a significant impact on various problem-solving outcomes achieved by individuals, specifically the originality, acceptability, effectiveness, and completeness of solutions generated. This contribution is valuable, because it extends the body of knowledge in the under-researched area of creative problem-solving methods. This is particularly important, because such methods have often been directly applied in practice for decades before any evaluation research is conducted.

In the broadest sense, the findings of this study are consistent with the meta-analytic findings of Scot, Leritz, and Mumford (2004) who reported that training individuals in the use of creative problem-solving methods was particularly effective. These authors also found training that facilitates cognitive processes helpful for problem-finding, conceptual combination, constraint identification, and idea generation to be successful. These aspects are also mirrored within the Spatial Playmaker.

By using small business owners as participants and business problems as tests, this research has also addressed the view highlighted by Dino (2015), who decries the lack of integration between creativity, innovation, and entrepreneurship research domains. However, the importance of this research is not limited to entrepreneurs. Indeed, this study's findings are also valuable for larger organisations, because their employees are increasingly required to engage in intrapreneurship. Intrapreneurship refers to actions by employees within an organisation to exploit different business opportunities and initiate new business activities for the benefit of the organisation (Baruah & Ward, 2015).

For more than a decade, innovation research has been greatly influenced by the concept of open innovation, referring to a distributed model of innovation aligned with the organisation's business model that uses intentional inflows and outflows of knowledge across organisational boundaries to achieve innovation (West, Salter, Vanhaverbeke, & Chesbrough, 2014). Although open innovation emphasises both inbound and outbound flows, research has heavily focused on inbound open innovation, referring to organisations acquiring innovation from the sources external to the organisation (West & Bogers, 2014). This is mirrored in practice, where there is tremendous interest from industry in the inbound variation of open innovation (West et al., 2014). Consequently, the open innovation trend has led organisations to become innovation-adopting instead of innovation-generating organisations. This research can also be viewed as countering this trend, as the Spatial Playmaker is a tool developed to help organisations to become innovation-generating.

This research is also a positive step toward answering calls by researchers such as Loewenberger (2013) who advocate developing the creative potential of individuals who are less inherently creative and thereby taking the view that everyone can be creative beyond rhetoric to a practical level. This also implies that organisational innovation can be a bottom-up process and outcome. From this perspective, this research has delivered on the promise of the Spatial Playmaker to empower employees to become *multiple problem-solving engines working in parallel*, which the current researcher believes is vital for innovation to become truly *employee-driven*.

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APPENDIX A:

THE SPATIAL PLAYMAKER METHOD OF CREATIVE PROBLEM-SOLVING: AN EXAMPLE

PROBLEM EXAMPLE – *Parcels4u*

- You own a parcel-delivery business. Over the last 3 years, the business has expanded and you now employ 8 employees (3 drivers, 1 admin person, 4 parcel sorters/loaders). Three of the parcel loaders were only appointed as recently as 2 months ago.
- The admin person takes orders & receives complaints. Parcel sorters / loaders sort & load parcels. Drivers pick up & deliver parcels (same day or next day).
- Although you've made a profit for the entire 3 years, you cannot afford a bigger premises (office) from which your business can operate.
- Things have recently started going wrong with your admin person receiving several daily calls from customers waiting days for their parcels. Currently, there is a backlog of undelivered overdue parcels that has built up since the problem started.
- You've since found out that after making deliveries your drivers often return with parcels that should have been loaded on vans that deliver to other routes.
- Problem: How would you reduce (customer complaints about) delivery delays in future as well as the current backlog?

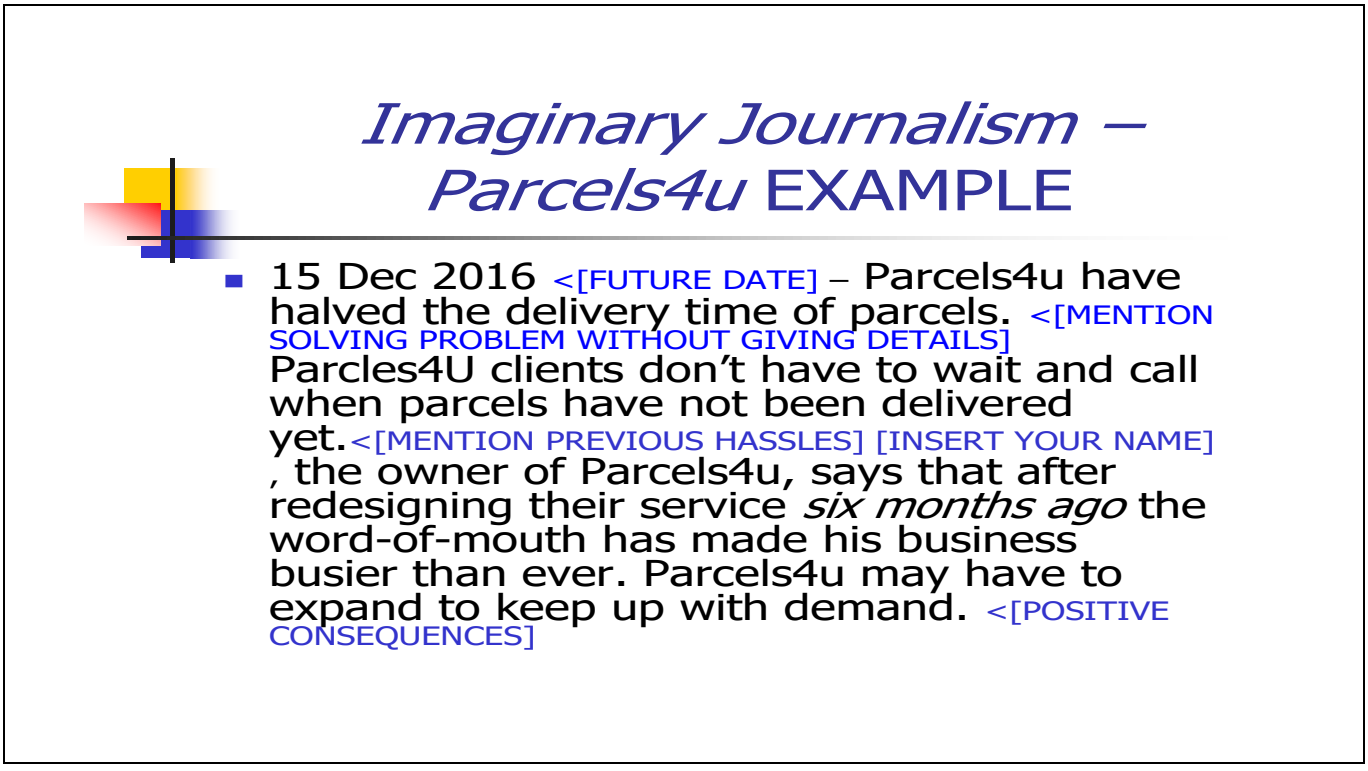
Stage 1: Stand off from the problem

Tool:

(i) Imaginary Journalism

When you are faced with a challenging problem:

Imagine that you are a journalist writing an article for your favourite newspaper. Write a story (4 or 5 sentences long) vividly describing the success that you as the problem solver will have achieved with your solution (without describing the idea/solution itself) at a future time (e.g. 6 months from now). It is important to imagine that the problem will occur and will be solved at a future date.



Stage 2: Pivot the problem

Tools:

(i) Board of directors (a.k.a. creative heroes)

- Select and list at least two people, living or dead, real or fictional, who you admire (e.g. business leaders or athletes or scientists or inventors or artists or family members or characters from books or movies) (Michalko, 1991).
- Write down the characteristic that you admire about them next to their name as a reminder. It is important that each director has a different characteristic.
- Whenever you are stuck in the creative process, imagine how each of your heroes would overcome the mental block (e.g. during next tool) or a specific sub-problem (e.g. during later stages).

Board of directors – Parcels4u EXAMPLE

Board member	***Characteristic***
Your mother	Ethical; Altruistic
Sherlock Holmes	Detail-oriented

(ii) Multiple Redefinition → if stuck, consult your one of your board of directors.

Redefine the problem by restating through a series of statements:

Statements:

Empathic: 'There is usually more than one way of looking at problems. You could also define this one as ….'

Analytic: '….but the main point of the problem is….'

Motivational: 'What I would really like to do is….'

Magical: 'If I could break all laws of reality (physical, social, etc.) I would try to solve it by ….'

Metaphorical: 'The problem put in another way could be likened to …'

Off-beat: 'Another, even stranger, way of looking at it might be….'

Afterwards, return to your original definition of the problem. Have any of the redefinitions helped? Can you see the problem from a different angle?

Write down any thoughts or ideas that this tool has sparked.

Multiple Redefinition – Parcels4u EXAMPLE

- ***Empathic:*** 'There is usually more than one way of looking at problems. You could also define this one as employees are working as fast as possible, but they are not organised enough.'
- ***Analytic:*** '….but the main point of the problem is these parcels are not being sent out on the correct routes.'
- ***Motivational:*** 'What I would really like to do is prevent my employees at the office from making sorting and loading mistakes with customers' parcels.'

Multiple Redefinition – Parcels4u EXAMPLE

- ***Magical:*** 'If I could break all laws of reality (physical, social, etc.) I would try to solve it by casting a spell that makes parcels float to the correct van'
- ***Metaphorical:*** 'The problem put in another way could be likened to asking how to reduce road traffic delays due to road works?'
- ***Off-beat:*** 'Another, even stranger, way of looking at it might be building a robot that checks that all the vans before they leave the office and moves misplaced parcels to the correct van.'

Multiple Redefinition – Parcels4u EXAMPLE

- So, did any of these redefinitions spark an idea or a vague notion of how to solve the problem?
- Yes. A few of the redefinitions mention organisation, prevention, and checks that need to be built into the process.

Stage 3: Break the problem into sub-problems

Tool:

(i) *Break the problem into sub-problems*

Two Options:

1. Break the problem into a Big sub-problem and small sub-problem(s)

Here you may use the *Analytic restatement* you wrote using the Multiple Redefinition tool as the big sub-problem and use aspects not covered in that restatement as smaller sub-problems.

2. Break the problem into sequential phases

This is useful if problem is a whole process or involves multiple actors.

Break problem into sub-problems – Parcels4u EXAMPLE (cont.)

Sub-problem 1	*Sub-problem 2*	*Sub-problem 3*
3 new parcel sorters may be making sorting errors	Cramped sorting room may be leading to sorting errors	Current Backlog of undelivered parcels

Stage 4: Playbook a solution

Tool:

Playbook a solution

1. Write the whole, original problem at the top of the page (landscape orientation).
2. Draw sub-problems as circles beneath the problem (use keywords). Use the top third of the page.
3. If one or more of the sub-problems are people-centred, then the following questions must be asked:
    - What are these people doing to contribute to the sub-problem?
    - Who are these people?
    - Why are they doing it? To answer why, you must speculate about which human needs their current actions are satisfying:

Human Need	***definition***
Distributive Justice	The need for the fair allocation of resources among all members of a community.
Safety/Security	The need for structure, predictability, stability and freedom from fear and anxiety.
Belongingness/Love	The need to be accepted by others and to have strong ties to one's family, friends, and identity groups.
Self-esteem	The need to be recognised by oneself and others as strong, capable, competent and able to have an effect on his/her environment.
Personal fulfilment	The need to reach one's full potential in all areas of life.
Identity	The need for the sense of oneself in relation to the outside world to be recognised as legitimate or not to be viewed as inferior or be threatened by others.
Cultural security	The need for recognition of one's language, traditions, cultural values, religion, ideas and concepts.
Freedom	The need for having no physical, political, and civil constraints while having the capacity to exercise choice in all aspects of one's life.
Participation	The need to actively partake and influence civil society.

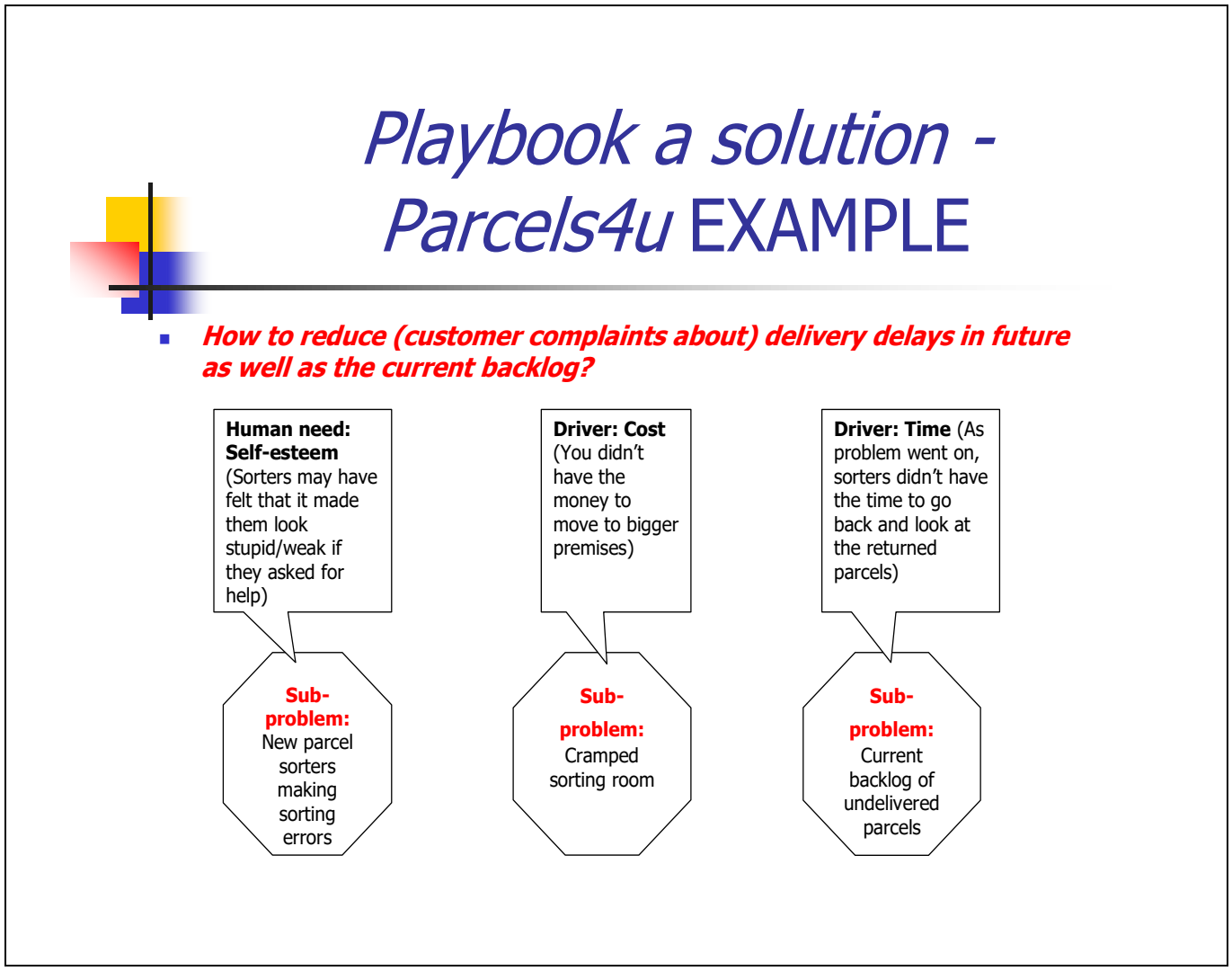
A sub-problem is process-, organisation-, or systems-centred if it involves multiple actors, relationships, and exchanges. If one or more of the sub-problems are process-, organisation-, or systems-centred, then the following question must be asked:

- Which process, organisation, or system is involved?
- What is this process, organisation, or system doing to contribute to the sub-problem?
- Why does the process, organisation, or organisation contribute to the sub-problem? To answer why, you must speculate about what is driving the manner of operating:

Driver	***definition***
Cost	This driver refers to the quest to minimize the monetary resources allocated to any activity and related perceptions.
Time	This driver refers to the quest to minimize the time allocated to any activity and related perceptions.
Habit and tradition	This driver refers to practices that are done the way they have always been done and for which no incentive to change has to date existed.
Trends and fads	This driver refers to the infatuation with an idea or principle or practice that is currently popular.
Competition	This driver refers to perceptions of competitors and what is required to remain competitive.

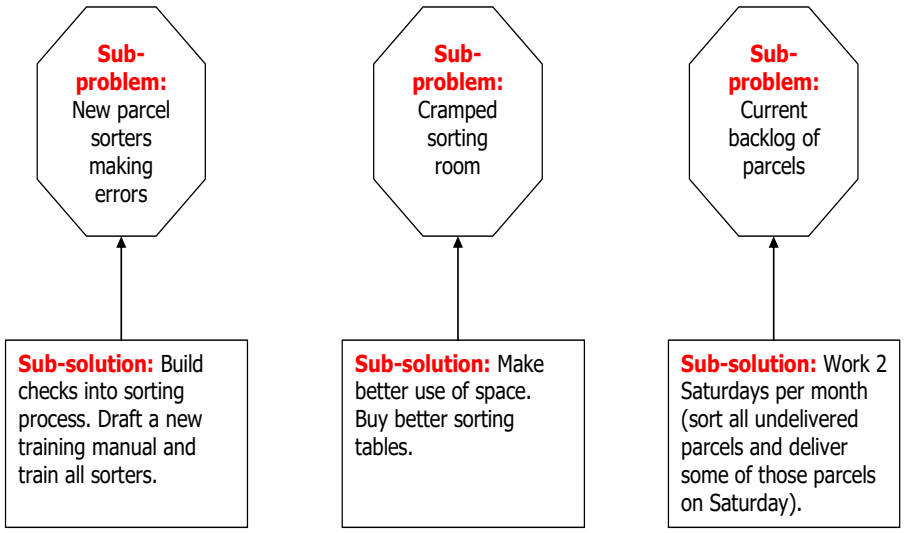
4. Once you have identified the need or driver in question, try to create a sub-solution to satisfy/address the identified need or driver. Devise sub-solutions for each sub-problem by asking whether each sub-problem can be solved by direct confrontation (directly neutralizing the sub-problem), pin-balling (if one solution can be devised for two or more sub-problems), or side-stepping (devising a solution that makes a sub-problem irrelevant by altering the *what, where, why, who* and *how* aspects of the sub-problem). Please note that side-stepping is mostly used for systems or organisation-centred sub-problems (as human needs cannot be side-stepped) and is particularly useful for Habit, Trend, and Competition drivers. Divide the lower third of the page into panels (the number equal to however many sub-solutions you have thought up) and write out or draw each sub-solution in a separate panel. Draw an arrow from each sub-solution panel to each sub-problem circle to indicate method of solution (direct confrontation = a straight arrow up; pin-balling = an arrow hitting a sub-problem and ricocheting into another sub-problem; or side-stepping = an arrow making a 90 degree turn and missing sub-problem). It should be

noted that sub-solutions must not be mutually exclusive or lessen the effectiveness of other sub-solutions.



Playbook a solution – Parcels4u EXAMPLE (cont.)

- ***How to reduce (customer complaints about) delivery delays in future as well as the current backlog?***



Playbook a solution – Parcels4u EXAMPLE (cont.)

- All 3 sub-solutions combined are your initial solution.

THE SOLUTION (so far):

- Build checks into sorting process. Draft a new training manual and train all sorters.
- Make better use of space. Buy better sorting tables.
- Work 2 Saturdays per month (sort all undelivered parcels and deliver some of those parcels on Saturday).

Stage 5: U-WIN the front page

Tools:

(i) U-WIN:

Does your solution have any ***Undesirable*** consequences or side effects?

- If yes, refine solution
- If no, continue.

Does your solution solve the ***Whole*** Problem?

- If no, refine solution
- If yes, continue.

In your opinion, is your solution ***Intuitive*** for others to use/implement?

- If no, refine solution
- If yes, continue.

Is your solution ***New*** (to the problem)?

- If no, refine solution
- If yes, continue.

U-WIN – *Parcels4u* EXAMPLE (cont.)

Your solution…

- ***Undesirable*** consequences? – YES (Building checks into process may increase in sorting time; Cost of new tables; Working on Saturdays will be unpopular)
- solve the ***Whole*** Problem? – YES
- ***Instructive*** for others to use/implement? – YES
- ***New*** (to the problem)? – YES

- NB: Therefore, you have to use ULTIC next!

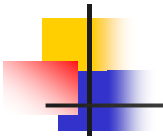
(ii) ULTIC (Under Less Than Ideal Conditions)

Using the answers gained from the U-WIN tool, use any of the refinements suggested for each of the specific U-WIN answers:

Answers read from U-WIN	***Suggested refinements***
When your solution has ***Undesirable*** consequences or side effects	• Involve fewer individuals or departments in implementation; • Revise (increase) timescales of the solution. • Scale down solution; • Simplify solution; • Use existing, unused resources.
When your solution does not solve the ***Whole*** Problem	• Rethink the smaller sub-solutions; • Rethink the sub-solutions for latter phases of the problem (i.e. the latter sub-problems); • Consider other users as well;
When your solution is not ***Intuitive*** for others to use/implement	• Scale down solution; • Simplify solution; • Consider other users as well; • Use existing, unused resources. • Change the 'how' of the solution or sub-solution.
When your solution is not ***New*** to the problem	• Improve any single sub-solution; • Use existing, unused resources; • Change any element of the solution or sub-solution (e.g. who, what, when, where, or how).

ULTIC
- Parcels4u Example

Answers read from U-WIN	***Suggested refinements***
When your solution has ***Undesirable*** consequences or side effects ▪**Building checks into process may increase in sorting time;** ▪**Cost of new tables;** ▪**Working on Saturdays will be unpopular**	▪Involve fewer individuals or departments in implementation: Use half of the staff for each Saturday and let each employee choose which Saturday they work; ▪Revise (increase) timescales of the solution; ▪Scale down solution; ▪Simplify solution: Assign checking parcels before they are loaded to one sorter; ▪Use existing, unused resources: Instead of buying new tables, modify old ones.



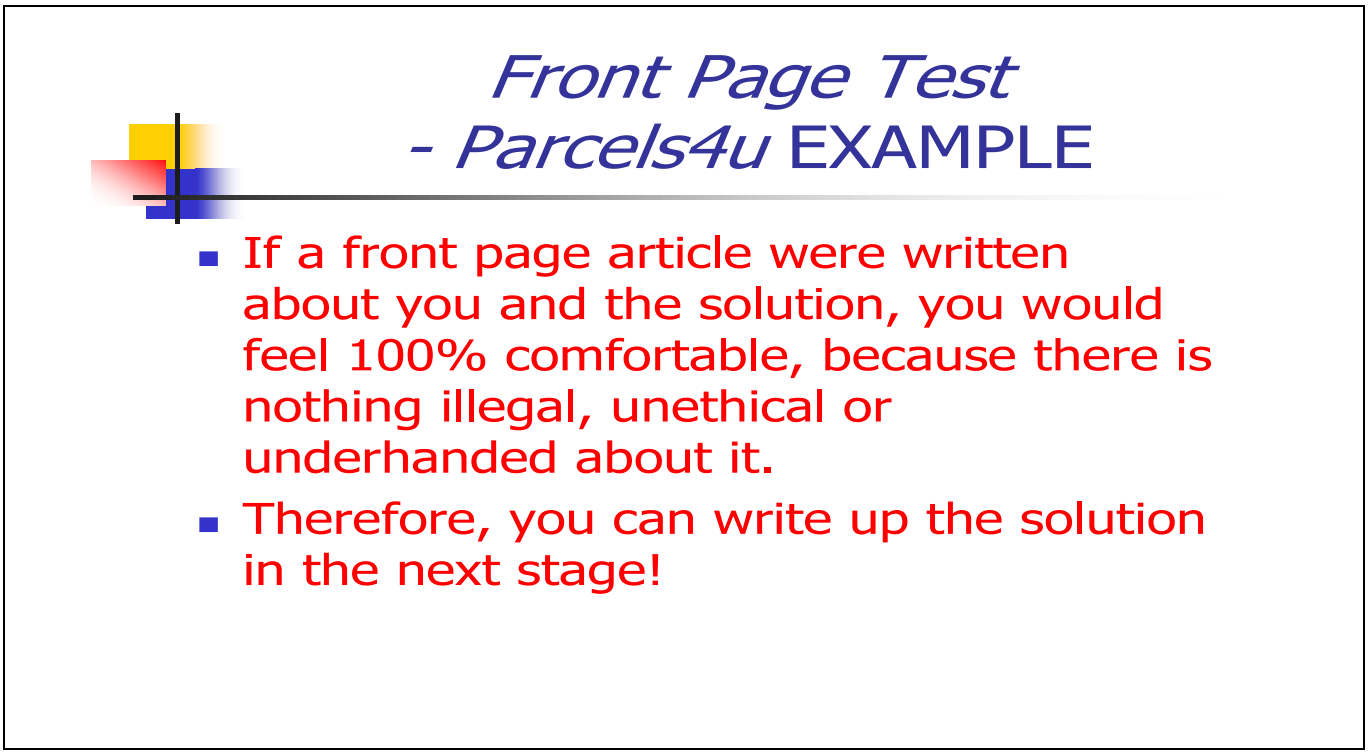
ULTIC – *Parcels4u* EXAMPLE (cont.)

REFINED SOLUTION:

- Build checks into sorting process. Assign checking parcels before they are loaded to one sorter. Draft a new training manual and train all sorters.
- Make better use of space. Modify existing sorting tables.
- Work 2 Saturdays per month (sort all undelivered parcels and deliver some of those parcels on Saturday). Use half of the staff for each Saturday and let each employee choose which Saturday they work.

(iii) Front Page Test

- Imagine a front page headline article outlining your solution.
- Would you be comfortable if your name is mentioned as the creator of the solution in the article knowing that the public (including your family, friends, acquaintances, and colleagues) would read the article?
- Would you be comfortable if your business or place of work's name and your family members were mentioned in the same article knowing that the public (including your family, friends, acquaintances, and colleagues) would read the article?
- If no, refine solution
- If yes, write up your final idea (in the next stage)!



Stage 6: Wrap it up and around

Tool:

(i) Motivated sequence:

Your final solution must be communicated and structured in the following manner:

- *Attention:* Pose a provocative question: “Wouldn’t it be great not to be faced with problem x?”
- *Need:* State the need for action by demonstrating the severity, extensiveness of the problem and how it relates to the audience.
- *Satisfaction:* State how your solution will respond to the need (emphasize uniqueness) and briefly summarize how your solution works (focusing on who, what, where, when, why, and how). If any possible cons to your solution exist, mention these cons and how they can be minimized.
- *Visualization:* Describe the positive consequences of implementing the solution. “Imagine…” Relate to human needs and drivers. Describe the negative consequences of not implementing the solution.
- *Action:* State the action you want the audience to take to make the solution happen. Make the action very specific and straightforward.

Motivated Sequence - Parcels4u EXAMPLE

- Wouldn't it be great not to be faced with undelivered parcels and complaints? ATTENTION
- For the past few months we've had to deal with customer complaints, an overloaded sorting room, and frustrated co-workers. NEED
- To get rid of the current backlog of undelivered parcels, we'll work 2 Saturdays per month to sort all undelivered parcels and deliver some of those parcels on Saturday. Only half of the staff will work each Saturday. Each employee will be allowed choose which Saturday they work. SATISFACTION
- We will build checks into the sorting process. For example, one sorter will will be responsible for checking parcels before they are loaded. SATISFACTION
- Once we're satisfied with the process, we'll draft a new training manual and re-train all sorters. SATISFACTION

Motivated Sequence - Parcels4u EXAMPLE

- We will also aim to make better use of space. For example, we can modify existing sorting tables to make sorting easier. SATISFACTION
- Imagine working in a less cluttered workplace [human need: freedom] with happier co-workers [human need: belongingness]. VISUALIZATION
- Imagine having more time to do your work, because the process is better organised [human need: personal fulfillment + driver: Time]. VISUALIZATION
- If we don't make these changes, we'll lose more customers. VISUALIZATION
- What I'm asking you to do is to cooperate and give 100% when we implement these changes. ACTION

APPENDIX B

SCRIPTED LESSON PLAN

Time	Objective/Activity
	Objective: Introduction and set the learning climate.
	"In life (work, business, personal), we all face problems we didn't plan for and for which there are no obvious solutions. This training course will offer you a new tool to help you solve these problems creatively. By a show of hands, who amongst us has faced problems that you had difficulty solving?"
10	*Activity: Introductions*
5	*Activity: Review session learning objectives*
	"Please turn to page 1 and read the objectives listed."
5	*Activity: Lecture: Definition of creativity*
5	*Activity: Lecture: Small Business Success Factors – How creativity can help?* (Lussier & Halabi, 2010; Teng, Bhatia, & Anwar, 2011)
5	*Learning resource: Lecture: Creativity blockers – why aren't you always creative?* (Bowket, 2005, p.13)
	"Anyone can be creative. However, if that is true, why aren't we creative *all of the time*? To answer that question, we're going to look at creativity blockers – those things that stop you from being creative."

SAMPLE LEARNING RESOURCE

Resource: Creativity Blockers (Bowket, 2005, p.13)

- A fear of making mistakes, giving the wrong answer, appearing foolish;
- A fear of change;
- A fear of consequences;
- Unchallenged habits of thinking;
- Unchallenged frameworks of language;
- Unchallenged principles and previous models of understanding;
- Unquestioning acceptance of ‘absolute truths’;
- Attachment to the familiar and comfortable;
- Solid certainty;
- Ongoing self-doubt and negative self-judgements;
- Over-reliance on rational thought, outside authority and expertise;
- Unwillingness to explore, experiment and play.

LESSON PLAN: IMAGINARY JOURNALISM

Time	Objective/Activity
	Objective: Use the *Imaginary Journalism* tool to prepare mentally (visualise) when first faced with a problem to be solved
5	*Warm-up: Something to ponder* (Arch & Meiss, 2000, p.152-153)
	"The fundamental reason why these experts made these statements is that they were unable to visualise a future (create a picture in their minds) where these ideas were possible. Imaginary Journalism is tool that allows you to create a picture in your mind."
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity: Lecture: How to use Imaginary Journalism*
	"When using this tool it is important that..."
15	*Activity: Practice: Imaginary Journalism*

SAMPLE TRAINING ACTIVITY

Activity: Something to ponder (Arch & Meiss, 2000, p.152-153)

Read what some "experts" said in the past, and see if you can guess who said it. Are we caught in any similar kind of thinking today? What achievements would be possible if we focused on the task?

"This telephone has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us." _____

"Who the hell wants to hear actors talk?" _____

"I think there is maybe a world market for maybe five computers." _____

Solutions:

"This telephone has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us." - *Western Union internal memo, 1876*

"Who the hell wants to hear actors talk?" - *H.M. Warner, Warner Brothers, 1927*

"I think there is a world market for maybe five computers." - *Thomas Watson, chairman of IBM, 1943*

LESSON PLAN: BOARD OF DIRECTORS

Time	Objective/Activity
	Objective: Use the *Board of Directors* tool to utilise your internal mental resources and imagination in problem solving
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity:* Lecture: How to use *Board of Directors*
	"When using this tool it is important that..."

LESSON PLAN: MULTIPLE REDEFINITION

Time	Objective/Activity
	Objective: Use the *Multiple Redefinition* tool to change perspective on a problem to be solved
5	*Warm-up: Activity: Which number is least like the others?* (Barbazette, 2013, p.145)
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity: Lecture: How to use Multiple Redefinition*
	"When using this tool it is important that..."
15	*Activity:* Practice: Multiple Redefinition

SAMPLE TRAINING ACTIVITY

Activity: Which number is least like the others? (Barbazette, 2013, p.145)

Which number is least like the others? Why?

1. Three
2. Thirteen
3. Thirty-one

Solution:

The number 2 is correct, because it is the only even number. The words three, thirteen, and thirty-one as well as the Numbers 1 and 3 are all odd numbers.

What made it difficult to solve this problem?
What assumptions did you make?

LESSON PLAN: BREAK PROBLEM INTO SUB-PROBLEMS

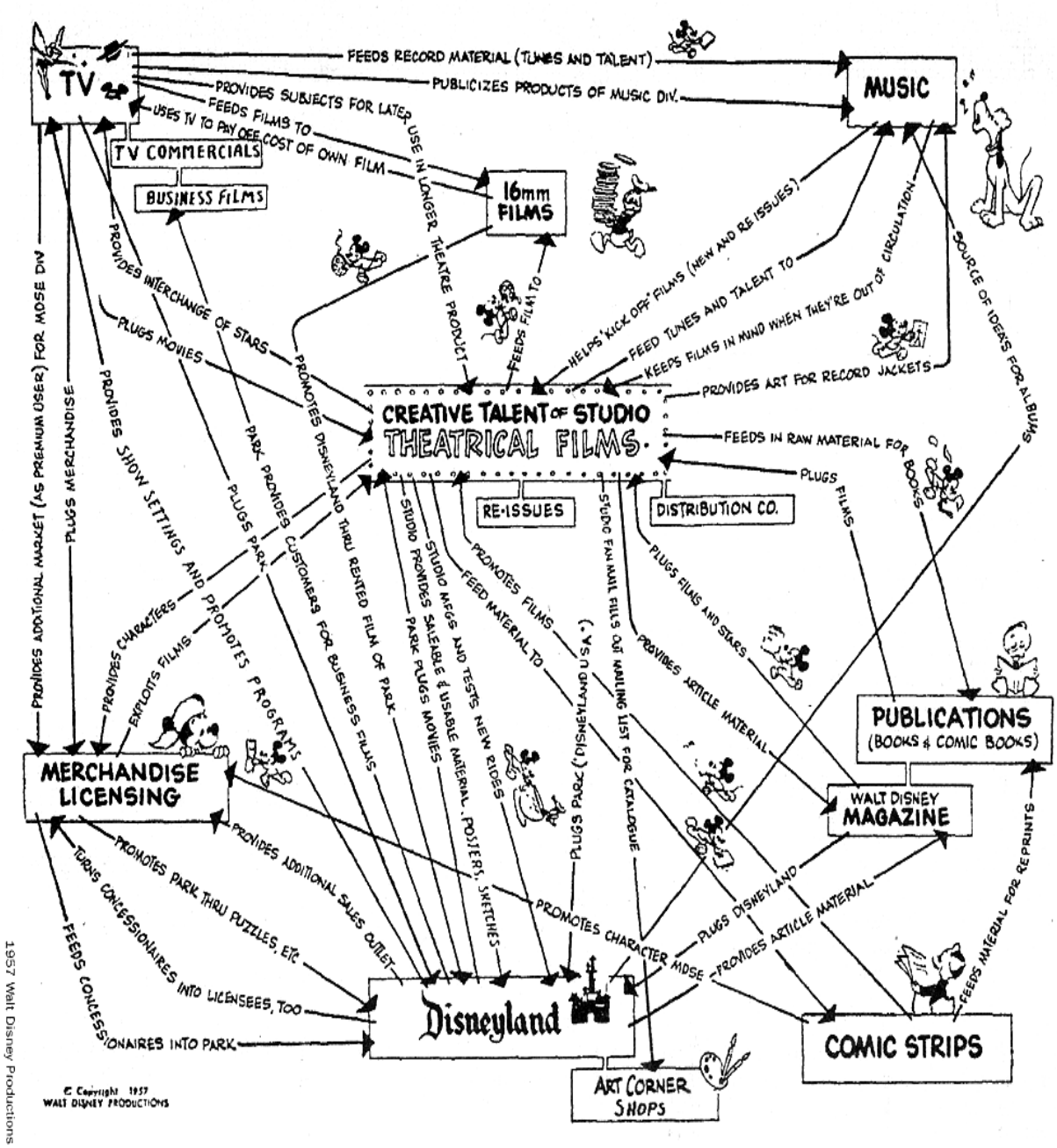
Time	Objective/Activity
	Objective: Use the *Break problem into Sub-problems* tool to analyse a problem to be solved
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity: Lecture: How to use Break problem into sub-problems*
	"When using this tool it is important that..."
15	*Activity:* Practice: *Break into Sub-problems*

LESSON PLAN: PLAYBOOK A SOLUTION

Time	Objective/Activity
	Objective: Use the *Playbook a Solution* tool to identify and visualise human needs or process drivers to solve sub-problems
10	*Learning resource: Disney business map and creativity strategy* (Duke, 2008; Dilts, Epstein, & Dilts, 1991)
	DISPLAY DISNEY BUSINESS MIND MAP. "The mind map you see before you was developed in the year 1957. In those times, a business model consisting of an animation studio, theme parks, publishing, merchandising and music was unheard of. Similarly, companies weren't using mind maps for business planning that widely at the time. However, since that time the Disney corporation achieved everything described on this map and much more. The question remains: How did Disney come up with these seemingly far-fetched ideas and have the courage to pursue them?" "Research tells us that Disney's creative strategy involves allowing your mind to be a dreamer (where wild dreams are possible), realist (where you consider how to practically achieve the dream), and critic (where you think of everything that can go wrong). This is but one way to use your imagination in problem-solving. The next tool is another, more personal way of achieving this."
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
20	*Activity: Lecture: How to use Playbook a Solution*
	"When using this tool it is important that..."
20	*Activity: Practice: Playbook a Solution*

SAMPLE LEARNING RESOURCE

Resource: ***Disney business map and creativity strategy*** (Duke, 2008; Dilts, Epstein, & Dilts, 1991)



LESSON PLAN: U-WIN

Time	Objective/Activity
	Objective: Use the *U-WIN* tool to determine whether proposed solution or idea is in need of refinement
5	*Warm-up: Dilbert Cartoon (Evaluation of ideas)*
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
10	*Activity:* Lecture: How to use *U-WIN*
	"When using this tool it is important that..."
10	*Activity:* Practice: *U-WIN*

LESSON PLAN: ULTIC

Time	Objective/Activity
	Objective: Use the *ULTIC* tool to refine your proposed solution or idea
10	*Warm-up: Historical examples of constraints and refining ideas* (Perl, 2008)
	"You will recall our earlier discussion on Disney's creative strategy. Well, when you refine a possible solution, you are entering the *realist* state of mind and asking: How to practically achieve the dream (implement the solution)?" "You should always try to balance the creativity (i.e. the novelty and usefulness) of a solution with the ease-of-implementation/feasibility without decreasing the creativity. That way other people are more likely to use, buy or invest in your solution." DISPLAY FLYING CAR IMAGE. "Another example is the flying car. This idea involved a vehicle that could be both flown in the air and driven on the road. It would be a winged vehicle that would have been easy to convert. There have been many designs, but the flying car does not the constraint of practicality. For, example, flying car would require huge changes to laws governing the roads and airspace. Furthermore, where are the wings when it is being driven? What would the ideal pricing be? How much would the cost of maintenance total?" DISPLAY LIGHTBULB IMAGE. "However, constraints are not always the end of an idea. Thomas Edison needed to test 6000 combinations of filament before he finally found a combination that made his electrical lightbulb work. This is good example of refining an idea until it overcomes the problem constraints."
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
10	*Activity: Lecture: How to use ULTIC*
	"When using this tool it is important that..."
15	*Activity: Practice: ULTIC*

SAMPLE TRAINING ACTIVITY

Activity: Historical examples of constraints and refining ideas (Perl, 2008)

Drive Right Up

A FLYING automobile with a 150-hp. Franklin engine cruises at 110 m.p.h. in the air and travels 60 m.p.h. on the road. Those speeds were set by the first model of a design by Ted Hall, aviation engineer. Portable Products Corp., Garland, Tex., is considering the possibilities of producing it.

The "roadable" plane has detachable propeller, wing, booms, and tail. The forward end of the engine crankshaft turns the prop, while a shaft extends aft from the engine into a conventional automobile transmission and differential. Power goes both to propeller and rear wheels for the take-off.

Hall's three-wheel, "roadable" airplane seats only two, but has ample luggage space in the rear. Rear wheels are on shock struts.

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LESSON PLAN: FRONT PAGE TEST

Time	Objective/Activity
	Objective: Use the *Front-Page Test* tool to determine whether proposed solution or idea is ethical
5	*Warm-up: Ethical scenarios* (Mujtaba & Sims, 2006)
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity: Lecture: How to use the Front-Page Test*
	"When using this tool it is important that..."
15	*Activity: Practice: Front Page Test*

SAMPLE TRAINING ACTIVITY

Activity: *Ethical scenarios* (Mujtaba & Sims, 2006)

Scenario 1:

Ben, the owner of CJ's construction, has decided to bid on a large contract to construct a mega-store. It is a very competitive process and CJ's Construction is in need of the work. Ben decides to submit a bid that is lower than they can usually afford and then make profit by using inferior/cheaper materials. Ben believes they can do that without arousing the suspicion of building inspectors. He argues most of the firms bidding will do the same since the bidding will be extremely competitive. What is your opinion of Ben's action - ethical or unethical? Why?

Scenario 2:

Ben, the owner of CJ's construction, has decided to bid on a large contract to construct a mega-store. It is a very competitive process and CJ's Construction is in need of the work. Ben decides to submit a bid that is lower than they can usually afford, but still use top quality/expensive materials. Ben believes that although they will not make a profit if CJ's Construction wins the bid, winning will get their foot in the door for future business as the mega-store is part of a chain that is expanding. He argues most of the firms bidding will do the same since the bidding will be extremely competitive. What is your opinion of Ben's action - ethical or unethical? Why?

LESSON PLAN: MOTIVATED SEQUENCE

Time	Objective/Activity
	Objective: Use the *Motivated Sequence* tool to communicate your proposed solution or idea
10	*Warm-up: Pyramid workers* (Spencer, 2012)
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to indicate which tool you are going to discuss.
15	*Activity: Lecture: How to use the Motivated Sequence*
	"When using this tool it is important that..."
15	*Activity: Practice: Motivated Sequence*

SAMPLE TRAINING ACTIVITY

Activity: Pyramid workers (Spencer, 2012)

Using a maximum of three sentences, create a short advertisement in order to recruit workers to come to Egypt and build pyramids.

LESSON PLAN: PRACTICE SESSION

Time	Objective/Activity
	Objective: Given a business case study problem, use the Spatial Playmaker method to solve the case problem creatively (i.e. in a novel and useful way).
5	*Activity: Overview of Spatial Playmaker method*
	Show overview flow diagram of Spatial Playmaker method to show that training has covered the entirety of the method.
30	*Activity: Practice: Spatial Playmaker*
10	*Closing*

APPENDIX C:

PRE-TEST PROBLEM

Nestled in the Winelands town of Paarl, lies the Nog ‘n bietjie wyn Bed & Breakfast. With its views of the mountains and its location near several world class wine estates, our cosy 4-bedroom establishment provides a tranquil getaway a mere 60km from Cape Town. Once staying at the property, the warm, personal service and attention to detail gently reminds you that this is your quiet escape from big city life. Enjoy wine tasting at any of the 10 nearby wine estates or participate in a guided walking tour down historic Paarl streets filled with Cape Dutch architecture. Explore local history and heritage at sites such as the Afrikaanse Taal Monument.

Book four nights at Nog ‘n bietjie wyn Bed & Breakfast and receive a fifth night free.

Rooms	**Peak season rates per night**	**High season rates per night**	**Low season rates per night**
Mountain view 1	R900	R800	R600
Mountain view 2	R900	R800	R600
Heritage	R800	R700	R500
Vineyard view	R900	R800	R600

Peak season = 1 December – 10 January; Easter weekend
High season = 1 September – 20 April
Low season = 21 April – 31 August

You are the owner of Nog ‘n Bietjie Wyn B & B. It is an old house that you converted into a Bed & Breakfast just before the 2010 Soccer World Cup six years ago. Above is the ad that you update and place 6 times a year on various online travel websites and send to travel agents.

For the past 5 years business has been good, but you have noticed a trend that has you worried: Your B & B is fully booked throughout the High and Peak season, but over the last few years visitors have been few during the low season. Many of the unique selling points of the area that you mention in the ad do not apply during the low season.

What can you do to attract more visitors during the low season? Note: You cannot reduce your low season prices, because low season prices are the lowest prices that still allow you to make a profit.

APPENDIX D:

POST-TEST PROBLEM

3D Printing is an exciting, new technology. 3D Printing (a form of additive manufacturing) differs from traditional “subtractive” manufacturing (where each part of a multi-part product has to be created separately and then assembled). For example, to produce a steel chain consisting of 40 links, traditionally each link had to be produced and then added together to create the steel chain.

Instead, 3D printers can create a product as a single object using digital file containing the product specifications and design together with the required raw materials (plastic, metal, wood, and even living cells) usually in powder form (Gross, Erkal, Lockwood, Chen, & Spence, 2014). 3D printers create full products by depositing layers of raw materials (in a similar way that inkjet printers operate). Using the steel chain example, 3D printers can print the steel chain as a single object – no assembly required.

One of the current limitations to 3D printing technology is that 3D printers are not suited to mass production. Another limitation is that products consisting out of many raw materials cannot be printed. Finally, 3D printers cannot integrate electronic circuitry without damaging the electronics (Greenemeier, 2013).

After attending a conference on 3D printing in Johannesburg and realising the potential of this technology for stimulating economic growth, the national ministers of Economic Development, Trade and Industry, and Small Business Development introduce a subsidy scheme for small businesses to enable the purchase of and encourage use of cost-saving 3D printing technology. Although primarily aimed at medium end of SMMEs (Small Micro Medium Enterprises) who have traditionally imported refined and processed components of their products from abroad, scope has been provided for smaller businesses and even all-new 3D printing start-ups to benefit as well.

You own and operate a curio shop in Cape Town – you have been in business for 2 years. You take great pride in employing 6 previously unemployed people who produce all your shop’s products (e.g. traditional African beadwork, necklaces, kieries, etc.). It occurs to you that since many of your products are made from one or two raw materials (wood, beads) the planned 3D printing subsidy could enable you to produce your products at a faster pace with a lower wage expense.

However, you feel that you have an obligation to retain your staff members that have been with you since the start of your business. You decide not to apply for the 3D printing subsidy, but know that new competitors in the form of new *3D-printed curio* shops will not have the same considerations. You anticipate that you will soon face competitors who *use 3D printers instead of employees* to create curios (beadwork, necklaces, kieries). These competitors will have lower wages to pay and therefore they will have lower production costs. You have written to the ministers in question. The ministers have since replied in writing that they see your problem as unfortunate, but that the subsidy scheme is already being implemented and cannot be stopped due to your situation.

How will you ensure that your curio shop remains competitive (in attracting and retaining customers) in the light of possible 3D-printed curio competitors? Note: You cannot reduce your price without reducing costs such as raw materials (e.g. wood, beads, etc.) and/or staff or reducing your profit (if costs are not reduced).