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**Enhancing suicide risk assessment through the use of visual
metaphor**

**A thesis presented in partial fulfillment of the requirements
for the degree of**

Master of Health Science

in

Psychology

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New Zealand

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QUOTATION

“Knowledge is a processing of piling up facts, wisdom lies in their
simplification”

Martin H. Fisher

“Tell me and I forget. Show me and I remember. Involve me, and I
understand”

A Chinese Proverb

ABSTRACT

Competent assessment and management of the risk of harm is a core competency that mental health professionals are expected to possess. However, despite this expectation, adequate training programs have been lacking for decades and, even when risk assessment training is provided, it is often reported as being insufficient. The literature indicates that training delivery methods often include passive and didactic methods during supervision or seminar sessions. To help enhance the learning of suicide risk factors, some authors proposed a visual metaphor that visually and metaphorically depicts all suicide risk factors. The main purpose of this study was to examine the efficacy of the proposed visual metaphor.

A pilot RCT was undertaken to test several hypotheses, all of which predicted that the visual metaphor would demonstrate superior effects when compared with the conventional textual teaching methods. A group of 22 psychology students were randomized into either a control group (who learnt suicide risk factors via the conventional textual teaching methods) or a treatment group (that learnt the risk factors using the visual metaphor in addition to the conventional textual teaching methods). Memory recall, knowledge transfer, cognitive load, and satisfaction were all tested at the end of the learning sessions.

Independent samples *t* tests indicated that the visual metaphor was effective in improving memory recall and knowledge transfer and reducing the cognitive load. The differences between the two groups' post-learning scores were significant in each of these outcome measures. The treatment group also expressed higher satisfaction levels in comparison to the control group. Overall the visual metaphor of suicide risk factors was found to be superior to the conventional teaching methods in teaching suicide risk

factors to university psychology students. Limitations, implications of this study and directions for future research are discussed.

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TABLE OF CONTENTS

QUOTATION.....	ii
ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES.....	ix
LIST OF FIGURES.....	x
LIST OF APPENDICES.....	xi
CHAPTER ONE: INTRODUCTION.....	1
1.1. Introduction.....	1
1.1.1. Rationale for the Present Study.....	4
1.1.2. Learning Styles.....	6
1.2. Research Questions, Hypotheses, and Objectives.....	9
1.2.1. Research Significance.....	11
1.2.2. Overview of Chapters.....	12
CHAPTER TWO: LITERATURE REVIEW.....	14
Part One: Suicide.....	14
2.1. Introduction.....	14
2.1.2. Global Suicide Statistics.....	15
2.1.3. New Zealand Suicide Statistics.....	17
2.1.4. Suicide Risk Factors.....	22
2.1.4.1. Static Risk Factors of Suicide.....	22
2.1.4.2. Dynamic Risk Factors of Suicide.....	23
2.1.5. Conclusion.....	27
Part Two: Visual Metaphor.....	28
2.2. Introduction.....	28
2.2.1. Visual Metaphor.....	28

2.2.2. Comprehension of Visual Metaphor.....	31
2.2.3. Visual Metaphor and Culture.....	36
2.2.4. Benefits and Limitations of Visual Metaphor.....	37
2.2.5. Conclusion.....	38
Part Three: Theoretical Framework: An Instructional Design Theory.....	40
2.3. Introduction.....	40
2.3.1. Cognitive Load Theory (CLT).....	40
2.3.2. Working Memory.....	41
2.3.3. Long-Term Memory, Schemas, and Learning.....	42
2.3.4. Components of CLT	43
Intrinsic Cognitive Load	44
Extraneous Cognitive Load.....	45
Germane Cognitive Load	45
2.3.5. Instructional Design Strategies Suggested by the CLT	46
2.3.6. CLT and the Current Visual Metaphor	47
2.3.7. Conclusion.....	48
CHAPTER THREE: METHODS	50
3.1. Introduction.....	50
3.2. Research Questions and Hypotheses.....	50
3.3. Study Design	51
3.4. Participant Recruitment.....	52
3.5. Measures	52
3.5.1. Introduction	52
3.5.2. Questionnaires	53
3.5.2.1. Demographic Survey	53
3.5.2.2. Memory Retention Test.....	53
3.5.2.3. Knowledge Transfer: Suicide Risk Vignette	54
3.5.2.4. The Paas Cognitive Load Rating Scale	55
3.5.2.5. Satisfaction Questionnaire	56
3.5.3. Development of the Visual Metaphor of Suicide Risk Factors	56
3.5.3.1. Challenges	70

3.6. Procedure	71
3.6.1. Random Allocation and Blinding	71
3.6.2. The Nature of the Teaching Content	72
3.6.3. Hands-on Procedure	73
3.7. Data collection.....	75
3.8. Data Analysis	75
3.9. Ethical Considerations.....	77
CHAPTER FOUR: RESULTS	81
4.1. Demographic Characteristics of Participants.....	81
4.2. First Dependent Variable: Memory Retention	83
4.3. Second Dependent Variable: Knowledge Transfer	84
4.4. Third Dependent Variable: Cognitive Load	85
4.5. Satisfaction Levels	86
CHAPTER FIVE: DISCUSSION and CONCLUSION.....	89
5.1. Introduction.....	89
5.2. Summary of the Findings.....	90
5.3. Discussion.....	90
5.4. Implications	96
5.5. Limitations of the Present Study.....	97
5.6. Recommendations for Future Research.....	99
5.7. Overall Conclusion.....	100
REFERENCES.....	101
APPENDICES	144

LIST OF TABLES

Table 1.	Highest Rates of Suicide by Country in 2012 -----	16
Table 2.	Lowest Rates of Suicide by Country in 2012 -----	17
Table 3.	Rates of Suicide by Year, Sex, and Age-Standardized Rates (2007-2012) --	18
Table 4.	Suicide Rates by Five-Year Age Group and Sex, 2012 -----	19
Table 5.	Suicide Deaths by Ethnicity, Life-Stage Group, and Sex, 2012 -----	20
Table 6.	Suicide Risk Factors -----	27
Table 7.	Activated Brain Areas While Comprehending Four Types of Metaphor ----	34
Table 8.	Static Suicide Risk Factor and Corresponding Visual Metaphors -----	65
Table 9.	Dynamic Suicide Risk Factors and Corresponding Visual Metaphors -----	66
Table 10.	Dynamic Suicide Risk Factors and Corresponding Visual Metaphors (continue) -----	68
Table 11.	Demographic Characteristics of Participants -----	81
Table 12.	Mean Scores and Standard Deviations of the Dependent Variables -----	87
Table 13.	Results of Independent Samples <i>t</i> Tests -----	88

LIST OF FIGURES

Figure 1.	Common methods used to commit suicide in 2012 -----	21
Figure 2.	An Example of visual metaphor -----	30
Figure 3.	A visual metaphor depicting Freud's concept; The Ego and the Id -----	31
Figure 4.	An example of a cultural-specific visual metaphor-----	36
Figure 5.	A diagram showing all phases involved in the current study -----	51
Figure 6.	Developmental process of the visual metaphor -----	57
Figure 7.	Initial draft of the visual metaphor of suicide risk factors-----	61
Figure 8.	A draft incorporating improvements based on the CLT design principles-----	62
Figure 9.	The visual metaphor undergoing further refinement -----	62
Figure 10.	Visual metaphor of static suicide risk factors -----	64
Figure 11.	Part one of dynamic suicide risk factors -----	65
Figure 12.	Part two of dynamic suicide risk factors -----	67
Figure 13.	The visual metaphor of suicide risk factors -----	69
Figure 14.	Random allocation carried out by a computer software-----	74
Figure 15.	Gender of participants -----	82
Figure 16.	Age of participants-----	82
Figure 17.	Ethnic groups of participants-----	83

LIST of APPENDICES

Appendix A.	The Visual Metaphor of Suicide Risk Factors	144
Appendix B.	Control Group Questionnaire	145
Appendix C.	Intervention Group Questionnaire	150
Appendix D.	Study Advertisement	155
Appendix E.	Participant Information Sheet	156
Appendix F.	Ethical Approval	160
Appendix G.	Permission to Use the Paas Cognitive Load Scale	161
Appendix H.	Publication {in press}	162

CHAPTER ONE: INTRODUCTION

The primary intention of this chapter is to provide some background information and discuss the rationale behind the current research project. The following themes are addressed: suicide; risk assessment as a core competency; the nature of available risk assessment training programs; barriers to appropriate suicide risk assessment; and learning styles. The second part of this chapter outlines the research's questions, hypotheses, objectives and significance. An overview of the thesis' chapters is also presented.

1.1. Introduction

Suicide, or intentional self-killing, is among the leading causes of death globally, resulting in the loss of approximately one life every 40 seconds worldwide (World Health Organization, 2014b). Suicide is also the second leading cause of death among people aged 15-59 (Mann et al., 2005; Pompili & Tatarelli, 2011), and it was also the second biggest cause of death among people aged 15-29 in 2012 (World Health Organization, 2014b). Furthermore, on the global scale, suicide accounts for about half of all violent and atrocious deaths in men and 71% in women (World Health Organization, 2014b). Although suicide rates vary internationally, it remains a significant health, and public and social concern, with an estimated loss of over 804,000 lives to suicide in 2012 (World Health Organization, 2014b). The global age-standardized suicide rate was around 11.4 per 100,000 population in 2012 (World Health Organization, 2014b). People aged 65 and over are amongst the highest risk groups for suicide worldwide, with a suicide rate of 22 per 100,000 population (Breitbart et al., 2000; Huh et al., 2012; World Health Organization, 2014b) and as the

aged population keeps growing, this rate may increase. With respect to age however, recent global suicide rates for young adults between the ages of 15-29 are causing alarm and serious concerns (American Psychological Association, 2015a; Ministry of Health, 2014, 2015a).

Suicide is a disastrous event to the victim, their families and communities, including the treating clinicians, and it is preventable (American Psychological Association, 2015b; Beautrais, Collings, Ehrhardt, & Henare, 2005; Beautrais, 2005; Haney et al., 2012; Large & Nielssen, 2012; Ministry of Health, 2015a; Pridmore & Walter, 2013; Schmitz et al., 2012; Walter & Pridmore, 2012; World Health Organization, 2014). The impact on close family and communities is significant and devastating, even long after their loved ones have taken their own lives (World Health Organization, 2014b). Suicidal behaviors also affect the attending mental health professionals, both emotionally and professionally (Cerel, Roberts, & Nilsen, 2005; Veilleux, 2011), with some clinicians reporting feelings of guilt, shame, and self-blame (Hendin, Lipschitz, Maltzberger, Haas, & Wynecoop, 2000; Kleespies, Penk, & Forsyth, 1993; Landers, O'Brien, & Phelan, 2010; Meichenbaum, 2005; Rothes, Scheerder, Van Audenhove, & Henriques, 2013) and fear of lawsuit (Mays, 2004; Tillman, 2006). This is even more profound for those in training (Kleespies et al., 1993).

Research indicates that up to 80% of suicidal patients warn or alert healthcare professionals before they attempt to harm themselves (Bongar et al., 1998; Sudak et al., 2007). Hence, suicide prevention has become imperative globally. All preventive measures start with a systematic risk assessment which, when performed well, is associated with improved management plan formulation, resulting in reduced suicide-related mortality (Beautrais et al., 2007; Bongar et al., 1998; Fenwick, Vassilas, Carter, &

Haque, 2004; Isaac, 2009; Mann et al., 2005; Shneidman, 2001; World Health Organization, 2014).

Patients presenting with suicidal ideation and intent is a frequent presentation and is one of the most anxiety-provoking clinical experiences for mental health professionals (David, Cukrowicz, & Bryan, 2008; Pompili & Tatarelli, 2011; Rudd, 2014) hence suicide risk assessment is considered a core competency that mental health professionals are expected to possess (American Psychiatric Association, 2003; David et al., 2008; Scheiber, Kramer, & Adamowski, 2003; Suicide Prevention Resource Center, 2006). With the absence of an adequate risk assessment, a valuable window for intervention is missed, leading to potentially adverse outcomes.

Assessing suicide risk in a clinical setting is not unique to the field of mental health, rather it is common across other specialties such as the medical and surgical fields. This fundamental skill is especially relevant when it is almost a certainty that psychologists, psychiatrists, counsellors, social workers and nurses will, at some point, need to assess patients with suicidal history, thoughts, or attempts during their training or career (Cramer, Johnson, McLaughlin, Rausch, & Conroy, 2013; David et al., 2008). This is important as about half of all suicides in any given year are by people who are receiving treatment (Ahmedani et al., 2014; Cruz et al., 2010; Fawcett, 1999; Luoma, Martin, & Pearson, 2002; Meehan et al., 2006). Two studies found that around half of all psychiatrists will lose at least one client to suicide during their careers (Chemtob, Hamada, Bauer, Kinney, & Torigoe, 1988; Ruskin, Sakinofsky, Bagby, Dickens, & Sousa, 2004), while around a quarter of counsellors had lost a patient during the course of therapy (McAdams & Foster, 2000). This highlights the significance of a suicide risk

assessment, conducted by mental health professionals, as a first step in achieving successful suicide prevention outcomes (Brunero, Smith, Bates, & Fairbrother, 2008).

1.1.1. Rationale for the Present Study

Although mental health professionals are expected to conduct a full suicide risk assessment, adequate training programs for such an essential skill have been lacking for decades (Cramer et al., 2013; Dexter-Mazza & Freeman, 2003; Schmitz et al., 2012; Sudak et al., 2007; Wheeler, Bowl, & Reeves, 2004). A number of studies have shown that only half of psychological trainees (Dexter-Mazza & Freeman, 2003; Kleespies et al., 1993) and community nurses (Davies, Amos, & Appleby, 2001) received risk assessment training. Similarly, a more recent study indicates that 88% of the total surveyed health professionals (232) reported having received no official training in suicide risk assessment and management (Palmieri et al., 2008). In addition, only a quarter of social workers received risk assessment training (Feldman & Freedenthal, 2006).

Similarly, a survey of 238 pre-doctoral psychology interns found that about 49.2% of interns reported that their training did not include any formal training regarding risk assessment (Dexter-Mazza & Freeman, 2003). Even worse, only 2-6 % of those on marriage and family therapy programs and counselling educational courses had risk assessment training (Wozny, 2005). In non-mental health nurses dealing with high-risk patients such as oncology patients, only 1.1 % had very good knowledge about suicide and suicide assessment skills (Valente, 2010; Valente & Saunders, 2004). Overall, even when risk assessment training was provided, it was reported, by training directors, psychological trainees, social workers and psychiatric residents, to be insufficient (Dexter-Mazza & Freeman, 2003; Thomas E. Ellis & Dickey, 1998; Feldman

& Freedenthal, 2006; Fenwick et al., 2004; Kleespies et al., 1993; Melton & Coverdale, 2009; Palmieri et al., 2008; Sudak et al., 2007).

Appropriate knowledge of suicide risk factors is the foundation for proper and accurate risk assessment (Bongar et al., 1998; Institute of Medicine, 2002; Palmieri et al., 2008; Pompili, 2011). Available training programs rely heavily on didactic teaching methods which might not be the most effective way of transferring knowledge about suicide risk factors into an applied clinical skill (Bloom, 2005; Schmitz et al., 2012). This is possibly due to the fact that providing information does not automatically translate into deep learning and thus developing risk assessment competency. The most popular methods of suicide risk assessment teaching, as identified by chief residents of psychiatry training programs in the USA, include formal teaching such as lectures, workshops and seminars, grand rounds, and case conferences, which often lack audio and/or video materials or relevant texts (Melton & Coverdale, 2009). A review of systematic reviews was carried out, that looked at studies concerning the effects of didactic programs and interactive education, among other methods, on improving clinical practice, it was concluded that didactic programs exhibited no-to-low effects, whereas, interactive programs demonstrated moderate-to-high effects (Bloom, 2005).

Barriers to appropriate suicide risk assessment have been documented in multiple studies (Bloom, 2005; Davies et al., 2001; Huh et al., 2012; Schmitz et al., 2012; Valente, 2002, 2011; Valente, 2010; Valente & Saunders, 2004). The most common barrier is a knowledge and skill deficit of risk assessment, this is not confined to one area of mental health services but rather is uniform across the field (Davies et al., 2001). For example, physicians and nurses reported poor recognition of suicide risk factors, limited and inadequate training, and the lack of time for both full evaluation and

attending comprehensive training (Bongar et al., 1998; Davies et al., 2001; Valente, 2010). This body of research suggests that there is an urgent need for improved training programs, ongoing education in suicide risk assessment and management that is interactive, supervised, regularly assessed, and utilizes various methods of teaching.

To conclude, undoubtedly suicide is a major public health issue, affecting people across nations and cultures and causing adverse effects on many levels including emotional, personal, familial and professional, to both family members and attending clinicians. Global and national suicide statistics are alarming for all ages, and for those between the ages of 15 and 29 years in particular. Knowledge of evidence-based risk factors, appropriate skills, and management training form the backbone for proper suicide risk assessment, which is of vital importance for suicide prevention. However, the literature shows that proper suicide risk assessment and management educational and training programs are lacking, even though health professionals are required to perform comprehensive risk assessment. Furthermore, the literature also indicates that most available programs are didactic in nature, with knowledge deficit of suicide risk factors among the main barriers to appropriate suicide risk assessment. Hence, improved educational and training programs that incorporate both auditory and visual methods of teaching suicide risk factors are warranted.

1.1.2. Learning Styles

The concept of learning styles refers to how individuals perceive, process, store, and retrieve information (Fleming & Baume, 2006; Hatami, 2013; Krätzig & Arbuthnott, 2006; Rogowsky, Calhoun, & Tallal, 2015; Romanelli, Bird, & Ryan, 2009). In the literature, learning styles are not explained in a concrete sense, but rather refer to individual preferences and tendencies of how people interact with learning materials.

Although, individuals have different learning styles, with some being visual, auditory, or kinesthetic learners, these preferences are not fixed or permanent modes of learning. Depending on the nature of the task and the learning content, individuals often tailor or modify their learning styles to maximize learning (Coffield, Moseley, Hall, & Ecclestone, 2004; Griffiths, 2012; Oxford, 2011; Reid, 1987, 1995).

In psychology, interest in learning styles dates back to the 1920s (Sternberg & Grigorenko, 1997) and in education, to the 1970s (Griffiths, 2012). Since then a significant amount of research has been devoted to investigating learning styles theoretically, conceptually and empirically, with many instruments developed along the way (Coffield et al., 2004). For example, the VARK questionnaire was first developed in 1987 by Neil Fleming, Christchurch, New Zealand (Fleming & Baume, 2006). According to the author, this instrument is based on a sensory model of how people receive and retrieve information, which categorizes learners into four main groups: auditory, visual, verbal (reading and writing), and kinesthetic learners. Other instruments also exist such as the Learning Style Inventory (Kolb, 1981); the Learning Style Questionnaire (De Vita, 2001; Honey & Mumford, 2001); and the Canfield Learning Style Inventory (Canfield, 1992). However, there is no universally accepted method or instrument of assessing learning styles (Romanelli et al., 2009). For a critical review of these learning styles instruments see (Coffield et al., 2004).

Proponents of learning styles assessment argue that identifying students' learning styles or preferences is beneficial (Blouin, Joyner, & Pollack, 2008; Fleming & Baume, 2006; Jham, Duraes, Strassler, & Sensi, 2008; Lubawy, 2003; Romanelli et al., 2009). They point out that knowing students' learning styles can help teachers, lecturers and others, match or tailor their teaching delivery modes to fit, as much as

possible, students' learning preferences, which in turn may lead to better motivation, attention and concentration and ultimately improve learning. However, opponents, although agreeing that there is ample evidence that individuals indeed have different learning styles, oppose the idea that matching learning content and delivery mediums to fit one's specific learning style enhances learning (Pashler, McDaniel, Rohrer, & Bjork, 2009; Riener & Willingham, 2010; Rogowsky et al., 2015; Rohrer & Pashler, 2012; Stahl, 1999; Willingham, 2005; Zacharis, 2011).

Pashler et al. (2009) conducted a critical review of the learning styles literature and concluded that "although the literature on learning styles is vast", "we found virtually no evidence" supporting the idea that "instruction is best provided in a format that matches the preference of the learner." Most of the reviewed studies suffered significant methodological limitations such as small size, confirmation bias, and selectively reporting findings, rendering them far from convincing. Others with an effective experimental design "found results that flatly contradict the popular" assumptions about learning styles (p. 105). The authors attribute the prevalence and popularity of learning styles instruments to the tremendous support that these instruments receive from "a thriving industry devoted to publishing learning-styles tests and guidebooks" and "professional development workshops for teachers and educators" (Pashler et al., 2009, p. 105).

In summary, learning styles do exist, and different people prefer different modes of presentation and learning (visual, auditory, reading/writing or kinesthetic). However, the supporting empirical evidence that matching educational activities to students' learning styles enhances learning is still lacking. Despite the lack of evidence, educators should consider incorporating visual, textual, and auditory components in

their teaching (multi-modal learning) to provide the opportunity for all individuals to learn through different modalities.

A colleague of mine and I have developed a visual metaphor of suicide risk factors (Visual Metaphoria, 2016) (for more information of the visual metaphor and its developmental process refer to sections 2.2. to 2.2.5.) (Appendix A). Based on the literature, we speculate that this visual metaphor would enhance learners' learning experience of suicide risk factors when used appropriately and effectively. This effect would be due to several properties of the visual metaphor including incorporating auditory, visual, and verbal stimuli and drawing on well-established theoretical framework. This visual metaphor has received some attention and there is a proposal paper currently in press at the Australasian Psychiatry Journal soon to be published (Appendix H).

1.2. Research Questions, Hypotheses, and Objectives

This research project looks at the efficacy of an innovative, recently developed, visual metaphor of suicide risk factors used as an adjunct to textual traditional teaching methods on first-year psychology students. This intervention will be compared to the sole use of traditional textual teaching methods. The purpose of the current research project is to answer and test the following questions and hypotheses:

Questions:

- 1- Does the use of a suicide risk factors visual metaphor influence students' memory retention of suicide risk factors?
- 2- Does the use of a suicide risk factors visual metaphor influence students' abilities to apply newly learnt materials to new suicide risk vignettes (knowledge transfer)?

- 3- Does the use of a suicide risk factors visual metaphor affect students' cognitive load while learning about suicide risk factors?
- 4- How are participants' overall satisfaction levels?

Hypotheses:

Students who are exposed to the visual metaphor of suicide risk factors will:

- 1- Demonstrate greater improvement in memory retention of suicide risk factors in comparison to the control group.
- 2- Show a better ability to apply the newly learnt materials to the suicide risk vignette, in comparison to the control group.
- 3- Report using less mental effort while learning about suicide risk factors, in comparison to the control group.
- 4- Report greater satisfaction levels in comparison to the control group.

Objectives:

The primary objectives of the current research are as follows:

- To examine the efficacy of the visual metaphor of suicide risk factors in teaching university psychology students suicide risk factors as measured by a memory retention test and a suicide risk vignette.
- To determine whether the visual metaphor of suicide risk factors influences the amount of mental effort (cognitive load) needed to learn suicide risk factors as measured by Paas Cognitive Load Rating Scale (Paas, 1992).
- To examine participants' satisfaction levels, as measured by a satisfaction survey developed by the author.

1.2.1. Research Significance

The significance of this research project lies within its area of study, suicide, which is a public and social concern. Recognition of suicide risk factors, risk assessment and management, and suicide prevention are interlinked, like three links in a keychain. Benefits from this research project, at the level of learning and recognizing suicide risk factors, can lead to further improvements in risk assessment and prevention. Firstly, at the societal level, the visual metaphor of suicide risk factors might benefit society by helping health professional trainees, mental health trainees, clinicians and other allied health professionals to remember, and ask about, all evidence-based risk factors when conducting risk assessment. This in turn might help identify those at high risk more effectively, and prevention strategies can then be designed to intervene.

Secondly, at the practitioner level, the visual metaphor of suicide risk factors might help bridge the gap in knowledge about suicide risk factors, and help learners to visually and metaphorically conceptualize suicide risk factors, rather than memorizing them from a list or table. This in turn will make the process of risk assessment much easier for both the clinician and the suicidal person, by allowing the interview or conversation to flow rather than going back-and-forth while ticking boxes. Furthermore, this study will be the first to examine the efficacy of the visual metaphor of suicide risk factors, which frankly has received some attention from clinicians and program leaders from various institutions, including Massey University, Auckland University, and Charles Darwin University. This visual metaphor employs various learning modalities, including visual and auditory, to cater for different learning styles of students. If proven effective, this visual metaphor can be used as a teaching and learning tool to enhance the conceptualization of suicide risk factors.

1.2.2. Overview of Chapters

Chapter One:

As aforementioned, chapter one of this thesis presents some background information. It also describes the rationale for the current research project, as well as outlining the research questions, hypotheses, objectives and significance. Finally, it provides an overview of the thesis.

Chapter Two:

Chapter Two is a literature review. Part one of the literature review highlights the importance of understanding suicide. The following themes are discussed: issues with suicide statistics and reasons for under-reporting, global suicide statistics, New Zealand suicide statistics, evidence-based suicide risk factors (static and dynamic risk factors), and the importance of suicide risk assessment and challenges that may hinder the process of competent risk assessment.

The second part of the literature reviews the importance of metaphor in general and visual metaphors in particular in the educational sphere. The following areas are discussed: visual metaphor, comprehension of metaphor, visual metaphor and culture, and benefits and limitations of using visual metaphor in the educational sphere.

Part three of this chapter provides a theoretical framework for the present research project, namely the Cognitive Load Theory. The relevance of this particular theory to the present research project is also discussed.

Chapter Three:

Chapter three describes the methodology for this research project. The following components are described: (a) study design, (b) research questions and hypotheses, (c) recruitment of participants, (d) measures used including questionnaires and the

developmental process of the visual metaphor of suicide risk factors, (e) procedure, (f) data collection, (g) data analysis, and (h) ethical considerations.

Chapter Four and Five:

Chapter four presents the results of the study. Chapter five provides a comprehensive discussion of the findings in context with previous research. Implications and limitations of the current research project are identified and discussed. The chapter ends with an overall conclusion of this research project and recommendations for future research.

CHAPTER TWO: LITERATURE REVIEW

Part One: Suicide

2.1. Introduction

Death is inescapable; it is a natural process of the human race. While this is true, suicide is less understood, despite its frequent occurrence throughout history, in all cultures (Kastenbaum, 2007; Khan & Mian, 2010; Lester, 2013). Although there is no single, universally accepted definition of suicide, the definition offered by many leading organizations including the World Health Organization (2015), American Psychological Association (2015), and Ministry of Health (2005, 2015), is that suicide is the act of purposely killing oneself.

However, this is not the only definition of suicide found in the literature, Silverman (2006) reported that there are as many as 15 frequently referenced definitions of suicide. Although these definitions vary based on their theoretical orientations, which stem from numerous disciplines such as psychology, psychiatry, sociology, public health and others, they share four essential characteristics. These include: (1) the outcome of the suicidal act is death; (2) the act is self-inflicted; (3) the intent of the act is to end one's life; and (4) at the time of the act, the person possesses a conscious awareness of the outcome (Silverman, 2006). This chapter is divided into three parts. Part one of the literature review will highlight the importance of understanding suicide. The following themes are discussed: issues with suicide statistics and reasons for under-reporting, global suicide statistics, New Zealand suicide statistics, and evidence-based suicide risk factors (static and dynamic risk factors).

2.1.2. Global Suicide Statistics

Prior to presenting the most up-to-date global and national statistics on suicide, it is fundamental to first mention that there appears to be a general consensus that under-reporting is a common issue when it comes to suicide (Andriessen, 2006; De Leo, 2015; Hawton, 1986; Kring, Johnson, Davison, & Neale, 2012; Pritchard & Hansen, 2014; Tollefsen, Hem, & Ekeberg, 2012). A number of reasons have been put forward to help explain why suicide may be under-reported. For instance, the criteria and classification systems (e.g. coroner's examination, necessity of a suicide note) that help determine whether someone has died by suicide may be too narrow and may differ between countries (Andriessen, 2006). Hawton (1986) also points out that the specified health professionals who decide whether or not a suicide has been committed vary depending upon the country (i.e. medical officers in the USA; coroners in the UK).

Furthermore, suicide verdicts are also influenced by various ethno-socio-cultural-religious factors in relation to how each country views suicide (Andriessen, 2006; Bhugra, 2012; Domino, 2005; Hjelmeland, 2011; Pritchard & Hansen, 2014). A current example of this is the Middle Eastern countries, where the majority of life aspects are guided by religion and cultural traditions, which strongly condemn suicide. Research indicates that there is a reluctance to report cases of suicide within Islamic nations (Colucci & Martin, 2008; Ineichen, 1998; Stack & Kposowa, 2011). Thus, these examples demonstrate that the true rate of suicide is likely to be under-estimated and hence these factors should always be kept in mind when evaluating suicide statistics.

Contrary to the preconceived belief that suicide is more prevalent in high-income nations, statistical evidence indicates that about 75% of all suicides occur in low-and middle-income countries (World Health Organization, 2014b). Generally, suicide rates

are three times higher for men than women in richer countries (3 to 1), whereas in low- and-middle-income nations the ratio is much lower, at 1.5 men for each woman who commits suicide (World Health Organization, 2014b). Given this however, suicide is a complex issue and even forbidden and illegal in some nations, and therefore suicide is likely to be under-reported, especially in countries without vigorous registration data. In these nations, suicide deaths may go uncounted. Countries with the highest and lowest suicide rates are reported in the most recent 2014 World Health Organization report on suicide titled *Preventing suicide: A global imperative*. However, for the sake of space, only the five highest and five lowest countries will be shown in Table 1 and 2.

Table 1

Highest Rates of Suicide by Country, Sex, and Age-Standardized Rates in 2012

Country	Sex	Number of suicides (All ages)	Age-standardized suicide rates (Per 100,000)
Guyana	Both sexes	277	44.2
	Females	72	22.1
	Males	205	70.8
Republic of Korea	Both sexes	17908	28.9
	Females	5755	18.0
	Males	12153	41.7
Sri Lanka	Both sexes	6170	28.8
	Females	1446	12.8
	Males	4724	46.4
Lithuania	Both sexes	1007	28.2
	Females	177	8.4
	Males	830	51.0
Suriname	Both sexes	145	27.8
	Females	32	11.9
	Males	114	44.5

Note: Adopted from World Health Organization (2014)

Table 2*Lowest Rates of Suicide by Country, Sex, and Age-Standardized Rates in 2012*

Country	Sex	Number of suicides (All ages)	Age-standardized suicide rates (Per 100,000)
Saudi Arabia	Both sexes	98	0.4
	Females	19	0.2
	Males	78	0.6
Syria	Both sexes	77	0.4
	Females	22	0.2
	Males	55	0.7
Kuwait	Both sexes	33	0.9
	Females	12	0.8
	Males	21	1.0
Lebanon	Both sexes	43	0.9
	Females	14	0.6
	Males	29	1.2
Oman	Both sexes	32	1.0
	Females	6	0.6
	Males	26	1.2

Note: Adopted from World Health Organization (2014)

2.1.3. New Zealand Suicide Statistics

Parallel to the rapid increase in global suicide rates, New Zealand's rate of completed suicides has also escalated since the late 1980s (Ministry of Health, 2005). In fact, according to the Ministry of Health (2005), suicide had become the second highest cause of death among people aged 15-24 by 1998. Recently published reports on suicide indicate that the New Zealand rate of suicide has been somewhat stable over the period of the last six years, with some variations, as shown in Table 3.

Table 3*Rates of Suicide by Year, Sex, and Age-Standardized Rates (Per 100,000) (2007-2012)*

Year	Male	Female	Sex Ratio (M: F)	Total of Deaths	Age-Standardized (Per 100,000)
2007	370	113	3.6:1	483	11.0
2008	366	131	2.9:1	497	11.2
2009	391	115	3.6:1	506	11.2
2010	380	142	2.7:1	522	11.5
2011	369	109	3.5:1	478	10.6
2012	404	145	2.8:1	549	12.2

Note: Adopted from Ministry of Health (2009, 2010, 2012a, 2012b, 2014, 2015a)

A recent suicide report released by the Ministry of Health (2015a) indicates that a total of 549 people died by suicide in 2012, equating to 12.2 deaths per 100,000 population as indicated in Table 3. Of these, 404 were male (18.1 per 100,000 males) and 145 were female (6.4 per 100,000 females). Both the male and female rates are slightly higher than they were in 2011; being 16.6 per 100,000 and 4.7 per 100,000 respectively. However, the male-to-female ratio has decreased from 3.5:1 in 2011 to 2.8:1 in 2012 (Ministry of Health, 2014, 2015a). Despite this modest ratio decline, male suicide rates have been consistently higher over time, compared to their female counterparts. This could be due to the fact that males often choose more potentially lethal means of suicide such as firearms and hanging, whereas females tend to use less deadly methods, including drug overdose (Callanan & Davis, 2011; Narishige, Kawashima, Otaka, Saito, & Okubo, 2014; Shah & Buckley, 2011).

Furthermore, with respect to age, as Table 4 illustrates, the suicide rate in 2012 declined with age. The rate was highest for the youth age group (15-24 years) at 23.3 per 100,000 youths, then for adults (25-44 years) at 15.8 per 100,000 adults, and finally at 12.9 per 100,000 for adults aged 45-64 years. The suicide rate was lowest for the older adults (65+ years) at 9.3 per 100,000. Overall, males had higher rates of suicide compared to counterpart females for every age group (Ministry of Health, 2015a).

Table 4

Suicide Rates by Five-Year Age Group and Sex, 2012

Age group	Male		Female		Total		% of all deaths
	Number	Rate	Number	Rate	Number	Rate	
5-9	1	0.7	0	0.0	1	0.3	3.3
10-14	7	4.7	5	3.5	12	4.2	25.0
15-19	54	33.7	23	15.2	77	24.7	44.5
20-24	53	30.9	20	12.6	73	22.1	37.4
25-29	39	26.0	11	7.4	50	16.7	30.9
30-34	22	16.4	11	7.7	33	11.9	18.4
35-39	31	23.2	11	7.5	42	15.0	17.8
40-44	50	33.6	10	6.1	60	19.2	14.1
45-49	37	24.5	12	7.4	49	15.6	7.2
50-54	32	21.6	13	8.3	45	14.8	4.8
55-59	22	17.1	8	5.9	30	11.4	2.6
60-64	14	12.0	6	5.0	20	8.4	1.2
65-69	8	8.6	2	2.0	10	5.2	0.5
70-74	11	15.1	1	1.3	12	7.9	0.4
75-79	12	23.8	3	5.2	15	13.8	0.4
80-84	5	13.6	3	6.4	8	9.6	0.2
85+	6	22.1	6	12.3	12	15.9	0.1
Total	404	18.1	145	6.4	549	12.2	1.8

Note: Adopted from Ministry of Health (2015a)

Rates are expressed as deaths per 100,000 population

As aforementioned, suicide was most common in the youth group (15-24 years) in 2012. A total of 150 New Zealand youths committed suicide (17.3 per 100,000 youths), of these 107 were males and 43 were females (32.3 and 13.8 per 100,000 respectively). The suicide rate for Māori youth was 2.8 times higher than non- Māori youth (48.0 and 17.3 per 100,000 respectively). This ratio has been consistently present over the 10 years period 2003-2012 (Ministry of Health, 2015a) .

In addition, with regards to ethnicity, the suicide age-standardized rate was highest for Māori at 17.8 per 100,000 Māori, compared with the European rate of 12.0 per 100,000 and Pacific people at 10.2 per 100,000 as shown in Table 5. Over the 10 years between 2003 and 2012, Māori suicide rates have been at least 1.2 times that of non-Māori suicide rates (Ministry of Health, 2015a). However, that being said, it should be mentioned that prior to 1995, the Māori suicide rate was generally lower than the non- Māori rate. The change in the suicide trend since then might be explained by the changes applied to the ethnicity coding system; from a biological concept to self-identification (Ajwani, Blakely, Robson, Tobias, & Bonne, 2003; Allan, 2001; Lang, 2002).

Table 5

Suicide Deaths by Ethnicity, Life-Stage Group, and Sex, 2012

Ethnicity	Sex	Life-stage age group					Total	Rate
		<15	15-24	25-44	45-64	65+		
Māori	Male	6	37	30	9	1	83	
	Female	3	24	9	1	0	37	
	Total	9	61	39	10	1	120	17.8
Pacific peoples	Male	0	7	7	5	1	20	
	Female	2	6	1	1	0	10	
	Total	2	13	8	6	1	30	10.2
Asian	Male	0	4	5	5	0	14	
	Female	0	2	1	4	2	9	
	Total	0	6	6	9	2	23	4.2

European & Other	Male	2	59	100	86	40	287	
	Female	0	11	32	33	13	89	
	Total	2	70	132	119	53	376	12.0
All ethnicities	Male	8	107	142	105	42	404	
	Female	5	43	43	39	15	145	
	Total	13	150	185	144	57	549	12.2

Note: Adopted from Ministry of Health (2015a)

Rates are expressed as deaths per 100,000 population

Finally, as Figure 1 illustrates, the most common methods used to commit suicide in 2012 were hanging, strangulation, and suffocation (62.8%), poisoning by solids and liquids (10.6%), other means (9.1), Firearms and explosives (8.4), poisoning by gases and vapours (8.2%), and submersion (0.9%) (Ministry of Health, 2015a). With respect to gender and method of preference, hanging, strangulation, and suffocation, as a group, was the most common method of suicide for both males (63.4%) and females (61.4%). The second most common method was firearms and explosives for males (10.9%), and poisoning by solids and liquids for females (22.8%) (Ministry of Health, 2015a).

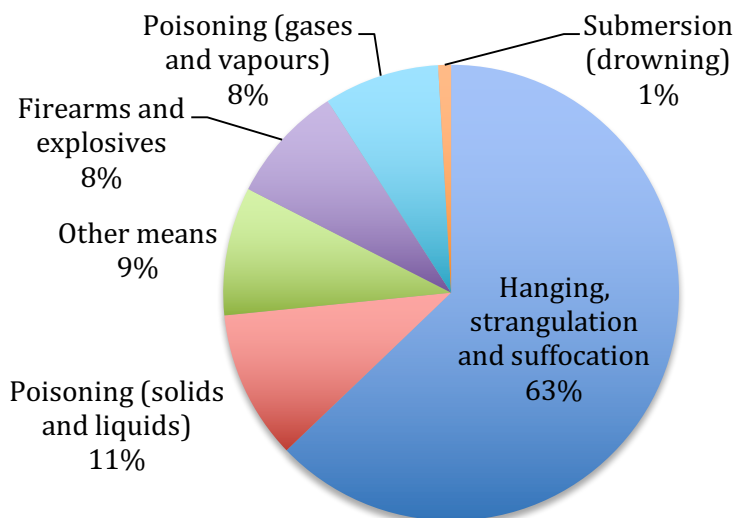


Figure 1. Common methods used to commit suicide in 2012

Note: Adopted from Ministry of Health (2015a)

2.1.4. Suicide Risk Factors

The concerns expressed about the issue of suicide have led to a dramatic increase in the volume of research, both internationally and locally, about the risk factors of suicide. Risk factors are defined as those attributes, characteristics, traits, life events, or experiences that can increase the likelihood of suicide. Evidence-based literature has identified and documented a number of suicide risk factors as shown in Table 6. Although the grouping of these factors into conceptually related domains varies between studies, static and dynamic grouping is how these risk factors will be grouped, as outlined below.

2.1.4.1. Static Risk Factors of Suicide

Static risk factors are those factors which cannot be changed and have limited implications for treatment (Rudd et al., 2006). These include:

- **Male Gender:** Males are more likely to commit suicide, whereas females are more likely to attempt suicide (Gaynes et al., 2004; World Health Organization, 2014b). The 2012 male-to-female ratio of completed suicide in New Zealand was 2.8:1.
- **Age:** An increased risk of suicide is associated with aging. People aged 65+, even those free from any mental illnesses, are amongst the highest risk groups for suicide worldwide (Harwood, Hawton, Hope, & Jacoby, 2006). However, recent suicide statistics indicate that young adults (15-29 years) are also at high risk.
- **Ethnicity:** The risk of suicide tends to be greater for indigenous people worldwide (US Department of Health and Human Services, 2001; World Health Organization, 2014b).

- **Past Suicide Attempts and Lethality:** Previous suicide attempts are the most robust risk factors and predictors of future completed suicide. A considerable proportion (up to 68%) of those who injure themselves deliberately in an attempt to end their own lives, die by suicide (Cooper et al., 2005; Phillips et al., 2002; Suominen et al., 2004).
- **Family History of Suicide:** A family history of suicidal behaviours is associated with increased risk of suicide (Brent & Mann, 2005; Cheng, Chen, Chen, & Jenkins, 2000; Runeson & Åsberg, 2003; Sarchiapone & D'Aulerio, 2014).

2.1.4.2. Dynamic Risk Factors of Suicide

Dynamic risk factors are those factors which can be modified and are often the target of intervention (Rudd et al., 2006). These include:

- **Issues with Sexual Identity:** Sexual minorities including gay, lesbian, bisexual, and transsexual are associated with an elevated risk of suicide attempts and completed suicide (Fergusson, Horwood, & Beautrais, 1999; Grossman & D'Augelli, 2007; Mathy, Cochran, Olsen, & Mays, 2009; Plöderl et al., 2013; Stone et al., 2013).
- **Social Isolation and Lack of Social Support:** Individuals who lack social support and are socially isolated are more vulnerable to suicide ideation and completed suicide in later life compared to those who have family affiliations and are involved in their communities (Alston, 2012; Fassberg et al., 2012; Phillips et al., 2002; Poudel-Tandukar et al., 2011).
- **Financial Struggle and Unemployment:** Long-term unemployment and insecure financial income are associated with increased incidence of suicide

(Cheng et al., 2000; Maki & Martikainen, 2012; Milner, Page, & LaMontagne, 2013; Norström & Grönqvist, 2015).

- **Bereavement and Changes in Relationship Status:** Loss of loved ones, changes to relationships status (divorced, widowed), and never being married are associated with elevated risk of suicide ideation, attempt, and completed suicide (Batterham et al., 2014; Luoma & Pearson, 2002; Pitman, Osborn, King, & Erlangsen, 2014; Roskar et al., 2011; Stroebe, Stroebe, & Abakoumkin, 2005).
- **Dysfunctional Upbringing and Childhood Adversity:** Early exposure to childhood adversities such as parental separation, dysfunctional family and environment, abuse (verbal, emotional or sexual), child neglect, and impaired parent-child relationships are associated with later suicidal behaviors (Brent, Baugher, Bridge, Chen, & Chiappetta, 1999; Fergusson, Woodward, & Horwood, 2000; Fortune, Stewart, Yadav, & Hawton, 2007; Hawton, Saunders, & O'Connor, 2012; Johnson et al., 2002).
- **Trouble with the Legal System:** Those facing legal issues and/or imprisonment are at elevated risk of suicide attempts (Beautrais, Joyce, & Mulder, 2000; Fazel, Grann, Kling, & Hawton, 2010; Shen et al., 2006).
- **Chronic Psychosocial Stressors:** Suicidal behaviors tend to be preceded by exposure to chronic psychosocial stressors such as shame, guilt, humiliation, bullying, loss, or threat (Bryan, Clemans, Leeson, & Rudd, 2015; Mathew & Nanoo, 2013).
- **Presence of Mental Illness:** Mental illnesses such as Major Depressive Disorder (MDD), bipolar disorder, anxiety disorders, schizophrenia, substance use disorder, and alcoholism are significantly associated with suicide ideation,

attempt, and completed suicide (Borges, Acosta, & Sosa, 2015; Hawton, Houston, Haw, Townsend, & Harriss, 2003; Phillips, 2010; Radomsky, Haas, Mann, & Sweeney, 1999).

- **Presence of Personality Disorders:** Personality disorders such as antisocial personality disorder, narcissistic personality disorder, and borderline personality disorder are found to elevate the risk of suicide with or without the presence of axis 1 disorders (Ansell et al., 2015; Baud, 2005; Reas, Pedersen, Karterud, & Rø, 2015).
- **Presence of Chronic Physical Illness:** A perception of poor health among people aged 15-54 years (Goodwin & Marusic, 2011); health impairments including lung cancer, genital cancer, epilepsy, heart diseases, chronic obstructive pulmonary disorders, liver diseases, and arthritis (Erlangsen, Stenager, & Conwell, 2015), and respiratory diseases, hypertension, and diabetes (Bolton, Walld, Chateau, Finlayson, & Sareen, 2015) in older adults are all associated with increased risk of suicide.
- **Access to Lethal Means:** Availability and ease of access to means of suicide such as firearms, poison, and gases appear to be associated with elevated risk of suicide (Mann et al., 2005; Sarchiapone, Mandelli, Iosue, Andrisano, & Roy, 2011; Skegg, Firth, Gray, & Cox, 2010).
- **Hopelessness:** Psychological and cognitive risk factors such as hopelessness, suicidal ideation, and suicidal intent are strongly associated with suicide in all ages, and more strongly if accompanied with depression and/or schizophrenia (Beautrais, 2004; Beck, Brown, Berchick, Stewart, & Steer, 2006; Brown, Jeglic, Henriques, & Beck, 2006; David, Kotov, Bakst, Rabinowitz, & Bromet, 2012; Jager-Hyman et al., 2014; Welton, 2007).

- **Alcohol and Substance Abuse:** Alcohol and substance abuse increase the risk of suicide (Bohnert et al., 2014; Schneider, 2009; World Health Organization, 2014b). In fact, 22% of the total deaths by suicide are due to alcohol abuse (World Health Organization, 2014a).
- **Suicide Plan:** People who verbalize a clear and detailed plans for suicide are at greater risk of suicide (Pope & Vasquez, 2011).
- **Help Seeking Behavior:** An unwillingness to seek help when needed increases the risk of suicide (Barnes, Ikeda, & Kresnow, 2002; Czyz, Horwitz, Eisenberg, Kramer, & King, 2013).
- **Suicide Note:** Writing a goodbye note or making changes to an existing will indicates higher risk of suicide, especially if the person is socially isolated and/or lives alone (Callanan & Davis, 2009; Cheung, Merry, & Sundram, 2015; Kuwabara et al., 2006). It is estimated that 15% to 40% of people who commit suicide leave a suicide note behind (Callanan & Davis, 2009).
- **Lack of Future Focused Goals:** Where a suicidal person lacks future oriented goals and plans, the risk of suicide is increased (Everall, Altrows, & Paulson, 2006; O'Connor, Fraser, Whyte, MacHale, & Masterton, 2008, 2009).

Table 6*Suicide Risk Factors*

Static Risk Factors	Dynamic Risk Factors			
Age (young/older adults)	Axis I disorders	Issues with the legal system	Changes in relationship status	Help seeking behavior
Gender (male)	Axis II disorders	Psychosocial stressors	Un-employment	Suicide note/changes in will
Ethnicity (indigenous people)	Axis III conditions	Alcohol and substance abuse	Hopelessness/suicide ideation and intent	Lack of future focused goals
Family history of suicide	Childhood adversity	Bereavement	Suicide plan	
History of attempted suicide	Issues with sexual identity	Social isolation/lack of social support	Easy access to means	

2.1.5. Conclusion

To conclude, undoubtedly suicide is a major public health issue, affecting people across nations and cultures and causing adverse effects on many levels including emotional, personal, familial and professional, to both family members and attending clinicians. Global and national suicide statistics are alarming for all ages, and for those between the ages of 15 and 29 years in particular. Knowledge of evidence-based risk factors, appropriate skills, and management training form the backbone for proper suicide risk assessment, which is of vital importance for suicide prevention.

Part Two: Visual Metaphor

2.2. Introduction

Traditionally, when someone speaks of metaphor, they are often referring to a verbal metaphor, which is defined as a figure of speech in which one person or object is conceptualized, represented or explained as something else. Therefore, a verbal metaphor entails two components: the 'target domain' and the 'source domain' (Lakoff & Johnson, 1980, 2003). To illustrate, consider the verbal metaphor discussed by Max Black: "Man is a wolf" (Black, 1979). In this example, the man, about whom something is conveyed, is the target domain and the wolf, a characteristic or concept that is used to describe the man (target), is the source domain. This being said however, verbal metaphor is not the only form of metaphor, there is also visual metaphor, in which both the target and the source domains are depicted pictorially (Coëgnarts & Kravanja, 2012). This second part of the literature review will highlight the importance of visual metaphor in the educational sphere. The following areas will be discussed: visual metaphor, comprehension of metaphor, visual metaphor and culture, and benefits and limitations of visual metaphor.

2.2.1. Visual Metaphor

Visual metaphor is commonly discussed in the current literature as a tool for knowledge visualization and organization (Burkhard, 2005; Burkhard & Meier, 2005; Eppler, 2006, 2013; Eppler & Burkhard, 2007; Lakoff & Johnson, 2003; Reisfield & Wilson, 2004; Stott, Mansell, Salkovskis, Lavender, & Cartwright-Hatton, 2010). According to Eppler (2006, p. 204), a visual metaphor is defined as *"a graphic structure that uses the shape and elements of a familiar natural or man-made artefact or of an easily recognizable activity or story to organize content meaningfully and use the*

associations with the metaphor to convey additional meaning about the content". Visual metaphors are common in our daily lives, for example the icons and images used within computer and smart phone user interfaces. People of all ages, who use digital devices, instantly recognize the recycle bin or Microsoft Word icons and many others, which visually represent various computer functions (Alyami, Sundram, Hill, Alyami, & Cheung, 2015).

Visual metaphors are also found in advertisements, newspapers, campaigns and scientific literature. For instance, 'tip of the iceberg' is a visual metaphor frequently used to describe that something being discussed, encountered, felt, or experienced is a relatively small proportion of a much larger concept, situation or problem that remains unexplored (Schuman, Rowe, Glazer, & Redding, 1977). Furthermore, verbal metaphors and their visual counterparts are also commonly used in scientific writings (Robson, 1985), medicine (Marcos, 1997), biology (Shilo, 2013), physiology (Paton, 1992), chemistry (Bhushan & Rosenfeld, 1995), psychiatry (Alyami et al., 2015), psychology (Nash, 1962; Stott et al., 2010), computer science (Carroll & Mack, 1985; Petre & Blackwell, 1999; Stützle & Sajaniemi, 2005), and films (Forceville, 2015).

In his book titled *Pictorial Metaphor in Advertising*, Forceville (1996) argued that a visual metaphor must have a minimum of three main characteristics to be labelled as 'visual metaphor'. First, it must have two domains, representing two different categories; second, one of those domains is identified as the target domain (the subject of the visual metaphor) and the other is the source domain (the concept that is utilized to convey something about the target); and third, the source domain must have one or more characteristics that can be mapped onto or attributed to the target domain. For example, consider Figure 2.



Figure 2. An Example of visual metaphor
Note: Adopted from (Media Bistro Network, 2016)

The obvious point of this metaphor is that ‘smoking kills’, with a cigarette that is visually depicted along with some bullets. Since the target (cigarette) and the source (bullet) domains are pictorially shown, interpretation of the metaphor is already given, namely that a cigarette is like a bullet; they both share a common characteristic, which is that they both cause death. However, returning to Forceville’s argument, can this metaphor be labelled as ‘visual metaphor’? The answer appears to be affirmative, simply because the metaphor meets all three prerequisite conditions. The image contains two different domains reflecting two different concepts that are portrayed as an image. One of those domains is the target domain (cigarette), about which the image appears to make a statement, and the other is the source domain (bullet) that is used to convey a statement about the target. In interpreting the metaphor, one feature of the source domain in particular, lethality or deadliness, is transferred on to the target.

Until recently research mainly aimed to study verbal metaphors (Refaie, 2003), in part due to the prominence of the print culture, which is dominated by written texts (St. Clair, 2000). Despite this intellectual neglect of the importance of visual metaphor, visual metaphors have been used effectively to comprehend, teach, and explain some of the most complex and abstract concepts. For example, in psychology Sigmund Freud used metaphor to conceptualize the relationship between the Ego and the Id as a horse and its rider. Freud stated that “... *the Ego... in its relation to the Id it is like a man on horseback, who has to hold in check the superior strength of the horse*” (Freud, 1923). To visually conceptualize Freud’s concept, consider Figure 3.

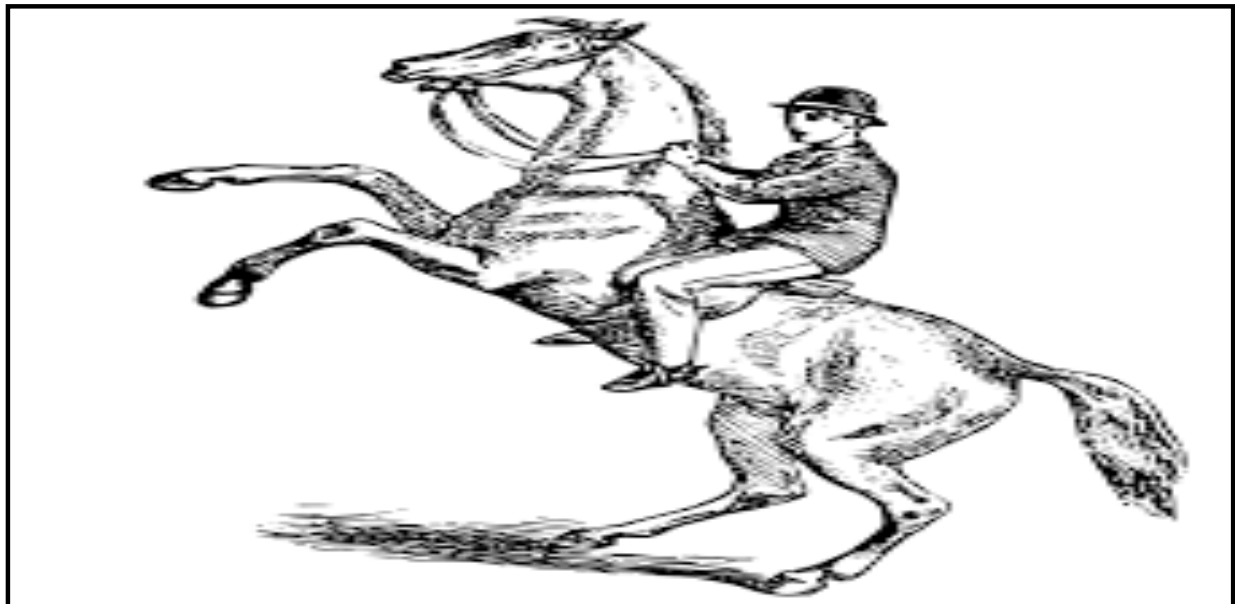


Figure 3. A visual metaphor depicting Freud's concept; The Ego and the Id

2.2.2. Comprehension of Visual Metaphor

On a neuropsychological level, research into the comprehension of metaphor began in the late 1970s (Winner & Gardner, 1977). The majority of this neuroimaging research has focused on investigating which regions of the brain are functional during verbal metaphor comprehension (Brownell, Potter, Michelow, & Gardner, 1984; Brownell, Simpson, Bihrlé, Potter, & Gardner, 1990; Kacirik & Chiarello, 2007; Mashal,

Faust, & Hendler, 2005; Mashal, Faust, Hendler, & Jung-Beeman, 2007, 2008; Pobric, Mashal, Faust, & Lavidor, 2008; Rinaldi, Marangolo, & Baldassarri, 2004; Winner & Gardner, 1977). However, systematic neuroimaging studies on visual metaphor comprehension are rather limited (Ojha, 2013).

Research in this area has extensively looked at the hemispheric difference (both language and visual regions) with respect to the comprehension of verbal metaphors. It is first worth mentioning that metaphor comprehension is a rather complicated process involving a number of brain regions including imagery, visuospatial perception, language, and others. The left hemisphere (LH) of the brain is known for processing linear, language-based information (e.g. syntax and phonology), whereas the right hemisphere (RH) is responsible for spatial and holistic processing and creative tasks (e.g. image processing and contextual understanding) (Faust & Weisper, 2000; Shibata, Abe, Terao, & Miyamoto, 2007; Springer & Deutsch, 1997). Therefore, it is suggested that the RH plays a significant role in metaphor comprehension, which a number of scholars have established.

For example, Winner and Gardner (1977) conducted an experiment using visuo-verbal modality tests on four groups: (1) patients with RH damage, (2) patients with LH damage, (3) patients with dementia, and (4) normal people. Participants were asked to listen to metaphorical sentences as they were read to them, and match them with the closest corresponding image of either the correct metaphorical meaning, literal meaning, the adjective included in the metaphor, or the noun included in the metaphor. Their main finding was that patients with RH damage often selected images representing the literal meaning of the metaphorical sentences over the appropriate metaphorical image. The authors attributed this tendency to the well-known

manifestations of RH damage including insensitivity to context, visuospatial and visuo-perceptual difficulties (Winner & Gardner, 1977).

In addition, years later Rinaldi et al. (2004) conducted a similar study in which they examined metaphor comprehension in 50 patients with RH damage in comparison to a control group of normal people, using both verbal and visuo-verbal materials. Results showed that patients with RH damage performed well in the verbal condition (73%), however, their performance dropped down to (51.2%) in the visuo-verbal condition. More importantly, the majority of the incorrect answers in the visuo-verbal condition were literal. It was concluded that although patients with RH damage retained the ability to comprehend metaphor to some degree, the tendency to give literal responses in the visuo-verbal condition was due to the RH damage (Rinaldi et al., 2004).

In a similar vein, based on the divided visual field paradigm, Faust and Mashal (2007) assessed the role of the RH of the brain in metaphor comprehension using four types of metaphor taken from poetry (literal, conventional, novel metaphors, and pairs of unrelated words). Participants were presented with these metaphors and asked to do a semantic judgment task in two Stimulus-Onset Asynchrony (SOAs) parameters (400ms and 1100ms). The main finding supported the significant role of RH in metaphor comprehension and showed that responses were faster and more accurate when metaphors were presented to the left visual field (processed in the RH of the brain), but only for novel metaphors (Faust & Mashal, 2007). That being said however, the debate continues in the literature about the decisive role of the RH of the brain in metaphor comprehension, with some studies reporting no hemispheric differences in metaphor comprehension (Bottini et al., 1994; Faust & Weisper, 2000; Giora, Zaidel, Soroker, Batori, & Kasher, 2000; Kacirik & Chiarello, 2007). For example, in their

experiments, Kacinik and Chiarello (2007) showed that both hemispheres of the brain are involved in metaphor comprehension via different mechanisms.

Returning to visual metaphor, as mentioned above, research into the comprehension of visual metaphor specifically is scarce. A review of the literature shows just one piece of research has investigated whether both verbal and visual metaphors activate the same brain regions and whether the RH of the brain also plays a major role in visual metaphor comprehension (Ojha, 2013). In this study five participants were sent into an fMRI scanner, where they were each shown 32 stimuli via a computer screen mounted at the head coil. Types of stimuli presented included literal verbal (8 sentences), metaphor verbal (8 sentences), metaphor visual (8 pictures), and literal visual (8 pictures). Participants were asked whether the stimulus was literal or metaphorical (Ojha, 2013). The main findings of this study are shown in the table below.

Table 7

<i>Activated Brain Areas While Comprehending Four Types of Metaphor</i>		
	Verbal	Visual
Literal	Putamen Insula (R)	Precuneus (L)
	Frontal-temporal space (R)	Putamen Insula (R)
	Precuneus (R)	Transverse temporal gyrus (R)
	Occipital lobe lingual gyrus (L)	Inferior frontal gyrus (R)
	Anterior lobe, Culmen (L)	Cingulate gyrus (L)
	Inferior frontal gyrus (L)	Midbrain (R)
	Occipital lobe, fusiform gyrus	Occipital lobe, Cuneus (L)
Metaphor	Temporal lobe, Sub gyral (R)	Putamen (L)
	Frontal lobe, Sub gyral (R)	Sub-lobar white matter (L)
	Thalamus (R)	Insula (L)
	Caudate (L)	Frontal lobe, Sub gyral (L)
	Middle temporal gyrus (L)	Parahippocampal gyrus (R)

Clastrum (R)	Superior temporal gyrus (L)
Putamen (R)	Precuneus (L)
Inferior temporal gyrus (R)	

Note. Adopted from (Ojha, 2013). R= Right hemisphere, L= Left hemisphere

With regards to the first part of the question, whether verbal and visual metaphor comprehension share the same areas in the brain, findings are inconclusive. It was reported that certain areas are activated in both conditions, but these areas are contralateral. For instance, during verbal and visual metaphor comprehension, the frontal lobe gyral is stimulated, but in the visual metaphor condition it is in the left hemisphere, whereas it is in the right hemisphere in the verbal metaphor condition. Also, the putamen is highly activated and the same condition applies here too (opposite hemispheres). Some other areas such as the right parahippocampal gyrus are only activated during the visual metaphor comprehension task (Ojha, 2013) as shown in Table 7.

Furthermore, to answer the second part of the question (whether the RH of the brain plays a major role in visual metaphor comprehension), findings do not support such a hypothesis. Comprehension of visual metaphor tends to activate areas in the LH rather than the RH, except the right parahippocampal gyrus. The author stated, *“if we consider right parahippocampal gyrus being mainly responsible for visual metaphor comprehension, then our data suggests that the right hemisphere is uniquely responsible for visual metaphor processing”* (Ojha, 2013, p. 114). These findings must be treated with caution due to the relatively small size employed.

2.2.3. Visual Metaphor and Culture

Although there are some similarities, verbal metaphors vary across cultures as well as within cultures as does visual metaphor (Bresciani, Eppler, Kaul, & Ylinen, 2011; Hooft, Mulken, & Nedertigt, 2013; Kovecses, 2005). This reflects cultural, ethnic, social, and religious variations, both across cultures and within a given culture, which play a vital role in interpretation of the metaphor. Hence, a visual metaphor may imply different connotations to different people in different cultures. For example, consider Figure 4. For those who are unfamiliar with the Indian culture, the image may be difficult to comprehend and might be interpreted literally as ‘a group of Indian women circling around an electricity pole’. However, for the Indian people this image conveys a religious ritual, in which women circle around a tree 108 times while tying a thread around its trunk. Metaphorically speaking, the electrical pole represents a tree and the barren land represents the absence of green land, carrying several connotations, one of which is that deforestation leaves no trees to worship.



Figure 4. An example of a cultural-specific visual metaphor

2.2.4. Benefits and Limitations of Visual Metaphor

Several scholars have pointed out a number of benefits when using visual metaphor as a tool to facilitate learning and knowledge organization and sharing (Burkhard, 2005; Coyne, 1995; Eppler, 2006; Eppler & Burkhard, 2007; Hanson, 1994). Visual metaphor enhances cognitive abilities due to its ability to optimally organize and structure the content (Read, Cesa, Jones, & Collins, 1990; Suthers & Hundhausen, 2003) and to *“reduce cognitive load, enhance representation of relationships among complex constructs, and provide multiple retrieval paths for accessing knowledge”* (O’Donnell, Dansereau, & Hall, 2002, p. 71). Furthermore, although visual metaphor is not the only tool for knowledge visualization and organization, it has great benefits over other tools. According to Eppler (2006) and Hanson (1994) well-designed and well-presented visual metaphors have low-to-medium levels of difficulty and high levels of understandability and memorability compared to concept mapping and conceptual diagrams. Other advantages include superior engagement with audience and enhanced attention, comprehension, and memory (Eppler, 2006).

Visual metaphors also help learners incorporate newly-learned material into prior knowledge (Burkhard, 2005; Eppler, 2006) and hence foster learning and knowledge transfer. It has been demonstrated that verbal metaphors (Coyne, 1995; Lakoff, 1993; Lakoff & Johnson, 1980), and visual metaphors (Refaie, 2003; Reisfield & Wilson, 2004) are fundamental cognitive processes and products of thought as well as language, and hence can be utilized in learning. In the same vein, visual metaphor simplifies complex and abstract scientific concepts by organizing the content in a meaningful way and using simple and familiar visual symbols (Andrew Ortony, 1993). Moreover, another benefit of visual metaphor is that it allows knowledge and information to travel across cultures (Bresciani et al., 2011). This could be attributed to the fact that well-designed

visual metaphors reduce the use of written communication to a minimum or even none, hence eliminating ambiguity.

Nonetheless, the use of visual metaphors in the educational sphere also has its limitations. Primarily, developing a novel and innovative visual metaphor to conceptualize a complicated scientific principle is a complex process that consumes time and energy, and requires countless attempts at designing and re-designing (Alyami et al., 2015). Secondly, visual metaphors are susceptible to misinterpretation, which could then cause perceptual error (Jeong, 2008). It is for this reason that some authors have suggested that visual metaphors should be accompanied by written or verbal descriptions to avoid misconceptions (Alyami et al., 2015). Thirdly, once developed, visual metaphors can be difficult to modify or extend in order to incorporate new materials (Eppler, 2006). In addition, visual metaphors are prone to deflecting attention from their content, leading the viewer to assume inaccurate associations (Cornelissen, Kafouros, & Lock, 2005; Eppler, 2006; Tufte, 1990). Finally, other limitations of visual metaphors are that they may appear too light-hearted, can be manipulative, lose their effects if overused (Coyne, 1995; Morgan, 1997) and can be difficult to comprehend by people with special needs, such as those with Autistic Spectrum Disorder (Rundblad & Annaz, 2010), or learning disabilities (Mashal & Kasirer, 2012a, 2012b).

2.2.5. Conclusion

The use of visual metaphors in teaching students and health professionals, especially those at the front-line, about suicide risk factors may prove valuable since one of the main barriers to proper risk assessment is knowledge deficit. Given the diversity, technological advances, learning styles, and cultural differences among learners, education providers are constantly challenged to keep the learning

environment and materials interesting and stimulating. Visual metaphor provides a solution to this challenge and enhances learning abilities by several means: allowing faster recall and retrieval of knowledge, structuring and presenting information in a way that allows the learner to make associations between the newly learnt material and prior knowledge, as well as conveying information more effectively across ages and cultures.

Part Three: Theoretical Framework: An Instructional Design Theory

2.3. Introduction

In the modern age, learners are expected to absorb and understand more information in a relatively short time. The amount of available knowledge is vast and expected to double in less than five years, and by 2020 such a growth rate in knowledge will continue every 73 days (Costa, 2006). Accompanying this massive expansion in knowledge are proportional distress and information overload, both highly likely outcomes for many learners. Hence, it is of paramount importance that educators incorporate educational interventions to address these issues. These interventions should be robust and based on strong theoretical frameworks that stem from various disciplines concerned with the concept of effective learning, including mainstream education, cognitive science, educational psychology, and cognitive psychology. One of the most influential theories of information processing is the Cognitive Load Theory (Jong, 2009; Khalil, Paas, Johnson, & Payer, 2005; van Merriënboer & Sweller, 2010). This third part of the review will discuss the theoretical framework of this research project, the Cognitive Load Theory in particular, and its relation to working memory, long-term memory, schemas, and effective learning.

2.3.1. Cognitive Load Theory (CLT)

The Cognitive Load Theory (CLT) was initially developed in the late 1980s (Sweller, 1988, 1989, 1994; Sweller, van Merrienboer, & Paas, 1998), and has since undergone further development (van Merrienboer & Sweller, 2005). The CLT is defined as *“a universal set of learning principles that are proven to result in efficient instructional environments as a consequence of leveraging human cognitive learning processes”* (Clark, Nguyen, & Sweller, 2011, p. 7). It is an instructional theory of learning informed by our

knowledge and understanding of the cognitive architecture of memory, including working memory, long-term memory and cognitive schemas (Sweller, 1988; Sweller & Chandler, 1991; Sweller et al., 1998; van Merriënboer & Sweller, 2010). Therefore, to understand the relevance of the CLT to this research project, it is important to first briefly discuss the architecture of memory.

2.3.2. Working Memory

The term 'cognitive load' refers to the amount of mental activity imposed on working memory at any given time (Sweller, 1988; Sweller & Chandler, 1991; Sweller et al., 1998). Working Memory (WM) is responsible for processing and storing information received through different modalities (Baddeley, 1992; Sweller et al., 1998). According to Baddeley (1992) and Baddeley and Hitch (1974), WM consists of three components: (i) 'a visuospatial scratch pad' which processes visuospatial information; (ii) 'a phonological loop' responsible for processing verbal information; and (iii) 'a central executive component' which maintains attention and coordination processes and oversees the two aforementioned components. The functional capabilities of the WM are essential in carrying out cognitive processes including reasoning, learning and critically evaluating information (Sweller et al., 1998).

Nonetheless, the WM has limits in the amount of information that it can process and store. With respect to the storage capacity Miller (1956), in his famous article '*The Magical Number Seven*', pointed out that the WM can only store up to seven items (e.g. digits, letters, or spatial positions) plus or minus two (7 ± 2). More recently it was shown that the storage capacity of the WM is about four items, at any given time when rehearsal is actively avoided (Cowan, 2001; Cowan, 2010). In addition, the processing capacity is even more limited to two or three items of information simultaneously

(Sweller, Ayres, & Kalyuga, 2011; Sweller et al., 1998). The duration of WM is also fairly limited, novel information is held for a few seconds and is lost after 20 seconds unless information is rehearsed (Peterson & Peterson, 1959).

The CLT recognizes the limitation of WM and suggests that learning can be improved by reducing the cognitive load imposed on WM through the use of multiple instructional strategies to enhance both the presentation and delivery of the teaching materials (Mayer & Moreno, 2003; Sweller et al., 1998; van Merriënboer & Sweller, 2010; van Merriënboer & Sweller, 2005). For example, redundant visual and textual information should be eliminated from the visual metaphor thus reducing the cognitive load and ultimately freeing up some of the limited cognitive resources to be used to enhance learning. Another solution suggested by the CLT to deal with the limited cognitive resources of the WM, is to chunk related information together, which in turn will be processed and stored as one item, using one cognitive resource rather than multiple resources, thus reducing cognitive load and optimizing learning (Chandler & Sweller, 1991; Sweller, 2006; Sweller et al., 1998; van Merriënboer & Sweller, 2010).

2.3.3. Long-Term Memory, Schemas, and Learning

Information processed through the WM is then transferred to the Long-Term Memory (LTM). In contrast to the WM, the capacity of the LTM is unlimited and it can store information indefinitely (Cowan, 2008; Freberg, 2009). Therefore, the CLT suggests that the LTM is the memory component where learning occurs, because new information is assimilated and processed in the WM, then transferred to the LTM for later use (Sweller et al., 2011, 1998). Furthermore, learners hold cognitive schemas within the LTM, which expands its storage capacity further. A schema can be defined as domain-specific knowledge within the LTM (Brewer & Treyens, 1981; Kalyuga,

Chandler, Tuovinen, & Sweller, 2001). These schemas differ in terms of their complexity and automation (van Merriënboer & Sweller, 2010). According to the Schema Theory, cognitive schemas allow the learner to organize related information in a meaningful way, making it able to be recalled later, and thus reduces WM cognitive load (Bartlett, 1932; Chi, Glaser, & Rees, 1982; Piaget, 1928). This is accomplished when all related information (schema) is processed by the WM, or recalled from LTM, as one element rather than multiple elements (Kirschner, 2002; Sweller, 1988; Sweller et al., 2011, 1998; van Merriënboer & Sweller, 2010). This is another solution to bypass the limited capacity of the WM.

2.3.4. Components of CLT

Based on the discussion of the architecture of memory above, the CLT makes a number of assumptions. These are: (i) the processing and storing capacity of the WM are limited, (ii) the LTM is unlimited, (iii) learning is the accumulation of knowledge and occurs in the LTM, (iv) cognitive schemas permit information to be organized in a meaningful manner, (v) cognitive schemas increase the storage capacity of the LTM even further, (vi) schemas allow processed information to be retrieved in chunks, rather than as individual entities, at any time (Chandler & Sweller, 1991; Clark et al., 2011; Sweller, 1988; Sweller et al., 2011, 1998).

The theory is concerned with *“the manner in which cognitive resources are focused and used during learning and problem solving”* (Chandler & Sweller, 1991, p. 294). In order for information to be stored in the LTM, and because the WM is limited, both in duration and capacity, it must first be processed by the WM. According to the theory learning is impeded by such limitations (Clark et al., 2011; Sweller, 1988; Sweller et al., 2011). The CLT proposes that the WM, and hence learning, is affected by three

types of cognitive loads, namely the intrinsic, extraneous, and germane cognitive loads (Paas, Renkl, & Sweller, 2004, 2003; van Merriënboer & Sweller, 2005). Ideally, negative factors that might impede the function of the WM should be minimized, while positive factors are maximized to enhance learning and ultimately, intellectual performance. The three types of cognitive loads are discussed below.

Intrinsic Cognitive Load

Intrinsic cognitive load refers to the *“mental work load imposed by the complexity of the content”* to be learned (Clark et al., 2011, p. 9). An element is defined as *“anything that has been, or needs to be learned”* (Sweller et al., 1998, p. 259). This type of load is determined by the number of elements to be processed simultaneously in the WM, which in turn depends on the interactivity between these elements. Element interactivity refers to the extent that individual elements within the received information can or cannot be processed or understood in isolation (van Merriënboer & Sweller, 2010). Hence, intrinsic cognitive load is dependent on the level of interactivity and connectedness between elements to be learnt. The CLT states that intrinsic load should be managed as much as possible (Sweller et al., 2011).

Teaching material with a high element of interactivity requires a huge effort to be learned, is difficult to understand, and imposes high cognitive load on the WM. This is because the WM must process multiple elements at the same time, and may be more than what the WM can handle (Clark et al., 2011; Sweller, 2010; Sweller, 1994; Sweller et al., 1998; van Merriënboer & Sweller, 2010; van Merriënboer & Sweller, 2005). Initially, intrinsic cognitive load was thought to be unable to be modified because it was an inbuilt feature of the material to be learnt (Sweller, 1994). Indeed this still holds true, but in recent years Clark et al. (2011), Sweller (2010), and van Merriënboer and

Sweller (2010) reported that intrinsic cognitive load can be reduced if the learner develops and uses cognitive schemas. As mentioned above, cognitive schemas organize large amounts of information in a meaningful way and allow their processing and retrieval as one element. Schemas are stored in the LTM and when the WM is processing multiple elements with high interactivity, instead of dealing with such elements individually and occupying all cognitive resources, schemas are brought to the WM from the LTM to deal with the new information (Paas et al., 2003).

Extraneous Cognitive Load

Extraneous load imposes a mental load on the WM by irrelevant or inadequate instructional design of the learning objectives; the authors defines it as *“the manner in which the tasks are presented”* (van Merriënboer & Sweller, 2010, p. 87). Like the intrinsic load, extraneous load is also determined by the element of interactivity but some interactive elements are modifiable since they are controlled by the instructor, teacher, or developer. According to the theory, extraneous (irrelevant) load results in overload and confusion and interferes with the process of developing schema, hence impeding learning (Chandler & Sweller, 1991; Clark et al., 2011; Sweller, 2010; Sweller, 1988). Therefore, it is important that educators take into account this type of load and design their instructions appropriately, in ways that improve WM and schema construction. The CLT posits that, given the limited capacity and duration of the WM, extraneous cognitive load should be minimized as much as possible (Chandler & Sweller, 1991).

Germane Cognitive Load

Finally, germane load refers to the amount of learning that actually takes place (Chandler & Sweller, 1991; Sweller, 1988; van Merriënboer & Sweller, 2005). Put

another way, germane load is the effort devoted by the learner to acquiring and developing cognitive schemas. As discussed above, cognitive schemas promote learning. The aim of CLT is not merely to decrease the cognitive load imposed on the WM, but to effectively allow the WM to function to its full extent by managing the necessary cognitive load (intrinsic), reducing the irrelevant load (extraneous), and maximizing the germane load (Sweller, 2010; Sweller et al., 2011).

2.3.5. Instructional Design Strategies Suggested by the CLT

The CLT puts forward a number of design principles aimed at reducing extraneous cognitive load, managing intrinsic cognitive load, and increasing germane cognitive load, hence preventing information overload while optimizing learning. It is important to mention that all design principles are evidence-based (for review, see Sweller et al., 2011). These principles are briefly outlined below.

Reducing the extraneous load:

- 1- *The worked-example principle:* Provide learners with completed worked examples (Renkl, 2005).
- 2- *The split-attention principle:* Avoid split-attention effect, both spatially and temporally, and use a single integrated source of information (Ayres & Sweller, 2005).
- 3- *The modality principle:* Utilize multimodal explanatory statements (visual and auditory) as appropriate to avoid overloading the visual and/or auditory processing unit in the WM (Low & Sweller, 2005).
- 4- *The redundancy principle:* Avoid re-describing the same material using different modalities (e.g. same information presented both visually and textually concurrently) (Sweller, 2005).

Managing the intrinsic load:

- 5- Commence with materials that have low element interactivity and move gradually towards materials with high element interactivity (Pollock, Chandler, & Sweller, 2002).

Increasing the germane load:

- 6- Encourage schema construction (Sweller, 2010; van Merriënboer & Sweller, 2010).
- 7- *The variability principle*: Use varying examples rather than examples with identical features (Paas & van Merrienboer, 1994).
- 8- Employ creative imagination, self-explanation, and task randomness (Leahy & Sweller, 2004).

2.3.6. CLT and the Current Visual Metaphor

Psychology students, nurses, social workers, psychologists, psychiatrists and other professionals involved in the mental health area all learn about suicide risk factors, assessment, and management. However, the literature shows that the main barrier to competent suicide assessment, leading to the possibility of improved prevention is a knowledge and skill deficit (Bloom, 2005; Huh et al., 2012; Schmitz et al., 2012; Valente, 2010; Valente & Saunders, 2004). Targeting skill deficits is beyond the scope of this research project and the focus here is on minimizing knowledge deficits. Currently, most available training programs rely heavily on didactic teaching methods, which may not be the most effective way of transferring knowledge about suicide risk factors into an applied clinical skill (Bloom, 2005; Schmitz et al., 2012). This is possibly due to the fact that simply providing information does not automatically translate into deep learning and thus developing risk assessment competency.

Learning suicide risk factors requires a huge amount of cognitive resources that may exceed the limited capacity of the WM. This is because the task itself has high element interactivity (levels of connectedness and interactivity between elements to be learnt). Put another way, suicide risk factors are interconnected and often influence each other in unpredictable ways and assessment of risk requires careful consideration of all risk factors, therefore, they are high in intrinsic cognitive load. Furthermore, didactic teaching methods, such as lectures and seminars may include tremendous amounts of information that is wholly or partially irrelevant to the learning objectives and often lack audio and/or video materials (Melton & Coverdale, 2009). Thus, didactic teaching methods may impose a high extraneous load on learners. High intrinsic and extraneous cognitive loads result in information overload and, unsurprisingly, low germane load.

The 'suicide risk factors visual metaphor' (Visual Metaphoria, 2016) examined in this study attempts to bypass, or work around, the limited capacity and duration of the WM by visually depicting suicide risk factors in a way that activates learners' existing cognitive schemas. In addition, the development of the visual metaphor was informed by the design principles recommended by the CLT in order to minimize extraneous load, manage intrinsic load, and optimize germane load, which will ultimately enhance learning. For full discussion on the developmental process of the suicide risk factors visual metaphor see section 3.5.3.

2.3.7. Conclusion

To sum up, the CLT stems from what we already know about the cognitive architecture of memory, in particular the WM and its limitations, the LTM, and cognitive schemas. Based on these premises, The CLT identifies three types of cognitive load that

influence the function of the WM and, ultimately, learning and intellectual performance. While the intrinsic load, or the 'What', is based on the content difficulty and is determined by the level of interactivity between elements to be taught, the extraneous load, or the 'How', is connected with the format and instructions by which the material is delivered to the learner. Germane load is the amount of actual learning that occurs. Furthermore, the CLT has demonstrated that, to enhance learning, educators should keep in mind the limitations of the WM, and hence minimize extraneous load (anything that is irrelevant to the learning objectives), manage the intrinsic load, and optimize the germane load. The visual metaphor of suicide risk factors deals with these loads accordingly.

CHAPTER THREE: METHODS

3.1. Introduction

The purpose of the current study was to investigate the impact that the use of the suicide risk factors visual metaphor (Visual Metaphoria, 2016) as an adjunct to traditional textual teaching methods, has on memory retention, knowledge transfer, cognitive load, and satisfaction. This chapter outlines the research protocol used to conduct the study. The following components are described: (a) research questions and hypotheses, (b) study design, (c) participant recruitment, (d) measures including questionnaires and the visual metaphor of suicide risk factors, (e) procedure, (f) data collection, (g) data analysis, and (h) ethical considerations.

3.2. Research Questions and Hypotheses

Questions:

- 1- Does the use of a suicide risk factors visual metaphor influence students' memory retention of suicide risk factors?
- 2- Does the use of a suicide risk factors visual metaphor influence students' abilities to apply newly learnt materials to new suicide risk vignettes (knowledge transfer)?
- 3- Does the use of a suicide risk factors visual metaphor affect students' cognitive load while learning about suicide risk factors?
- 4- How are participants' overall satisfaction levels?

Hypotheses:

Students who are exposed to the visual metaphor of suicide risk factors will:

- 1- Demonstrate greater improvement in memory retention of suicide risk factors in comparison to the control group.

- 2- Show a better ability to apply the newly learnt materials to the suicide risk vignette in comparison to the control group.
- 3- Report using less mental effort while learning about suicide risk factors in comparison to the control group.
- 4- Report greater satisfaction levels in comparison to the control group.

3.3. Study Design

To answer the aforementioned research questions and test the hypotheses, a pilot randomized controlled trial (pilot RCT) was conducted. Participants were randomly assigned to either an intervention group or a control group, thus allowing for control of most of extraneous variables.

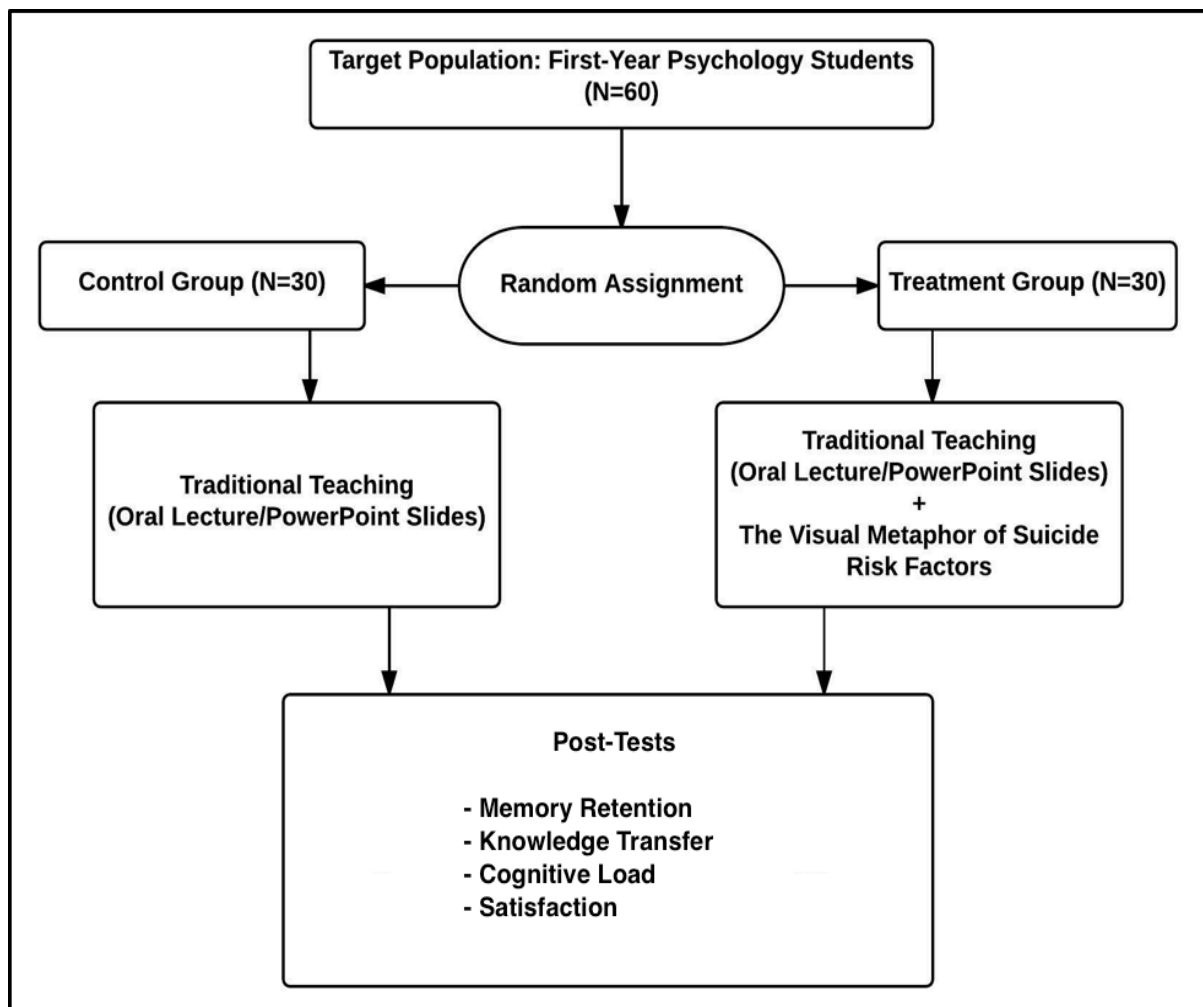


Figure 5. A diagram showing all phases involved in the current study

3.4. Participant Recruitment

The target population for this research project was a convenient sample of 60 first-year psychology students enrolled at Massey University's Albany Campus, Auckland. The reason for choosing this specific sample group was because first-year psychology students at Massey University have had no formal university tuition about suicide risk factors and/or assessment and management, thus eliminating any influence from prior knowledge. The recruitment process for potential participants was carried out through a study advertisement on notice boards on the University Campus (Appendix D) and verbal announcements at psychology lectures. Also, an invitation email was sent to additional potential participants. A Participant Information Sheet (PIS) was distributed to all potential participants (Appendix E). In an acknowledgement of time spent in assisting in this research project, all participants were offered \$10 vouchers. Also, all participants went into a random draw to win a Fitbit Flex Wireless Wristband, providing they had consented and provided their email addresses on the Consent Form. Two weeks after the completion of the study, two winners were selected via a randomized computer draw. The study eligibility criteria are as follows:

- The student is enrolled in first-year psychology paper(s) at Massey University, Albany Campus.
- The student is fluent in the English language.

3.5. Measures

3.5.1. Introduction

This section of the thesis describes the measures used in the current study, which are twofold: 1) questionnaires and 2) the development of the visual metaphor of suicide risk factors. In the first part, the questionnaires, including a demographic survey, memory retrieval test, knowledge transfer test, cognitive load questionnaire,

and satisfaction survey, will be described in detail. Purposes and psychometric properties, if available, will also be discussed. Administered questionnaires can be found in Appendices B and C. The second part of this section will describe the developmental process of the suicide risk factors visual metaphor.

3.5.2. Questionnaires

3.5.2.1. Demographic Survey

A demographic survey was administered to all participants, to elicit information about them. The survey included only three questions, specifically it enquired about participant's age, gender, and ethnicity. These particular characteristics can be confounding variables when assessing educational interventions. Therefore, obtaining age and gender data would allow adjustment for these variables. In addition, it would be informative to see whether age and/or gender are associated with any difference in the outcome measures. Also, research shows that people from indigenous populations use visual metaphors more than non- indigenous populations. Therefore, this will also be useful in assessing whether there is an association between ethnicity and outcome measures.

3.5.2.2. Memory Retention Test

The process of memory retrieval is a fundamental aspect of everyday life, and learning in particular. This is because memory failures are often due to retrieval failures (Goldstein, 2011; McBride & Cutting, 2016). In order to test the participants' memory retention of the imparted suicide risk factors information a free recall test, in which participants are simply asked to remember or retrieve information, was generated. The test included only one open-ended question- what are the suicide risk factors? Based on the suicide literature review and subsequently the visual metaphor, there are twenty-

three evidence-based risk factors of suicide in total and hence the question is scored out of a total of 23 points. For each correct answer one point is allocated.

3.5.2.3. Knowledge Transfer: Suicide Risk Vignette

Learning outcomes can be measured directly or indirectly depending on the specific outcome being measured. Among these learning outcomes are knowledge comprehension and knowledge transfer and, although closely related, they are conceptualized and measured differently. Therefore, this research project will focus only on knowledge transfer as a primary learning outcome. An important goal of education is not only the generation and acquisition of new knowledge, but also knowledge transfer, a process by which newly learnt information is transferred to the learner (Bresman, Birkinshaw, & Nobel, 2010; Lee & Wu, 2010; Newell, 2005; Perez-Nordtvedt, Kedia, Datta, & Rasheed, 2008; Suebsom & Dahalin, 2010). Successful and constructive knowledge transfer is measured by the learner's ability to retrieve and apply the newly absorbed material to novel situations and problem solving (Paas, 1992; Plass, Heidig, Hayward, Homer, & Um, 2014; Suebsom & Dahalin, 2010; Um, Plass, Hayward, & Homer, 2012).

To measure knowledge-transfer of suicide risk factors in the current research project the author developed a suicide risk vignette, in which a case study of a suicidal patient is presented. The vignette was reviewed by the project supervisor, Dr. Bev Haarhoff, and two independent mental health professionals. Comments and suggestions were discussed during supervision and incorporated as appropriate. Participants were instructed to read the case study carefully and identify the factors that increased the patient's risk of suicide. The suicide risk vignette included only seventeen suicide risk factors. This was done because it seemed more appropriate to make the scenario less

dramatic. Furthermore, the case study was written in a way that resembled a problem-solving puzzle, in order to engage, stimulate and provide an opportunity for participants to retrieve and apply their knowledge to the presented case study. The scoring system was as follows: one point was allocated for each correctly identified risk factor and the total score calculated by adding the points gained (maximum score of 17 points).

3.5.2.4. The Paas Cognitive Load Rating Scale

The term cognitive load (mental effort) has been found in the literature since the late 1970s (Moray, 1979). Research on cognitive load since then has produced multiple methods of measurement, but there is yet to be a standardized measure of cognitive load (Brunken, Seufert, & Paas, 2010). Available measurement paradigms range from subjective (Paas, 1992; Paas & van Merriënboer, 1993; Paas, Tuovinen, Tabbers, & Gerven, 2003; Salomon, 1983; Salomon & Leigh, 1984); objective (Brunken, Plass, & Leutner, 2003; Brunken, Steinbacher, Plass, & Leutner, 2002; Mayer, 2005; Seufert, Jänen, & Brünken, 2007; Tabbers, Martens, & van Merriënboer, 2004); to combined approaches (Paas, Tuovinen, Tabbers, & Gerven, 2003).

For the purposes of the current study, a self-reported subjective rating scale, namely the Paas Cognitive Load Rating Scale (Paas, 1992), was chosen to assess the participants' cognitive load (mental efforts). This measure contains one question, asking about the total amount of mental effort invested in learning the topic at hand or solving a particular problem. Participants scored this question on a 9-point Likert scale where: 1= very low mental effort, and 9= very high mental effort. Professor Paas' permission to use his cognitive scale in the current research can be found in Appendix G.

In terms of the psychometric properties of the measure, in his seminal work Paas (1992) reported an internal reliability of .90 Cronbach's coefficient alpha. In addition, in

her doctoral dissertation at the University of Southern California, Gimino (2000) investigated whether self-reported scales of cognitive load are reliable and valid measures. In her validation and exploratory study, she looked at the Cognitive Load: Subjective Experience Scale (Paas, 1992) and the Amount of Invested Effort scale (Salomon, 1983, 1984). Gimino concluded the following:

“Results from the Cronbach alpha tests indicate that both the Paas and Salomon mental effort scales provide a reliable means for assessing the amount of effort subjects invest in solving problems ranging from familiar to novel. However, the Paas scale (.8531 < α < .8635) is consistently more reliable than the Salomon scale (.8052 < α < .8635). In addition, both scales provide better reliability for novel tasks than they do for familiar tasks” (Gimino, 2000, p. 113).

These findings are consistent with findings reported by the original authors and others (Paas, 1992; Paas & van Merriënboer, 1993; Salomon, 1983, 1984; Salomon, Globerson, & Guterman, 1989; Salomon & Leigh, 1984; Windell & Wiebe, 2007).

3.5.2.5. Satisfaction Questionnaire

The use of existing, validated, and standardized satisfaction surveys was not possible because they are not applicable to the context of the current research topic. Therefore, a satisfaction survey was generated by the author, informed by a review of multiple satisfaction surveys found in the literature, and reviewed and refined with the project supervisor Dr. Bev Haarhoff. The survey contained seven items, scored on a 5-point Likert scale where 1 =strongly disagree, 2= disagree, 3= neither, 4= agree, and 5 =strongly agree. The primary purpose was to assess the overall satisfaction levels.

3.5.3. Development of the Visual Metaphor of Suicide Risk Factors

Dr. Hussain Alyami introduced me to the idea of visual metaphor. Making hand-made sketches and drawings of abstract principles and concepts allowed me to retrieve

knowledge more effectively when needed. This effect was attributed to the power of visual metaphor, as it draws on familiar objects, activates existing cognitive schemas, makes strong associations between objects, provides multiple hooks for knowledge retrieval, and as the name indicates it is a visual stimuli created by the learner, hence is not easily forgotten. Since 2013, Dr. Hussain and I have collaborated in developing a visual metaphor for suicide risk (Visual Metaphoria, 2016). The developmental process consisted of multiple phases as Figure 6 shows.

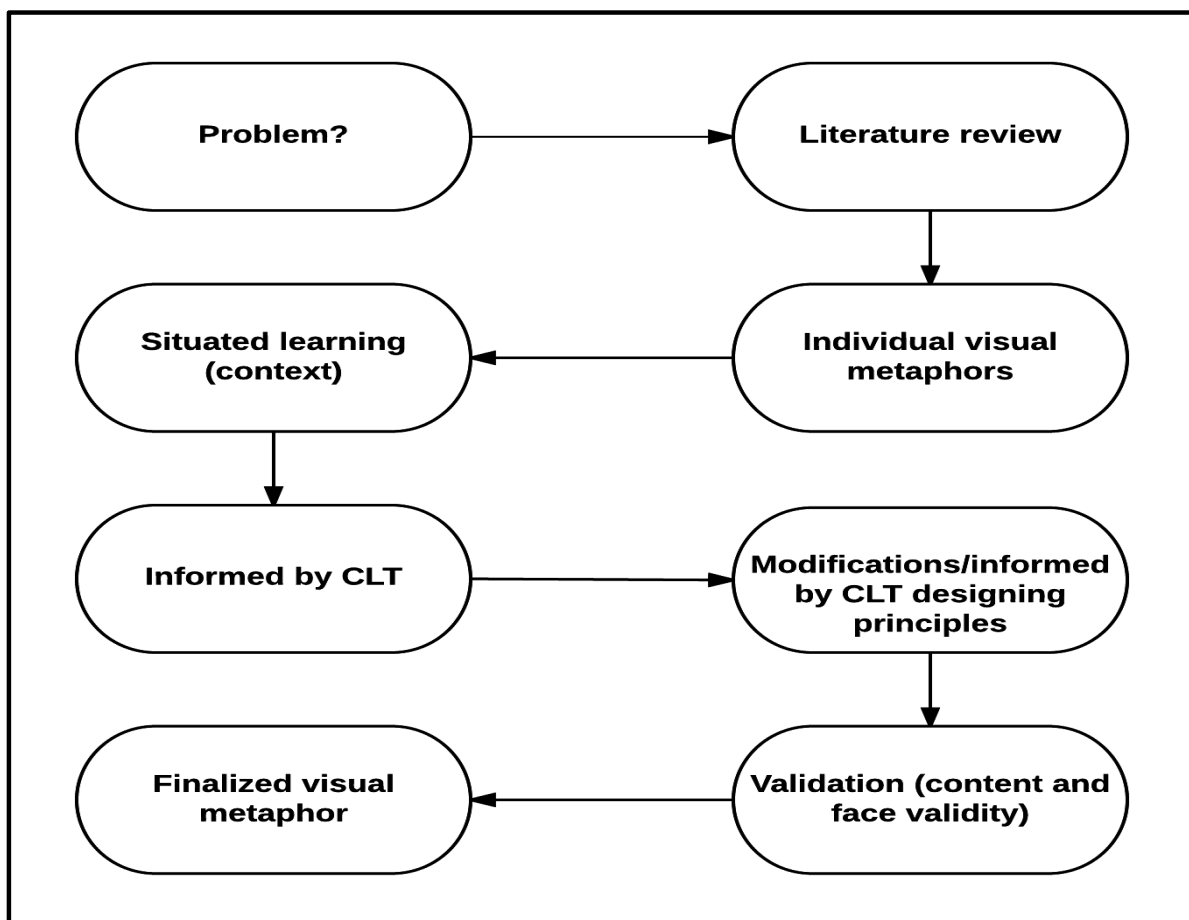


Figure 6. Developmental process of the visual metaphor

Phase One:

The first step in the developmental process was to identify the problem and locate it within its context. Acquiring comprehensive knowledge of suicide risk factors is essential to risk assessment, and subsequently management and prevention.

However, learning all suicide risk factors can be difficult for several reasons, including that there are a large number of risk factors and these factors often coexist and mediate and/or moderate each other. This issue posed a problem/question, namely how to visually conceptualize all suicide risk factors in one visual metaphor.

Phase Two:

To attempt to answer this question we conducted a comprehensive literature review. At first, a wide search strategy was used, and therefore a large number of studies were identified. However, because individual studies often look at particular risk factors such as childhood abuse, bereavement, or mental illness, it was decided that these studies should function as secondary sources. For primary sources the authors turned to global and national suicide assessment guidelines, as well as epidemiological studies, for a more comprehensive account of suicide risk factors. Epidemiological studies shed light on risk factors across populations, whereas assessment guidelines focus on risk factors that are clinically relevant (Ministry of Health, 2003; Moscicki, 1997; Welch, 2001; World Health Organization, 2014b). See section 2.1.4.

Phase Three:

Once risk factors were identified, creating culturally sensitive and universal visual and metaphorical representations of each risk factor was the next major task. Eppler defines visual metaphor as *"a graphic structure that uses the shape and elements of a familiar natural or man-made artefact"* (Eppler, 2006, p. 204). For each risk factor identified a number of visual representations were allocated, by using the Google Image search engine. For example, alcoholism was depicted by a picture of a Rum bottle, a line drawing of a Rum bottle, or a wine glass, substance abuse was pictorially represented

by a syringe, and methods of committing suicide such as hanging and firearms were represented by a noose and a pistol respectively and so on.

However, not all risk factors were represented this way, as there are some risk factors, including past suicide attempt and lethality, hopelessness, suicide ideation and intent, which were difficult to represent through visual metaphor. Through extensive reading of the literature, the authors came across Ausubel's Assimilation Theory of learning and Bruner's Constructivist Theory of learning. Ausubel's Assimilation Theory of learning suggests that meaningful learning occurs when newly learnt information builds on, and activates, prior knowledge, hence making connections between the new information and the existing knowledge (Ausubel, Novak, & Hanesian, 1986). Similarly, the Constructivist Theory of learning posits that effective learning takes place when new knowledge is constructed based upon the learner's prior knowledge (Bruner, 1973). Hence, both theories of learning emphasize the important role of prior knowledge and activation of existing cognitive schemas in acquiring, processing and storing new information in the LTM.

After learning these theories of learning, we asked the following question: how can we visually and metaphorically represent past suicide attempt and lethality, hopelessness, suicide ideation and intent? Visual representations of these risk factors must be straightforward, familiar to the learners, based on prior knowledge, and activate cognitive schemas in order to enhance learning. Through creativity and many iterative discussions, the authors developed visual metaphors for these risk factors. For example, past suicide attempt and lethality were pictorially depicted as a broken, sunken boat and a severity gauge with mild, moderate, and severe designated on it. Furthermore, since hopelessness, suicide ideation and intent all fall within the same

domain, namely the cognitive domain, the visual representation must convey this information in addition to these risk factors. Therefore, we found that the most appropriate visual representation was a thought bubble, in which hopelessness is represented by a sad and hopeless face, suicide ideation is depicted by a noose, and suicide intent is represented by a judge's gavel.

Phase Four:

Having developed visual metaphors for all risk factors, the next step in the developmental process was to consider how to present the visual metaphor to learners. We first thought of presenting these visual representations separately or in groups (static vs dynamic). In doing so however, we realized that this approach is not helpful for several reasons; it may cause inconsistencies, lead to misinterpretations and poorly activate existing cognitive schemas. Learners may also find themselves using up all available cognitive resources while learning via this approach, and therefore hindering the process of effective and meaningful learning. This approach also lacks context, which according to the Theory of Situated Learning is essential to the learning process (Lave & Wenger, 1990). To avoid these undesired outcomes, we chose to combine all the visual representations of risk factors in one visual metaphor and, more importantly, to add context to the visual metaphor. After several iterative discussions we found that the most appropriate context, in which all visual representations of risk factors can fit perfectly, is a seafaring journey context (Figure 7). Health professionals and people with previous suicide attempts (Jones et al., 2015; Lakoff & Johnson, 2008) often describe suicide as a journey. On this journey the suicidal person has his/her risk factors (static vs dynamic, and internal vs external).

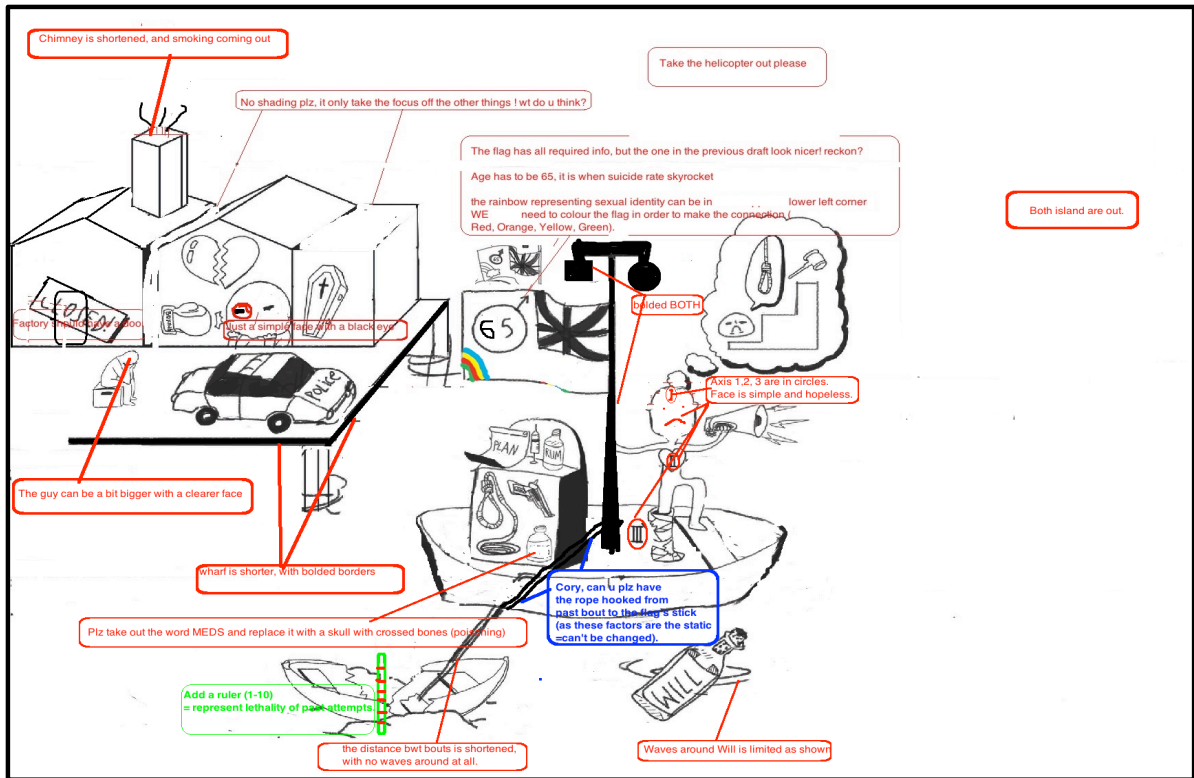


Figure 7. A draft incorporating improvements based on the CLT design principles

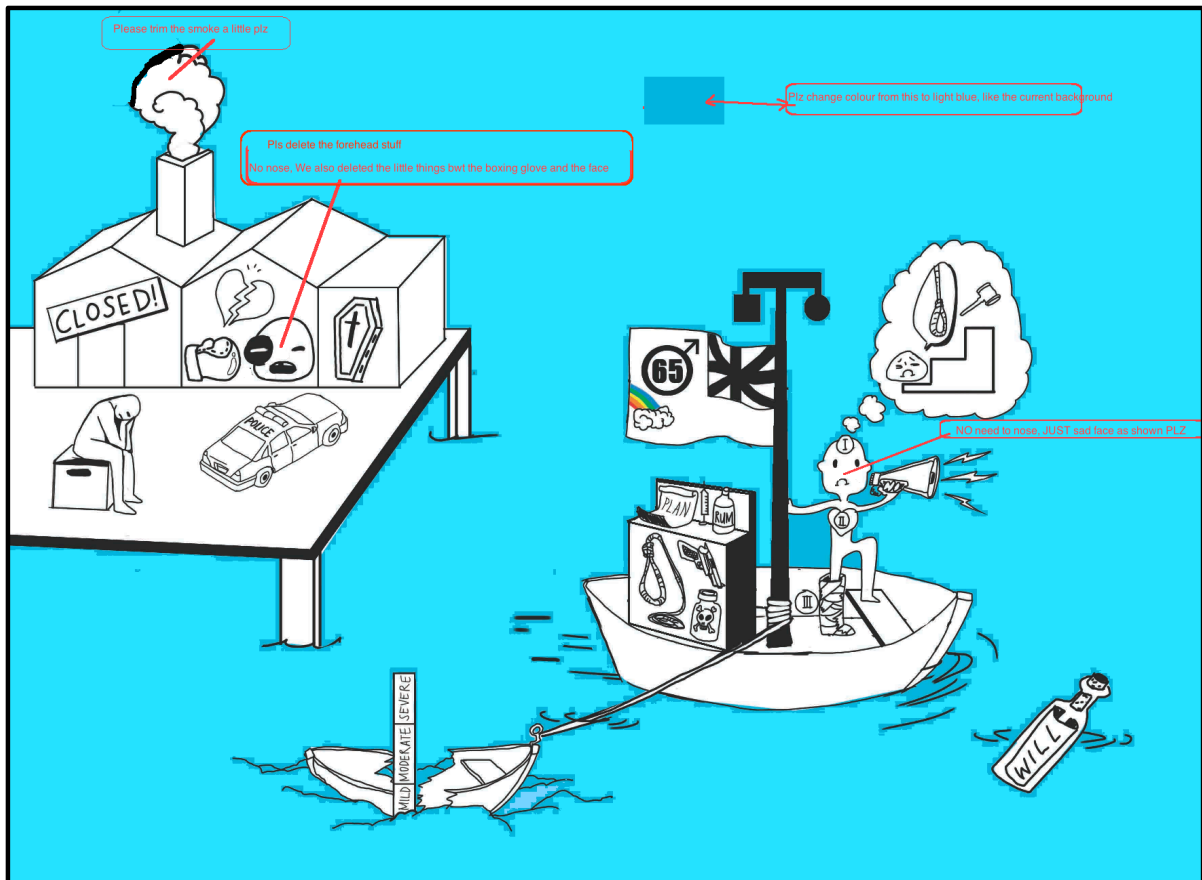


Figure 8. The visual metaphor undergoing further refinement

Phase Six and Seven:

After several amendments the next step was to validate and cross-examine the cultural sensitivity and universality of the visual metaphor. In its pre-final draft, the visual metaphor of suicide risk factors was discussed with four mental health professionals with long-standing clinical experience. These were: Dr. Bev Haarhoff, a clinical psychologist at Massey University; Dr. Frederick Sundram, a consultant psychiatrist at North Shore Hospital; Dr. Gary Cheung, a consultant psychiatrist at Auckland City Hospital; and Dr. Hussain Alyami, a psychiatric registrar at Middlemore Hospital. Each of these experts was given a list of the suicide risk factors extracted from the Ministry of Health (2003), Moscicki (1997), Welch (2001), and World Health Organization, (2014), as well as a copy of the visual metaphor. They were then asked to conduct a content validity assessment based on the narration and visual representations provided, and to examine whether the visual metaphor was culturally sensitive and universal.

The feedback received indicated that the visual metaphor of suicide risk factors has high content validity and is culturally sensitive and universal. However, some concerns were expressed with respect to the sensitivity of the rainbow symbol, which was intended to represent issues with gender identity (see Figure 9). The experts conveyed that the rainbow sign symbolizes homosexuality initially, and if it were to be used to represent gender identity disorder would indicate that homosexuality is an issue in itself. This concern was therefore carefully evaluated and the rainbow symbol was substituted with an ID card with interlinked gender sign.

With respect to face validity, this important type of validity was constantly cross-examined during the entire developmental process. This reflects our commitment to

developing a visual metaphor of risk factors that is effective in teaching risk factors while at the same time is basic, easy to follow, self-explanatory, and cognitively less loading. In conducting face validity, we often asked lay people and friends from various disciplines such as medicine, nursing, engineering, and IT, whether the visual metaphor was transparent and relevant to suicide risk factors. The feedback we received was overwhelmingly positive. Finally, having completed the steps mentioned above, the visual metaphor was then finalized.

To reduce the learner's cognitive load while learning suicide risk factors through the visual metaphor, the visual metaphor was presented gradually in the following three figures and tables, and a final summary in Figure 13.

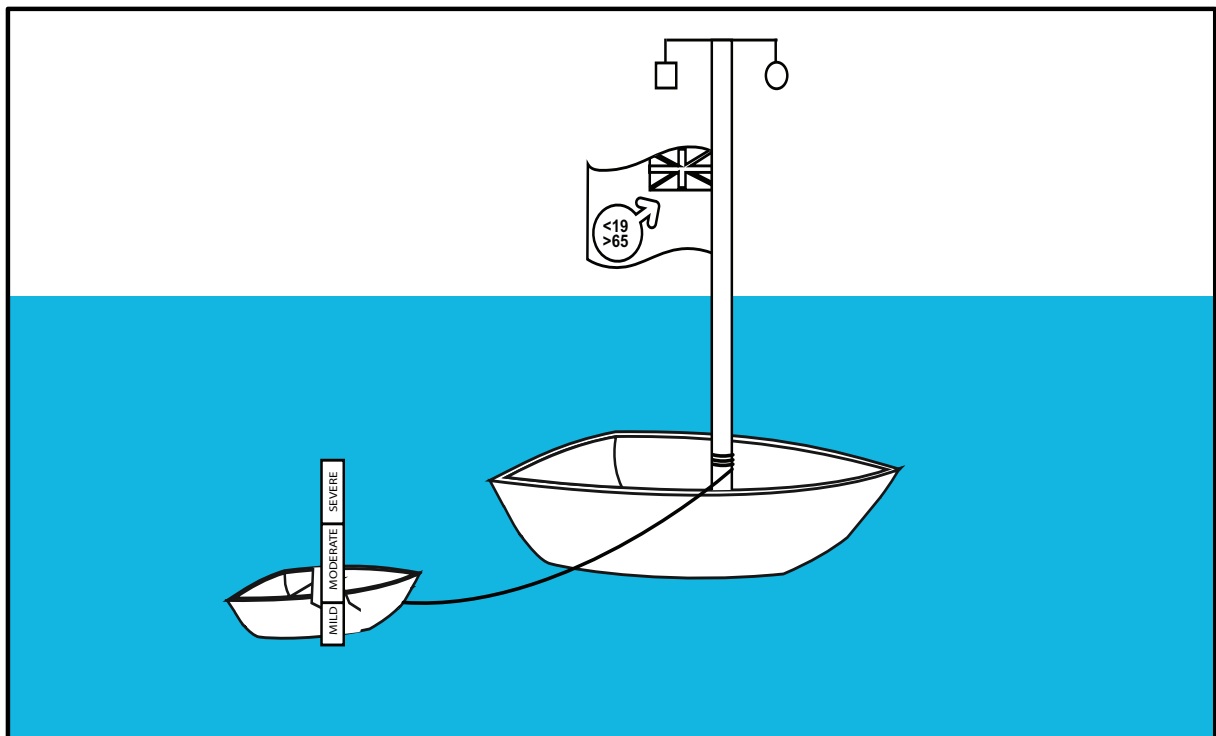
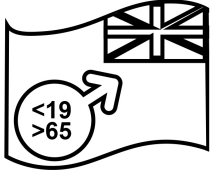
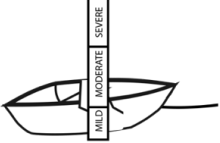



Figure 9. Visual metaphor of static suicide risk factors
Note: Adopted from (Visual Metaphoria, 2016)

Table 8

Static Suicide Risk Factor and Corresponding Visual Metaphors

Risk factor	Metaphorical description	Visual metaphor
Age Gender Ethnicity	<19 and >65 Male gender sign Flag	
Previous suicide attempts and lethality	Sunken broken boat, with a severity gauge	
Family history of suicide	Genogram	

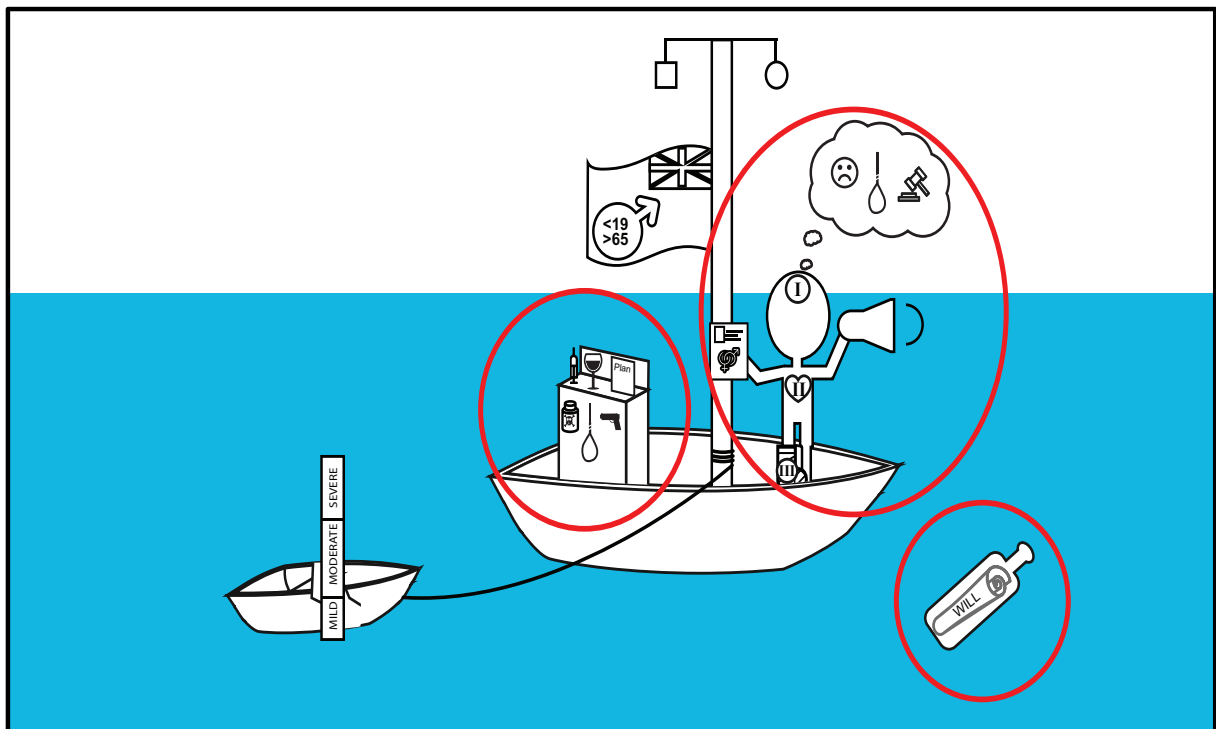













Figure 10. Part one of dynamic suicide risk factors

Note: Adopted from (Visual Metaphoria, 2016)

Table 9

Dynamic Suicide Risk Factors and Corresponding Visual Metaphors

Risk factor	Metaphorical description	Visual metaphor
Presence of axis I disorders (Psychiatric disorders)	Roman numeral (I)	
Presence of axis II disorders (Personality disorder or intellectual disability)	Roman numeral (II)	
Presence of axis III disorders (Medical conditions)	Roman numeral (III)	
Gender dysphoria	Interlinked gender signs on an ID like card	
Hopelessness Suicidal ideation Suicide intent	Hopeless face Noose Judge's gavel	
Help seeking behavior	Megaphone	
Alcohol abuse	Wine Glass	

Substance abuse	Syringe	
Suicide plan	Plan on a piece of paper	
Suicide note	Note in a bottle	
Access to lethal methods	Firearms, noose, and poison or stockpiling medications	

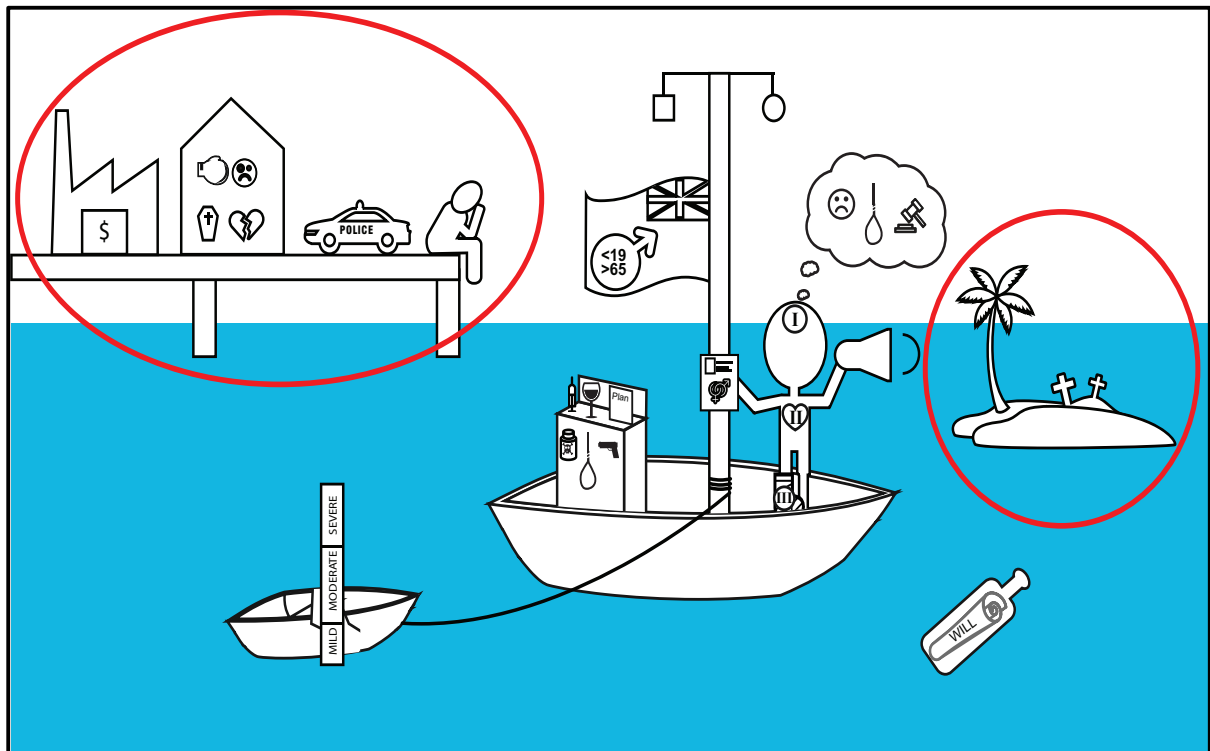









Figure 11. Part two of dynamic suicide risk factors
Note: Adopted from (Visual Metaphoria, 2016)

Table 10

Dynamic Suicide Risk Factors and Corresponding Visual Metaphors (continue)

Risk factor	Metaphorical description	Visual metaphor
Issues with the legal system	Police car	
Unemployment	Factory	
Recent bereavement	Coffin	
Relationship break up	Broken heart	
Childhood abuse	Boxing glove and a black eye	
Social isolation/lack of social support	Person sitting alone	
Lack of future focused goals	Cemetery on an island	

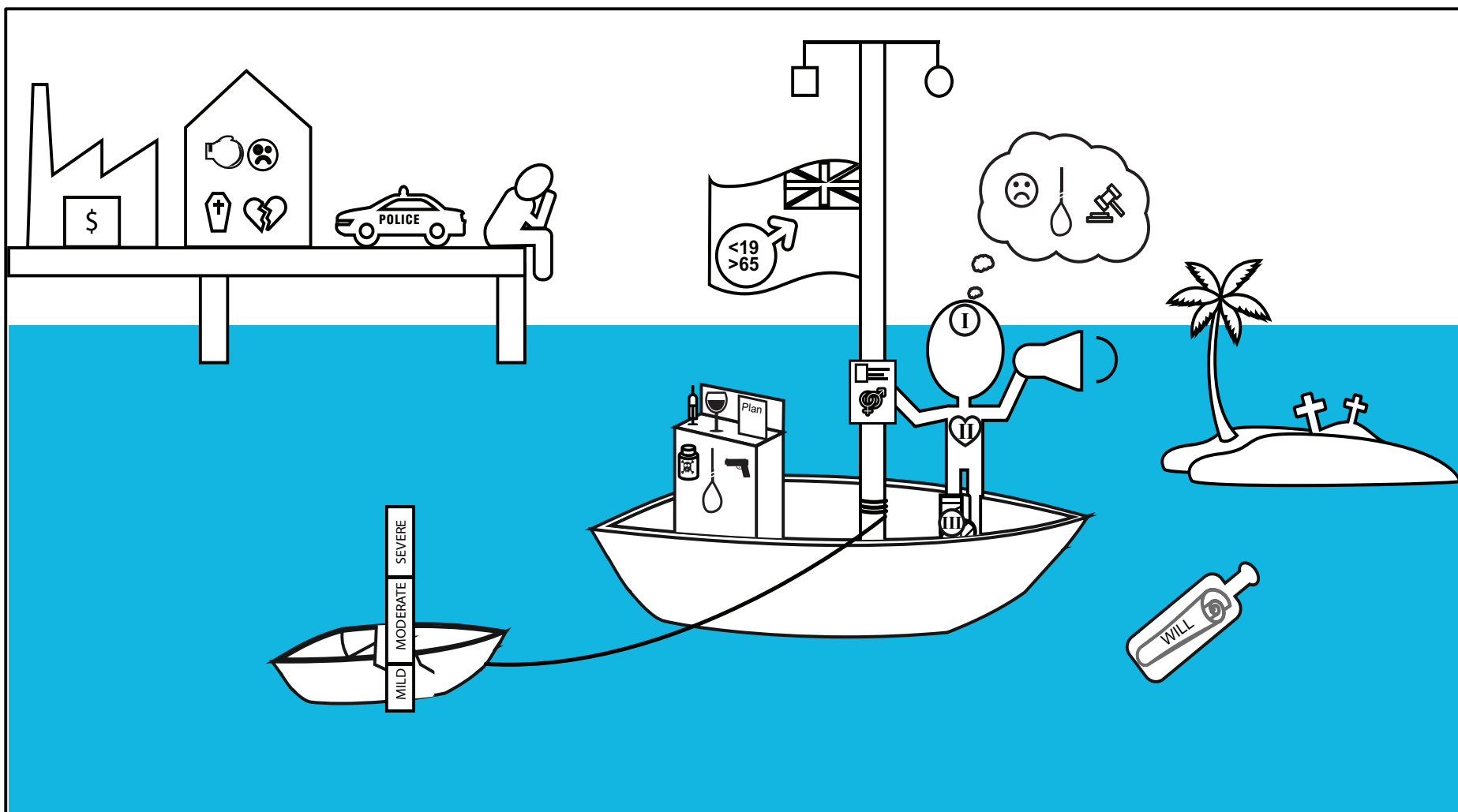


Figure 12. The visual metaphor of suicide risk factors
Note: Adopted from (Visual Metaphoria, 2016)

3.5.3.1. Challenges

During the developmental process we encountered multiple challenges. Firstly, creating visual metaphors for some of the risk factors was, although straightforward in some instances, a difficult task. This was true for risk factors that fall within the cognitive domain, including hopelessness, suicide ideation and intent. The reason for this is that these risk factors are abstract constructs, and hence we had to be creative. This was also true for other risk factors including alcohol use, substance use, issues with sexual identity, future goals and past suicide attempts and lethality, where multiple visual representations were developed for each of these risk factors. We considered the cultural sensitivity and universality of the visual representations before deciding which of these representations was the most appropriate.

A second challenge we faced was that once the visual representations were created, they were concrete and not meaningful, even after combining them into a single visual metaphor, simply because the context was lacking. After several discussions and considering several contexts, the authors decided to use a seafaring journey context, which created a further obstacle, namely some of the visual metaphors had to be recreated to fit the context accordingly.

Finally, a major challenge that has proven difficult to overcome lies in resolving the conflicts and differing points of view of the graphic designers, illustrators and the authors. At first, even making extensive modifications was a smooth process on the part of the illustrators and designers. There was no resistance to change, partly due to the fact that they were being paid and partly that they had not invested much of their valuable time and emotions in illustrating and designing the visual metaphor. However, as time passed and the visual metaphor developed and refined further, the illustrators

and designers became resistant to make further changes. This could be attributed to the notion that they may have become personally attached to the visual metaphor. This was also further complicated by the CLT design strategies we employed, which goes against the artistic traits they possess which drive them to be creative, colourful, and fashionable. To deal with this particular challenge, we held two educational sessions with the illustrators and designers, during which the CLT, its components and designing principles were comprehensively discussed.

3.6. Procedure

To describe the procedure used in the current pilot RCT in detail it is important to discuss the following issues: (1) random allocation and blinding, (2) the nature of the teaching content for both groups and (3) hands-on procedure.

3.6.1. Random Allocation and Blinding

Random allocation (assignment) and blinding (masking) are two cornerstones of randomized control trials (Dettori, 2010; Feeley et al., 2009; Kendall, 2003; Kim & Shin, 2014; Viera & Bangdiwala, 2007). Random allocation of participants to either the control or treatment groups allows confounding variables to be evenly distributed between the two groups, and hence any difference in the outcome is attributed to the intervention (Feeley et al., 2009; Kim & Shin, 2014). Random allocations are concealed from the researcher in order to eliminate selection bias; a concept used to describe instances where the researcher deliberately excludes potentially eligible participants from the study (Attia, 2005; Dettori, 2010). Furthermore, blinding or masking is another crucial issue in RCT design. It refers to keeping the participants, the investigators, and anyone involved in the data collection and analysis unaware of the identity of each assigned group and intervention (Karanicolas, Farrokhyar, & Bhandari,

2010; Kendall, 2003; Miller & Stewart, 2011). Blinding is important because knowing the nature of the group and its assignment may influence the behavior, responses, and analysis and therefore introduce bias. This being said however, blinding is often impossible in educational research given that the intervention is visible (Hutchison & Styles, 2010).

In the current study, a computer program, titled *Research Randomizer*, was used to randomly allocate a total of 100 numbers into two sets (control and treatment sets), each set contained 50 numbers. Each number had an equal chance of being assigned to either the control or intervention group. These random numbers were then printed on mini cards and sealed in envelopes. The envelopes were shuffled in a box and each participant was then asked to shuffle the box again, and pick an envelope and follow the instructions (when and where the teaching session was to be held). Moreover, given the educational nature of this research, blinding was not possible as both the researcher and participants knew to which groups they were randomly assigned. This was due to the fact that the primary investigator had developed the intervention, along with another colleague, and was responsible for delivering the sessions. Participants were also un-blinded, because the nature of the teaching content (the presence or absence of the visual metaphor) was visible. Un-blinding might limit the validity of the findings, but this is addressed in the discussion chapter.

3.6.2. The Nature of the Teaching Content

The suicide risk factors content, taught to the control group, was prepared in advance, by the primary investigator to be equivalent to a standard first-year psychology lecture. The content was reviewed and approved by the project supervisor Dr. Bev Haarhoff. In addition, the content focused mainly on suicide risk factors, though

the most recent report on suicide published by the Ministry of Health (Ministry of Health, 2015a) was also discussed at the beginning of the session. Main points covered included: definition of suicide; suicide New Zealand statistics; definition of a risk factor; the importance of learning and recognizing risk factors; categories of suicide risk factors (static vs dynamic); and finally, evidence-based suicide risk factors. Information on what to do in the unlikely event that unpleasant emotions may be triggered as a result of participation in this research project was also included. A list of support services contacts was provided. The content was delivered in the conventional way, using PowerPoint slides and oral presentation, with a total of 23 slides. The teaching content for the intervention group, although otherwise identical to the control group, also included the visual metaphor of suicide risk factors.

3.6.3. Hands-on Procedure

Ethics approval was obtained from the Massey University Human Ethics Committee Northern (#15/042). Consent forms were also distributed and collected prior to the commencement of the study. At the beginning of each session participants were welcomed and acknowledged for taking part in this research project. Session outline and rules were explicitly covered, including that no identifying personal information such as name or student ID number was to be shared with the researcher, either verbally or by writing any such information on the questionnaire. It was important that the participants be reminded of this so as to keep the study anonymous. The teaching content was then presented using PowerPoint slide. Questions and queries were encouraged, and where the researcher had a satisfactory answer it was provided, otherwise the researcher admitted the limits of his knowledge and provided a list of references where answers could be sought.

This was true for both groups. However, the intervention group was also presented with the visual metaphor of suicide risk factors. The purpose and meaning of each visual representation in the visual metaphor was explained. For example, being male is a risk factor, and this is represented by a male gender sign. The male gender sign was then visually depicted in the visual metaphor. Having gone through all risk factors and their visual representations, an animated video of the visual metaphor, with narration, was presented to reinforce learning. Afterwards, the complete visual metaphor was presented as a static image. Each session lasted for 1 hour 15 minutes; 50 minutes for teaching and 25 minutes to complete the questionnaire. At the end of the teaching sessions participants were encouraged to answer all parts of the questionnaire. Figure 14 summarizes the procedure used in the current research project.

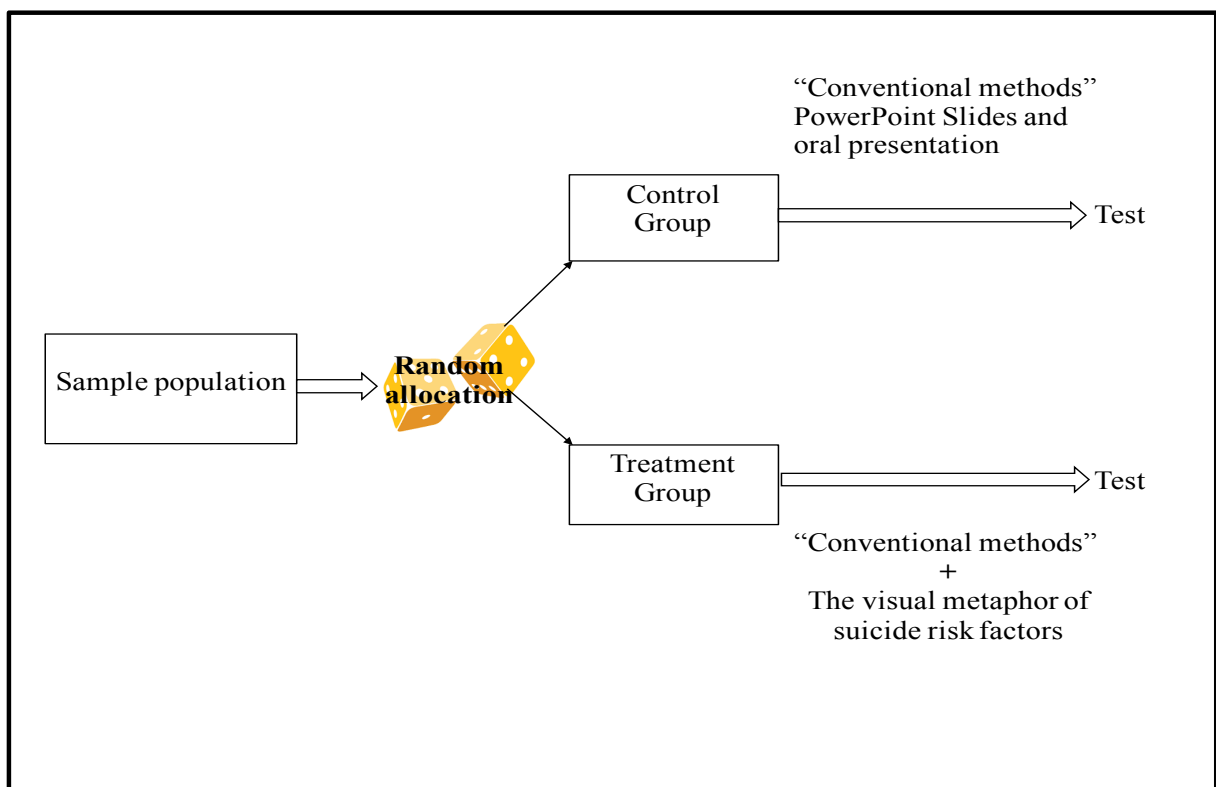


Figure 13. Random allocation carried out by a computer software

3.7. Data collection

Only post-experiment data were collected, as this was an experimental design research project looking at the efficacy of an educational and clinical tool. The target population, as previously mentioned, was first-year psychology pupils, who at that level have had no formal university education in evidence-based suicide risk factors. Given this, it was the researcher's assumption that the baseline knowledge would most likely be similar for all potential participants and hence there was no need to carry out pre-experiment testing.

Data were collected using questionnaires; hard copy questionnaires were distributed to both groups of participants at the end of each teaching session. Completed questionnaires were collected by the primary investigator. The study was anonymous and no identifying information was collected, with the exception of the email addresses of those who were interested and consented to enter the draw to win a Fitbit Wireless Wristband. These participants sent their details to an email address created solely for the purpose of this study. Two weeks after the study, the primary investigator selected two winners, using a randomized computer draw. The returned hard-copy questionnaires from both groups were classified and organized for the analysis phase.

3.8. Data Analysis

Collected data were subjected to statistical analysis using the IBM SPSS Statistics (version 23) software. To review the scoring systems adopted see section 3.5.2. To answer the research questions and investigate the hypotheses, the following analysis was conducted:

At first, data assumptions for *t* tests were evaluated. The dependent variables' data for both groups were: interval, approximately normally distributed as determined by Shapiro-Wilk test, and the two group variances were not significantly different as determined by the Levene's test. Therefore, the three core data assumptions for an independent *t* test were satisfied.

The first dependent variable: Memory retention

The first dependent variable was the learning suicide risk factors as measured by memory retention test (see Appendices B & C). Individual scores were calculated for both groups, with a maximum possible total of 23 points. To determine whether there was a difference in memory retention of suicide risk factors, both groups' mean scores were computed and an independent *t*-test was performed. This particular statistical test was appropriate for the current study because both groups consisted of different participants and the analysis was comparing the groups' mean scores.

The second dependent variable: Knowledge transfer

The second dependent variable was knowledge transfer, the learner's ability to retrieve and apply the newly absorbed material (suicide risk factors) to a novel suicide risk vignette (see Appendices B & C). Individual scores were calculated, with a maximum possible total of 17 points. To determine whether there was a difference in knowledge transfer of suicide risk factors, both groups' mean scores were computed and an independent *t*-test was performed. This particular statistical test was appropriate for this study because the groups consisted of different participants and the analysis was comparing the groups' mean scores.

The third dependent variable: Mental effort

The third dependent variable in this study was the amount of mental effort, or cognitive load, required to learn suicide risk factors, as measured by a self-reported subjective rating scale, the Paas Cognitive Load Rating Scale (Paas, 1992) (see Appendices B & C). The scale was scored on a 9-point Likert scale and individual scores were calculated. To determine whether there was a difference in the amount of mental effort used while learning suicide risk factors, both groups' mean scores were computed and an independent *t*-test was performed. This particular statistical test was appropriate for the current study because both groups consisted of different participants and the analysis was comparing the groups' mean scores.

Finally, participants' satisfaction levels in both groups was also evaluated by a 7-item questionnaire developed by the author, with a 5-point Likert scale (see Appendices B & C). To determine whether there is a difference in groups' satisfaction levels, both groups' mean scores were computed and an independent *t*-test was performed. This particular statistical test was appropriate for the current study because both groups consisted of different participants and the analysis was comparing the groups' mean scores.

3.9. Ethical Considerations

For the current research project, ethical approval (#15/042) was obtained from the Massey University Human Ethics Committee: Northern. The main ethics application was submitted on the 17th of August 2015, to be considered at the committee meeting scheduled on the 27th of August 2015. At that stage provisional approval was granted, subject to minor changes. During the process of incorporating the feedback the ethics

application was resubmitted twice and a final approval was issued on the 23rd of September 2015 (see Appendix F).

In the first resubmission, the ethics committee recommended that I reconsider and/or elaborate my answers to few procedural related questions including: (a) equivalency of the teaching materials for both groups, (b) anonymity of participants, (c) questionnaires, (d) potential risks, (e) cultural issues, and (f) why age, gender, and ethnicity data are collected.

With regard to the concern surrounding the equivalency of the teaching materials to both groups, the committee was assured, by my supervisor Dr. Bev Haarhoff, that the teaching materials will be equivalent to a standard first-year psychology lecture and that both groups will receive identical information on the topic except the intervention, which will only be delivered to the intervention group.

With respect to the issue of how the anonymity of participants will be managed during data collection, as well as while delivering the compensation vouchers to participants, responses were amended as follows: During the data collection stage “hard copy questionnaires will be manually distributed and collected at the end of the experiment. Compensations will be delivered in the following manner: ‘\$10 vouchers will be offered to all participants in acknowledgement of their time and participation in the study. Each participant will collect one voucher on his/her way out of the classroom. Also, having consented to go into the draw to win a Fitbit Wireless Wristband, the primary investigator, two weeks after the completion of the study, will use a randomized computer draw to select two winners’.

The committee also enquired about the questionnaires to be used in this study and stated “the questionnaire may not be suitable for the expertise of the students at

the level of paper being taught and may be better suited to a group with greater expertise in the subject". My response to that was "to address baseline knowledge and the expertise issue, I have chosen a pilot randomized controlled trial, with the assumption that knowledge baselines are similar in both groups, especially as they have not had any teaching on this topic. I have consulted Dr. Peter Cannon and Dr. Veronica Hopner, who teach first-year psychology papers at Massey University, Albany campus, and they confirmed that there is no tuition on suicide risk factors and/or assessment at this level". Furthermore, in response to the question of why age, gender, and ethnicity data are collected as part of the demographic information, the committee was informed that, "age can be a confounding variable in assessing educational interventions, therefore, obtaining age would allow adjusting for this variable. In addition, it would be good to see if age is associated with any difference in the outcome measures. Also, research shows that people of indigenous populations use visual metaphors more than non-indigenous populations. Therefore, this will be useful in assessing whether there is an association between ethnicity and outcome measures".

The committee also recommended that I reconsider and expand my response on the question of potential risks and mitigation strategies. My amended answer was "no risk is anticipated, given the fact that potential participants would have been given the Participant Information Sheet detailing the content of the project, and the opportunity to choose to not participate. In addition, potential participants, as students of psychology will be required to learn about psychological assessment, which will include risk assessment as they progress through the program. In the unlikely event that unpleasant emotions may be triggered as a result of participation in this research project, participants will have received the necessary information regarding support services at the end of the Participant Information Sheet".

Additionally, the committee drew my attention to potential cultural issues that may arise from participation in the study. Research would indicate that suicide rates could be higher in some ethnicities than other. The visual metaphor and traditional teaching delivered will have the same content and will not include specifying which ethnicity has higher risks than others as the purpose is to teach the overall suicide risk factors. This being said however, different countries and cultures have different views on suicide. I have discussed this issue in particular with various psychology staff at Massey University including Dr. Bev Haarhoff, Dr. Mei Wah Williams, Mr Jhanitra Gavala, and other professionals from the University of Auckland including Dr. Hussain Alyami, Dr. Ali Al Mansour, and Dr. Gary Cheung. The conclusion was that cultural issues are around us, and we just have to be aware of them.

Finally, in the second resubmission, the ethics committee recommended that the Participant's Information Sheet be shortened. As a result, the information sheet was edited and the number of pages was reduced from 6 to 3.

CHAPTER FOUR: RESULTS

4.1. Demographic Characteristics of Participants

The target population for this research project was a convenient sample of 60 first-year psychology students enrolled at Massey University, Auckland. Of those, only 22 students participated in the current study, achieving a reasonable response rate of 36%. The control and treatment groups consisted of 13 and 9 participants respectively. Table 11 shows the demographic characteristics of participants.

Table 11

Demographic Characteristics of Participants

Characteristic		Frequency	Percentage %
		19	77.3
Age	20	3	13.6
	21	2	9.1
	Male	1	4.5
Gender	Female	21	95.5
	NZ European	19	86.4
Ethnicity	Asian	2	9.1
	Middle Eastern	1	4.5

Gender

Of those 22 participants, 21 (95.5%) were female and 1 (4.5%) was male. The overwhelming female participation in this study was expected and was representative of the target population. The control group consisted of 12 females and 1 male, whereas

the treatment group consisted of only females as Figure 15 illustrates.

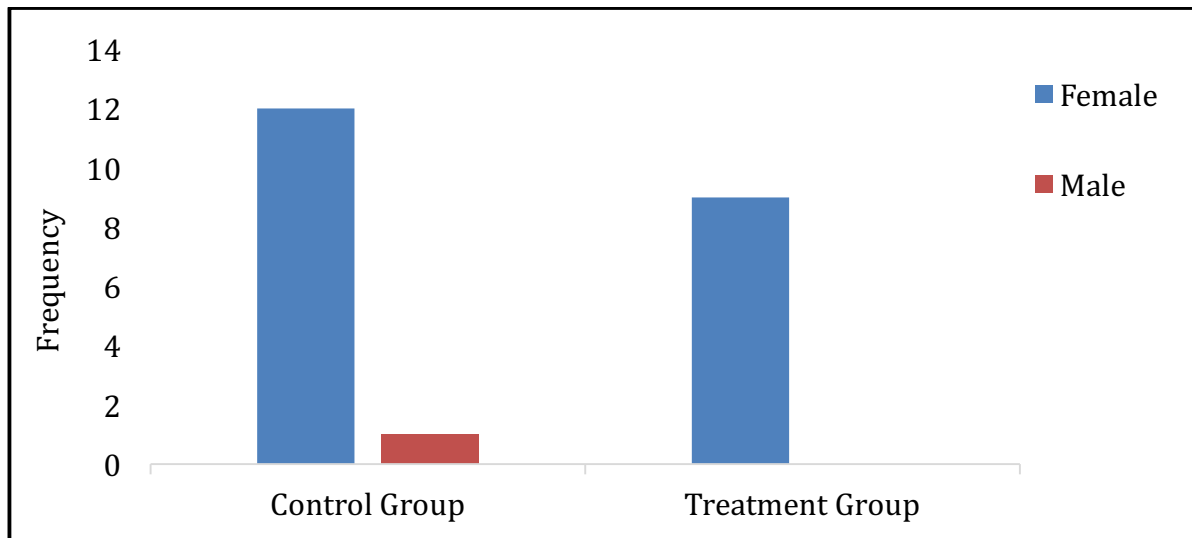


Figure 14. Gender of participants

Age

Participants' ages ranged from 19 to 21 years, with a mean age of 19.3 ($SD=0.65$) years. In this sample, 77.3% of participants were aged 19 years, 13.6% aged 20 years, and 9.1% aged 21 years. The control group included eight participants aged 19 years, three aged 20 years, and two aged 21 years. The treatment group on the other hand included nine participants aged 19 years. This is shown in Figure 16.

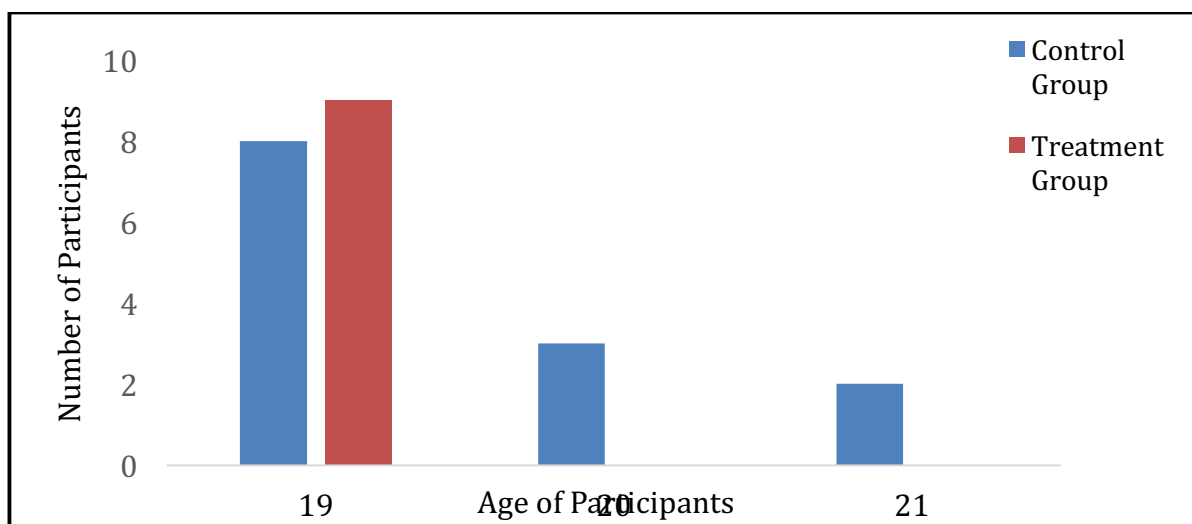


Figure 15. Age of participants

Ethnicity

The overwhelming majority of participants were NZ Europeans (86.4%), followed by Asian (9.1%) and Middle Eastern (4.5%). Figure 17 shows the internal composition of the two group.

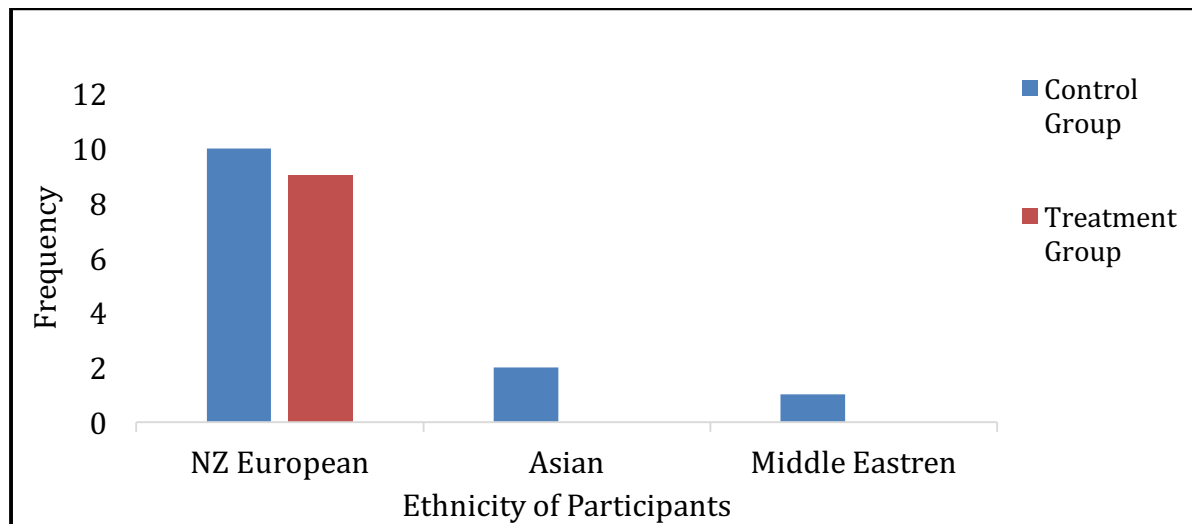


Figure 16. Ethnic groups of participants

4.2. First Dependent Variable: Memory Retention

To evaluate participants' memory retention of suicide risk factors, both groups' mean scores on the memory retention test were calculated and compared. The treatment group (students who were exposed to the visual metaphor of suicide risk factors) scored higher on the memory retention test ($M= 14.56, SD= 3.167$) than did the control group ($M= 11.77, SD= 2.587$) as shown in Table 12. Data distributions for the treatment and control groups were approximately normally distributed as determined by Shapiro-Wilk test, with $p= .736$ and $.947$ respectively. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, $F(20) = .694, P= .415$.

The difference between mean scores was statistically significant, $t(20) = -2.26$, $p = .035 < .05$, two tailed (Table 13). Therefore, hypothesis 1, which stated that students who receive the visual metaphor of suicide risk factors will demonstrate greater memory retention of suicide risk factors in comparison to those who did not, is supported. Cohen's d was estimated at 1.01, which is a large effect based on Cohen's (1992) guidelines. This result suggests that the visual metaphor enhances memory. However, due to the relatively small sample size, caution when generalizing these results beyond the target population of this study is warranted.

4.3. Second Dependent Variable: Knowledge Transfer

To determine whether there is a group difference with respect to the knowledge transfer outcome measure, the learner's ability to retrieve and apply the newly absorbed material to novel situations and problem solving was tested. Both groups' mean scores of the suicide risk vignette were calculated and compared. The result is presented in Table 12. The treatment group (students who were exposed to the visual metaphor of suicide risk factors) scored higher on the presented suicide risk vignette ($M = 14.33$, $SD = 1.000$) than did the control group ($M = 11.38$, $SD = .870$). Data distributions for the treatment and control groups were approximately normally distributed as determined by Shapiro-Wilk test, with $p = .364$ and $.111$ respectively. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, $F(20) = .212$, $P = .650$.

The difference between mean scores was statistically significant, $t(20) = -7.359$, $p = .000 < .05$, two tailed (Table 13). Therefore, hypothesis 2, which predicted that the treatment group will show greater abilities to apply the newly learnt materials to the clinical vignette in comparison to the control group, is supported. Cohen's d was

estimated at 3.28, which is a large effect based on Cohen's (1992) guidelines. This result indicates that the visual metaphor of suicide risk factors not only helps learners retrieve information, but also improves learners' ability to apply what they have learnt about suicide risk factors to a new suicide risk vignette. However, it is important to note that given the small sample size, caution when generalizing these results beyond the target population of this study is warranted.

4.4. Third Dependent Variable: Cognitive Load

To evaluate participants' cognitive loads while learning suicide risk factors, both groups' mean scores were calculated and compared. The treatment group (students who were exposed to the visual metaphor of suicide risk factors) reported using less mental efforts while learning suicide risk factors ($M= 3.44$, $SD= .882$) than did the control group ($M= 7.00$, $SD= .816$) as shown in Table 12. Data distributions for the treatment and control groups were approximately normally distributed as determined by Shapiro-Wilk test, with $p= .338$ and $.112$ respectively. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, $F(20) = .230$, $P= .637$.

The difference between mean scores was statistically significant, $t(20) = 9.723$, $p= .000 < .05$, two tailed (Table 13). Hypothesis 3, which predicted that the treatment group will expend less mental efforts while learning suicide risk factors in comparison to the control group, is therefore supported. Cohen's d was estimated at 4.35, which is a large effect based on Cohen's (1992) guidelines. This suggests that the visual metaphor reduces the cognitive load that the learning material (suicide risk factors) imposed on the working memory during learning in comparison to the conventional way of teaching. However, due to the relatively small sample size, caution when generalizing

these results beyond the target population of this study is advised.

4.5. Satisfaction Levels

To evaluate participants' satisfaction levels, both groups' mean scores were calculated and compared. The treatment group had higher means scores on all satisfaction questions ($M= 26.44, SD= 3.575$) than did the control group ($M= 17.93, SD= 3.968$) as shown in Table 12. Data distributions for the treatment and control groups were approximately normally distributed as determined by Shapiro-Wilk test, with $p= .331$ and $.050$ respectively. Additionally, the assumption of homogeneity of variances was tested and satisfied via Levene's F test, $F(20) = .134, P= .718$.

The difference between mean scores was statistically significant, $t(20) = -5.151, p= .000 < .05$, two tailed (Table 13). Cohen's d was estimated at 2.30, which is a large effect based on Cohen's (1992) guidelines. These results support hypothesis 4, which predicted that the treatment group will report greater satisfaction levels in comparison to the control group.

Table 12*Mean Scores and Standard Deviations of the Dependent Variables*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Memory Retention	Control Group	13	11.77	2.587	.717
	Treatment Group	9	14.56	3.167	1.056
Knowledge Transfer	Control Group	13	11.38	.870	.241
	Treatment Group	9	14.33	1.000	.333
Cognitive Load	Control Group	13	7.00	.816	.226
	Treatment Group	9	3.44	.882	.294
Overall Satisfaction Levels	Control Group	13	17.92	3.968	1.100
	Treatment Group	9	26.44	3.575	1.192

Table 13*Results of Independent Samples t Tests*

		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
Memory Retention	Equal variances assumed	.694	.415	-2.26	20	.035	-2.78	1.22	-5.34	-2.24	
Knowledge Transfer	Equal variances assumed	.212	.650	-7.35	20	.000	-2.94	.401	-3.78	-2.11	
Cognitive Load	Equal variances assumed	.230	.637	9.72	20	.000	3.55	.366	2.79	4.31	
Overall Satisfaction Levels	Equal variances assumed	.134	.718	-5.15	20	.000	-8.52	1.65	-11.97	-5.07	

CHAPTER FIVE: DISCUSSION and CONCLUSION

5.1. Introduction

The aim of the current study was to examine the efficacy of the visual metaphor of suicide risk factors, used as an adjunct to conventional teaching methods, on first-year psychology students in comparison to conventional teaching methods only. Outcome measures included: memory recall of suicide risk factors, knowledge transfer (the student's ability to retrieve and apply the newly learnt materials to a suicide risk vignette), cognitive load (the amount of mental activity imposed on working memory while learning suicide risk factors) and satisfaction levels. For the purpose of this study, an experimental pilot RCT study was utilized.

The Cognitive Load Theory (CLT) and its instructional design strategies (Sweller, 2010; Sweller, 1988; Sweller et al., 2011, 1998; van Merriënboer & Sweller, 2010) provided the theoretical framework for the visual metaphor of suicide risk factors. For a comprehensive discussion of the CLT and how it informed the development of the visual metaphor of suicide risk factors see sections 2.3 to 2.3.7 and 3.5.3.

Data were collected from nine participants (comprising the treatment group) and 13 participants (the control group). Since both groups' mean scores are being compared, an independent samples *t* test was performed, with .05 alpha level, using the IBM SPSS Statistics (version 23) software. In this chapter, a summary of the findings is provided and research questions are discussed in relation to the study results and in the context of previous research. Following this, implications, limitations of the present study, recommendations for future research, and finally an overall conclusion are presented.

5.2. Summary of the Findings

In line with the initial hypotheses, the treatment group (participants who learnt suicide risk factors via the visual metaphor) performed significantly better than the control group (participants who learnt suicide risk factors via the conventional methods of teaching) on the memory retention test and the suicide risk vignette. Moreover, the treatment group reported using less mental effort while learning suicide risk factors than did the control group. With regards to participants' satisfaction, the treatment group also reported greater satisfaction levels compared to the control group. Overall, results indicate that the visual metaphor of suicide risk factors is an effective clinical tool for teaching suicide risk factors to university psychology students. However, the generalizability of this finding may be limited given the study limitations discussed in section 5.5.

5.3. Discussion

There are several accounts that might explain why the visual metaphor of suicide risk factor demonstrated a superior effect than the conventional textual teaching methods. The following factors appear to have supported this result: overcoming or bypassing the limited processing and storage capacity of the working memory; activating prior knowledge and pre-existing cognitive schemas; and the visual and metaphorical nature of the intervention.

Limited Processing and Storage Capacity of the Working Memory

One explanation, of particular relevance, relates to the limited capacity of the working memory for processing and storing information. The working memory can hold up to seven items, plus or minus two, and process two to three items of information simultaneously (Cowan, 2001; Cowan, 2010; Miller, 1956; Sweller et al.,

2011, 1998). Effective learning occurs when information is processed and transferred from the working memory to the long-term memory (Sweller et al., 2011). As stated earlier, learning suicide risk factors for the first time involves a huge amount of cognitive recourses that may exceed the limited capacity of the working memory. This may be due to the high intrinsic cognitive load of the learning content (high levels of complexity, connectedness, and interactivity between elements to be learnt), and high extraneous cognitive load (information ineffectively presented to the learners). Learning content that is high in intrinsic and extraneous loads predictably results in information overload and hence low germane load (ineffective learning).

In light of this, the visual metaphor of suicide risk factors, informed by the CLT instructional principles, was successful in not only in bypassing the limitations of the working memory, but also in teaching suicide risk factors more effectively. Firstly, the complexity and interactivity of the content (intrinsic load) was managed as much as possible by introducing suicide risk factors gradually, commencing with those that are less complex such as the static risk factors (age, gender, ethnicity, family history of suicide, and previous suicide attempts), and moving toward the more complex ones (dynamic risk factors). Secondly, the methods and strategies by which information was presented to the learners (extraneous load) was reduced. The visual metaphor included no redundant information or information that was not directly related to the learning objectives, utilized multimodal explanatory statements (visual and auditory as appropriate, as opposed to image and written text) to avoid overloading the visual and/or auditory processing units in the working memory, and presented information in an integrated format (symbols appeared in the visual metaphor sequentially and adjacent to each other), in order to avoid split-attention effect.

Furthermore, the germane load (effective learning that actually occurs) was optimized as much as possible by several means including: creative imagination, schema construction, and friendly-interactive discussions. The visual metaphor of suicide risk factors was a novel, creative, and imaginative visual tool. After learning the visual metaphor, participants were asked to close their eyes and reproduce the visual metaphor in their minds (covert rehearsal), with the intention of reinforcing learning of suicide risk factors. In addition, another strategy that was used to enhance learning was encouraging schema construction. Learners hold cognitive schemas in their long-term memories. A schema can be defined as domain-specific knowledge within the long-term memory (Brewer & Treyns, 1981; Kalyuga et al., 2001) or “as a construct that permits us to treat multiple elements of information as a single element” (Leahy & Sweller, 2004, p.858). According to the Schema Theory, cognitive schemas allow the learner to organize related information in a meaningful way, able to be recalled later as one element rather than multiple elements (Kirschner, 2002; Sweller, 1988; Sweller et al., 2011, 1998; van Merriënboer & Sweller, 2010), and thus reduces working memory cognitive load (Bartlett, 1932; Chi et al., 1982; Piaget, 1928).

Activating Prior Knowledge and Pre-Existing Cognitive Schemas

The visual metaphor of suicide risk factors builds on prior knowledge and pre-existing cognitive schema, because the symbols used in the visual metaphor were all familiar to participants, with the exception of the DSM-IV-TR Multiaxial Diagnostic System (Axis I, II, and III) (American Psychiatric Association, 2000). Activating participants’ prior knowledge enhanced meaningful and effective learning of suicide risk factors as it permitted participants to make connections between the new information and the existing knowledge (Ausubel et al., 1986; Bruner, 1973; Andrew

Ortony, 1993; Tennant & Pogson, 1995). Also, the visual metaphor adopted a seafaring cognitive schema (someone sailing away from the port alone, on a small boat, leaving the city and everyone behind and heading to a death island). Participants were all familiar with this cognitive schema, and since the visual metaphor contained all the suicide risk factors, remembering or retrieving suicide risk factors from the long-term memory was much easier than recalling twenty-three risk factors individually.

The Visual and Metaphorical Nature of the Intervention

Another possible explanation is that the visual metaphor of suicide risk factors, as the name implies, is a visual and metaphorical representation of risk factors. Research shows that images and drawings of abstract concepts result in better free recall than when expressed textually (Borgo et al., 2012; Eitel, Scheiter, Schüler, Nyström, & Holmqvist, 2013; Höffler & Leutner, 2007; Paivio, 1986; Paivio & Csapo, 1973; Sampson, 1970). Why this is the case may best be explained by the Dual Coding Theory (Clark & Paivio, 1991; Paivio, 1986; Paivio & Csapo, 1973). The theory posits that language (verbal or text) and images are encoded and processed in the brain differently. Images are represented and processed by a visual system, whereas words are handled by a verbal system. Both systems complement and supplement each other; indeed recent MRI studies have confirmed that visual information (images) is processed by the right hemisphere of the brain (Lai, van Dam, Conant, Binder, & Desai, 2015; Smith et al., 1995), while linguistic information is processed by the left hemisphere of the brain (Dundas, Plaut, & Behrmann, 2014; Knecht et al., 2000).

The Dual Coding Theory claims that images of familiar objects or symbols are encoded, both visually and verbally, while text or words are encoded only verbally (Paivio, 1986). Therefore, the chance of recalling a visual stimulus is doubled because

the stimulus can be retrieved either by remembering the word or name that describes the stimulus or by the visual representation of the stimulus. The visual metaphor of suicide risk factors allows us to do this (remember the risk factors both visually and verbally). For example, participants can retrieve 'issues with sexual identity' as a suicide risk factor from the long-term memory by either remembering the words or the visual representation of this risk factor (depicted by an interlinked gender sign in the visual metaphor).

Possible Criticisms

Another point worth discussing here is that the visual metaphor might raise some cultural issues in relation to some of the symbols of suicide risk factors used, although universality and culture sensitivity were carefully considered during development. Research shows that visual metaphors vary across cultures, reflecting the cultural, ethnic, social and religious backgrounds (Hooft et al., 2013; Kovecses, 2005). The visual metaphor of suicide risk factors contains some symbols that may be culture specific and could confuse, or in some instances offend, certain groups e.g. a cross representing death or a flag signifying ethnicity may correspond to colonialism for some individuals. If this happens to be the case, an adaptation of the visual metaphor can be made as easily as simply changing the cross or the flag to equally representative visual symbols that are still meaningful within the given context. Nonetheless, it is crucial that each symbol within the visual metaphor is interpreted according to the metaphorical descriptions provided.

Furthermore, the visual metaphor could potentially be criticized as having a biomedical bias, stemming from the fact that the DSM-IV-TR Multiaxial Diagnostic System (Axis I, III, and III) was used in the visual metaphor. Indeed, this is a valid

criticism. However, attention should be directed to the fact that the term mental illness encompasses multiple categories such as: mood disorders, anxiety disorders, psychotic disorders and so on, as do the terms personality disorders and terminal illness (borderline personality disorder, antisocial personality disorder, lung cancer, pancreatic cancer, Alzheimer's and Parkinson's diseases etc.). Furthermore, comprehensive risk assessment of suicide is often conducted by mental health professionals, who base their diagnosis on the DSM diagnostic criteria. Therefore, using the DSM multiaxial framework to represent these risk factors domains not only saves time and effort but also carries the correct connotation and meaning. It also activates the trainee/clinician's prior knowledge of this system in an attempt to reduced extraneous cognitive load.

The suicide risk factors visual metaphor may be more beneficial to novice learners than to experts. This could be attributed to the notion that experts may have constructed their own cognitive schemas for remembering suicide risk factors and hence see the visual metaphor of less use. This notion is supported by considerable evidence from the field of computer science (Blackwell, 2006; Cameron, 2002; Colburn & Shute, 2008; Fiore, Cuevas, & Oser, 2003; Hsu, 2006). This research shows that metaphor use is likely to positively influence novice learners' performance and deep learning of concepts at hand, and this effect becomes more apparent as novice learners construct more abstract and richer cognitive schemas. On the other hand, expert learners may not benefit from metaphors immediately after learning, rather the benefits are found some time after learning. Explanations as to why this is the case are lacking, but it could be because experts have their own schemas, or mental models, of the concepts that are being revisited, and integration of any new schemas elicited by visual metaphors with pre-existing schemas requires more time.

5.4. Implications

In light of the main findings of this study, there are two implications to be addressed. The first derives from the finding that the visual metaphor enhances memory recall of suicide risk factors and augments the learners' ability to apply learnt materials to new suicide risk vignettes. This calls on tutors, lecturers, and paper-coordinators to incorporate the visual metaphor of suicide risk factors into the teaching curriculum and suicide risk assessment related teaching contents. The benefits of this lie in the fact that the visual metaphor, accompanied by its metaphorical descriptions, enhances memory, promotes effective learning of risk factors, and caters for various learning styles. Going even further, the visual metaphor could potentially be printed on self-reminding flash cards for mental health trainees/clinicians to keep with them when conducting risk assessments.

The second implication stems from the second main finding of this study, which is that the visual metaphor imposes less cognitive load on learners' working memory compared to the conventional didactic teaching methods. The design of the visual metaphor was informed by the Cognitive Load Theory, which has been shown to be an effective instructional design. This adds supporting evidence for the theory and its design principles. Educators should be cognizant of the limitations of the working memory and avoid information overload in order to enhance deeper learning. While the complexity and elements of interactivity of any given learning content are mandatory and sometimes unavoidable, the delivery methods and presentation techniques (the essence of the Cognitive Load Theory) are in the hands of educators. Every effort should be exercised to prepare and deliver learning content effectively.

5.5. Limitations of the Present Study

As with any other study, several limitations threaten the internal and external validity of the current findings. A major limitation was the limited sample size of participants involved in the study. Although every effort was made to recruit as many participants as possible including: distributing study flyers around the university campus; delivering verbal announcement during lecture sessions; sending an electronic invitation email via Stream; offering a \$10 Countdown voucher for each participant; and a random draw to win Fitbit Wireless Wristbands, the study response rate was relatively low. This could be attributed to several reasons, one of which might be that suicide is a sensitive subject for many people, including the young adults, some of whom may have attempted suicide themselves, or know someone who either died by suicide or had a family history of suicide. Additionally, another possible reason for the low number of participants might be related to when the study was conducted (Thursday and Friday afternoons) and the relatively long duration of the study (1hour and 15minutes). Students may have felt exhausted or had other commitments, given that it was the end of the week, which further made recruitment more difficult. Overall, this small sample size threatens the generalizability of the study findings, and more robust replications of this study are warranted.

A second limitation was that, although this experimental pilot RCT study included random assignment and allocation concealment, blinding was not possible given the educational nature of this research. Simply because both the researcher and the participants knew to which groups they were randomly assigned. This was due to the fact that the primary investigator had developed the intervention, along with another colleague, and was responsible for delivering the sessions. Participants were also un-blinded, because the nature of the teaching content (the presence or absence of

the visual metaphor) was visible. Therefore, un-blinding might have influenced how participants responded to the questions, which in turn may have limited the internal validity of the study. Similarly, the absence of pre-testing to establish a baseline of participants' prior knowledge of suicide risk factors limited the type of analysis conducted.

Another threat to the external validity of this study was the use of a single researcher to conduct all phases of the experiment. The primary researcher was responsible not only for recruiting participants, but also preparing, designing, and delivering the learning content for both group conditions. Also, it was the researcher's duty to mark the returned questionnaires and analyze the data. Therefore, it is possible that participants' behaviors or the study outcomes were unintentionally influenced by the researcher's expectancy.

Finally, although the Paas Cognitive Loading Scale (Paas, 1992) is a simple, valid and reliable measure of the cognitive load, it remains subjective and based on the premise that "learners are able to introspect the amount of mental effort invested during learning and testing" (p. 429). Monitoring one's own mental effort during learning may be difficult to achieve, especially if one is immersed in the learning task. Furthermore, Naismith, Cheung, Ringsted, and Cavalcanti (2015) and Brunken et al. (2010) point out that this single-item scale, although provides a global assessment of cognitive load, does not differentiate between the different types of cognitive loads as identified by the Cognitive Load Theory and hence is "unable to provide useful information regarding which processes have caused the perceived amount of mental load" (Brunken et al., 2010, p. 183).

5.6. Recommendations for Future Research

The findings of this study and the limitations addressed above give rise to some recommendations and suggestions for future research in this area. Future studies should replicate the current study in different settings but with a full RCT experimental design, including those elements that were absent in this study. This will allow for broader generalization regarding the effectiveness of the visual metaphor of suicide risk factors.

Improvements to the current design may include:

- 1-** Pre testing to establish baseline criteria.
- 2-** Double or even triple blinding if possible.
- 3-** A larger sample size.
- 4-** An independent blinded researcher/marker.
- 5-** Objective measures of cognitive load.

Future research is also invited to investigate the following issues:

- 1-** Test the efficacy of this visual metaphor with various groups including, but not limited to, postgraduate psychology students, psychology interns, psychologists, and senior clinicians. It will also be worthwhile to compare the utility of the visual metaphor as a means to teach suicide risk factors to a younger generation of trainees (novice learners) across multiple disciplines with an older generation of mental health professionals (experts).
- 2-** Examine the effects of using the visual metaphor of suicide risk factors alone in comparison to conventional lectures.
- 3-** Investigate the impact that the visual metaphor has on the learning

performance of participants with different learning styles.

- 4- Conduct follow-up studies to determine the lasting effects of the visual metaphor on memory and knowledge transfer.
- 5- Conduct qualitative research (Grounded theory or Thematic Analysis methodology) to study participants' subjective experiences and thoughts about the visual metaphor.

5.7. Overall Conclusion

The primary goal of this study was to investigate the efficacy of the visual metaphor of suicide risk factors (Visual Metaphoria, 2016), used as an adjunct to traditional textual teaching methods, on first-year psychology students. This intervention was compared to the sole use of traditional textual teaching methods (oral presentation plus PowerPoint textual slides). This research has provided support for the use of the visual metaphor when teaching suicide risk factors to university psychology students. The treatment group (participants who were exposed to the visual metaphor) freely recalled more risk factors and identified more risk factors from the suicide risk vignette provided. The intervention was also reported as being less cognitively loading compared to the conventional teaching methods. Higher satisfaction levels were also reported by the treatment group. These findings were very encouraging given the diversity, complexity, and large number of suicide risk factors.

It is hoped that these findings might inspire educators to include the visual metaphor of suicide risk factors into the teaching curriculum and related suicide risk assessment teaching contents in order to enhance deeper learning. It is also hoped that future large-scale studies replicate these findings to add empirical support for the effectiveness of the visual metaphor of suicide risk factors.

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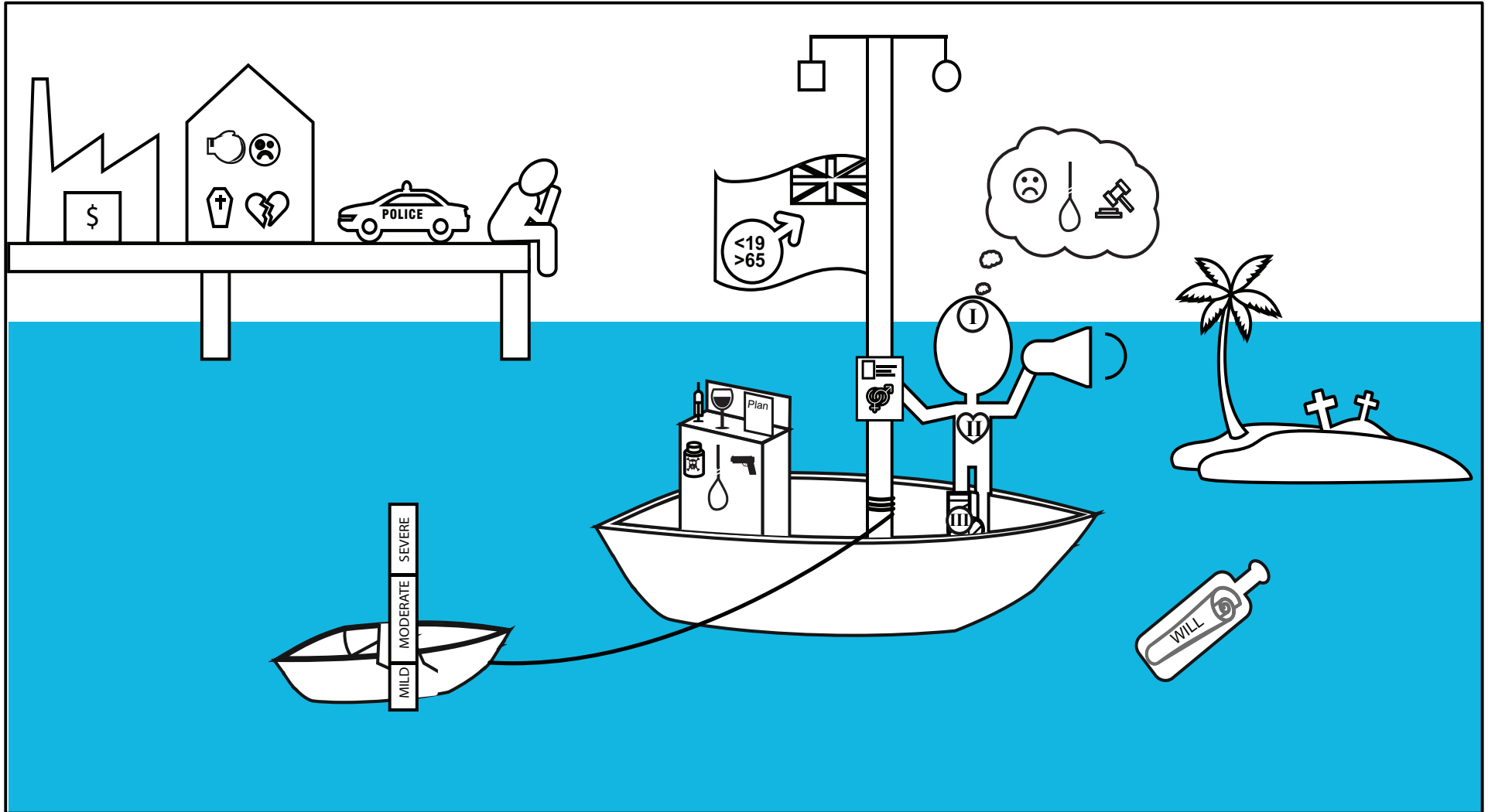
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APPENDICES

APPENDIX A: The Visual Metaphor of Suicide Risk Factors



Note: Adopted from (Visual Metaphoria, 2016)

APPENDIX B: Control Group Questionnaire

Suicide Risk Factors Questionnaire

The questionnaire is split into **4 sections**. In total there are **5 pages**.

Section 1 has **one** part asking about some demographic information.

Section 2 has **two** parts, asking about your knowledge of suicide risk factors after attending traditional teaching session.

Section 3 has **one** parts asking about your level of mental effort associated with learning suicide risk factors.

Section 4 has **one** part asking about your satisfaction.

Section 1A: Demographic information

Please answer the questions or circle the answers as appropriate.

1. Gender:	Male	Female	2. Age:	_____
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3. Which ethnic group do you belong to?

NZ European

Maori

European

Pacific People

Asian

South East Asians

Middle Eastern

African

Other: (Please state):-----

**Section 3A:
Cognitive load**

Please circle the number that best describes your subjective experience while learning suicide risk factors.

In studying and learning suicide risk factors, I invested

1. Very, very low mental effort.
2. Very low mental effort.
3. Low mental effort.
4. Rather low mental effort.
5. Neither low nor high mental effort.
6. Rather high mental effort.
7. High mental effort.
8. Very high mental effort.
9. Very, very high mental effort.

**Section 4A:
Satisfaction**

Please rate the extent to which you agree with each of these items by circling a value from **1 (strongly disagree)** to **5 (strongly agree)**, where **3** indicates you **neither agree nor disagree**.

	Strongly disagree	Disagree	Neither	Agree	Strongly agree
1. I enjoyed learning about suicide risk factors.	1	2	3	4	5
2. The teaching session stimulated my interest in suicide risk assessment.	1	2	3	4	5
3. The teaching session helped me learn suicide risk factors more effectively	1	2	3	4	5
4. The content of the teaching session was laid out in such a way that kept me engaged.	1	2	3	4	5
5. I consider what I learnt valuable for my future.	1	2	3	4	5
6. The lecture and power point slides helped me recall suicide risk factors easily.	1	2	3	4	5
7. Overall, I was satisfied with the learning session.	1	2	3	4	5

If you would like to add any comments, please use the space below:

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APPENDIX C: Intervention Group Questionnaire

Suicide Risk Factors Questionnaire

The questionnaire is split into **4 sections**. In total there are **5 pages**.

Section 1 has **one** part asking about some demographic information.

Section 2 has **two** parts, asking about your knowledge of suicide risk factors after being introduced to the visual metaphor.

Section 3 has **one** parts asking about your level of mental effort associated with learning suicide risk factor.

Section 4 has **one** part asking about your satisfaction.

Section 1A: Demographic information

Please answer the questions or circle the answers as appropriate.

1. Gender:	Male	Female	2. Age:	_____
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3. Which ethnic group do you belong to?

NZ European

Maori

European

Pacific People

Asian

South East Asians

Middle Eastern

African

Other: (Please state):-----

**Section 3A:
Cognitive load**

Please circle the number that best describes your subjective experience while learning suicide risk factors.

In studying and learning suicide risk factors, I invested

1. Very, very low mental effort.
2. Very low mental effort.
3. Low mental effort.
4. Rather low mental effort.
5. Neither low nor high mental effort.
6. Rather high mental effort.
7. High mental effort.
8. Very high mental effort.
9. Very, very high mental effort.

**Section 4A:
Satisfaction**

Please rate the extent to which you agree with each of these items by circling a value from **1 (strongly disagree)** to **5 (strongly agree)**, where **3** indicates you **neither agree nor disagree**.

	Strongly disagree	Disagree	Neither	Agree	Strongly agree
1. I enjoyed learning the visual metaphor of suicide risk factors.	1	2	3	4	5
2. The visual metaphor stimulated my interest in suicide risk assessment.	1	2	3	4	5
3. The visual metaphor helped me learn suicide risk factors more effectively.	1	2	3	4	5
4. The content of the visual metaphor was laid out in such a way that kept me engaged.	1	2	3	4	5
5. I consider what I learnt valuable for my future.	1	2	3	4	5
6. The visual metaphor helped me recall suicide risk factors easily.	1	2	3	4	5
7. Overall, I was satisfied with the visual metaphor.	1	2	3	4	5

If you would like to add any comments, please use the space below:

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APPENDIX D: Study Advertisement

Suicide risk factors: A clinical visual tool for better knowledge retention and transfer

Research Study:

First-year psychology students are invited to participate in a pilot Randomized Control Trail (RCT) study investigating the effectiveness of an innovative, recently developed visual metaphor of suicide risk factors. The study is primarily conducted by Mohsen Alyami, and supervised by Dr Bev Haarhoff, at Massey University, School of Psychology, Auckland.

What will you be doing?

Participants will be randomly assigned to either a control or intervention groups. The control group will attend 1.15 hour long traditional teaching session, whereas the intervention group will also attend 1.15 hour long traditional teaching session plus have access to the visual metaphor of suicide risk factors. All participants will provide demographic information such as age, gender, and ethnicity, and answer some survey questions.

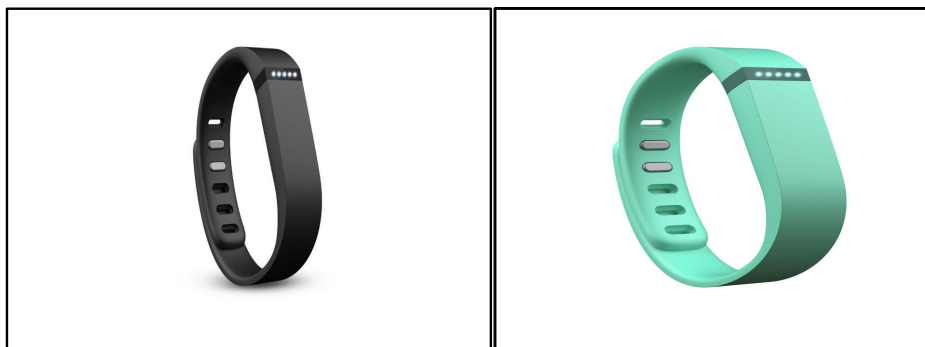
Compensation is available:

\$10 Countdown voucher will be offered to all participants in acknowledgement of time and participation in the study. In total there are 60 vouchers to give away. At the completion of the study, each participant will collect one voucher on their way out of the classroom. To go into the draw to win a **Fitbit Flex Wireless Wristband (Black or Teal)**, you need to consent to provide your email address to the project supervisor Dr Bev Haarhoff at suicideriskfactors@hotmail.com

More Information?

All first-year psychology student are welcome to participate.

If you would like more information about the study and/or participation, please contact Mohsen Alyami at suicideriskfactors@hotmail.com OR at 0212227367



APPENDIX E: Participant Information Sheet



School of Psychology
Massey University

Suicide risk factors: A clinical visual tool for better knowledge retention and transfer

INFORMATION SHEET

Researcher(s) Introduction:

Dear participants, to introduce myself, my name is Mohsen Alyami and I am currently undertaking my research project in partial fulfillment of requirements for the degree of Master of Health Science endorsed in Psychology at Massey University, Albany campus, Auckland.

Project Description:

A brief summary of the project:

The research project looks at the effects of the utilization of an innovative, recently developed visual metaphor of suicide risk factors on 60 first year psychology students in comparison to textual traditional teaching methods. The research aim is to investigate the effects of suicide risk factors visual metaphor on students' knowledge retention and knowledge transfer. Another aim of the project is to assess participants' subjective mental effort while learning suicide risk factors. Also, participants' perceived usability and usefulness of the visual metaphor will be assessed in addition to satisfaction levels.

It could potentially contribute to the following:

- Enhance your memory of suicide risk factors through the use of visual aids.
- Improve your confidence in recognizing both static and dynamic suicide risk factors.
- Allow you to learn through interactive discussions where making mistakes is less anxiety provoking.

An invitation to participate in the research:

You are invited to participate in this research to assess the effectiveness of the proposed visual metaphor of suicide risk factors on your knowledge retention, knowledge transfer, satisfaction, and perception of usefulness and usability. To find potential participants, like you, I have advertised on notice boards as well as made verbal announcements during some of your lectures.

Your participation is completely voluntary and you may decline this invitation to participate without penalty.

Details of compensation/payments offered for participation:

\$10 vouchers will be offered to all participants in acknowledgement of time and participation in the study. In total there are 60 vouchers to give away. At the completion of the study, each participant will collect one voucher on their way out of the classroom. To go into the draw to win a Fitbit Flex Wireless Wristband (Black or Teal), you need to consent to give your email address to the project supervisor Dr Bev, who at the completion of the study will use an automated computer program to pick a winner.

suicideriskfactors@hotmail.com

Description of discomforts or risks to participants as a result of participation:

Although a discussion on suicide may be a difficult issue for some participants, no risk is anticipated. However, in the unlikely event that unpleasant emotions may be triggered, participants should contact support services. Multiple professional contacts are listed at the end of the Information Sheet.

Project Procedures:

The procedures in which participants will be involved:

If you choose to participate, you will be randomly assigned either to control or intervention groups (pilot RCT). Both groups will have the usual traditional teaching (lecture and textual PowerPoint slides). While the control group will only receive traditional teaching, the intervention group will also have access to visual metaphor of suicide risk factors.

After the teaching session, you will be asked some questions in relation to your knowledge of suicide risk factors, subjective mental effort, perceived usability and usefulness of the visual metaphor and satisfaction levels. Participants will be required to provide some demographic information such as gender, age, and ethnicity. The experiment will take a maximum of 1.15 hour for each group approximately, 50 minutes for teaching session and 25 minutes to complete the questionnaire.

Data Management:

Storage and disposal of data:

All data (hard copy and digital) will be stored securely in locked cabinets and on password-protected computers at Massey University, Albany campus, Auckland. Consent forms will also be securely stored separately from data. Stored data will only be accessible by the student (Mohsen Alyami) and his supervisor (Dr. Bev Haarhoff). The data will be stored for a maximum of five years from the time the study is completed, after which time it will be destroyed by the supervisor.

The preservation of confidentiality is paramount. Therefore, the information shared will be confidential to the researcher and his supervisor only. If the information you

provide is reported and/or published, this will be done in a way that does not identify you as its source.

Method for accessing a summary of the project findings:

You can access the summary of the project findings online. Type the following link in your browser <http://suicideriskfactors.blog.com/?p=4>. Results will be made available on the web page on the 15th of July 2016 for 15 days, a point of time after which the web page will be terminated.

Participant's Rights:

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Decline to answer any particular question;
- Withdraw from the study at any time and you will not have to provide a reason for this decision. You may request to have the data you provided for this study withdrawn up until one month after completion of the questionnaires. At this point in time, data provided by the participants will not be able to be withdrawn from this study. To withdraw from this study, participants can contact Mohsen Alyami (mohalyami@hotmail.com).
- Ask any questions about the study at any time during participation;
- Provide information on the understanding that your name will not be used unless you give permission to the researcher;
- Be given access to a summary of the project findings when it is concluded.

Project Contacts:

Supervisor: Dr Bev Haarhoff

School of Psychology, Massey University, Albany Campus.

(09) 414 0800 ext. 43105

B.A.Haarhoff@massey.ac.nz

Student: Mohsen M Alyami

School of Psychology, Massey University, Albany Campus.

021 222 7367

mohalyami@hotmail.com

suicideriskfactors@hotmail.com

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application #15/042. If you have any concerns about the conduct of this research, please contact Dr. Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

List of Professional Contacts:**Crisis Services:**

North Shore (Adults): 486 8900

West Auckland (Adults): 486 8900

Marinoto North (Child & Youth): 0800 489 555

Auckland Central: 270 9090

Subsidized Support:

Lifeline (24 hour counseling): 0800 543 354 (www.lifeline.org.nz).

Warmline (24 hour counseling): 0508 927654

Samaritans (24 hour support): 0800 726 666

Youthline (Phone counseling youth): 0800 376 633 (www.youthline.co.nz)

Supporting families (Family MH support): 0800 732 825

Massey University Student Amenities Centre (Health & Counselling)

Address: 5 University Avenue, Albany, Auckland 0632

Phone: 06-350 5701

The Centre for Psychology Albany Campus, Massey University, Auckland

Address: 3rd Floor, North Shore Library Building, 229 Dairy Flat Highway, Albany Village

Phone: 09 441 8175

Email: centreforpsychology@massey.ac.nz

Website: psychology-services.massey.ac.nz

APPENDIX F: Ethical Approval



MASSEY UNIVERSITY ALBANY

22 September 2015

Mohsen m Alyami
1C/28 Morning Star Place
Mount Albert
Auckland 1025

Dear Mohsen

HUMAN ETHICS APPROVAL APPLICATION – MUHECN15/042

Suicide Risk Factors: A clinical visual tool for better knowledge retention and transfer

Thank you for your application. It has been fully considered, and approved by the Massey University Human Ethics Committee: Northern.

Approval is for three years. If this project has not been completed within three years from the date of this letter, a re-approval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Andrew Chrystall'.

Dr Andrew Chrystall
Acting Chair
Human Ethics Committee: Northern

cc Dr Beverley Haarhoff
School of Psychology
Albany Campus

Professor James Liu
Head of School of Psychology
Albany Campus

Te Kunenga
ki Pūrehuroa

Research Ethics Office
Private Bag 102 904, Auckland, 0745, New Zealand Telephone +64 9 414 0800 ex 43276 humanethicsnorth@massey.ac.nz

APPENDIX G: Permission to use Paas Cognitive Load Scale

RE: Permission to use your cognitive load scale 1992

From: paas@fsw.eur.nl
To: mohalyami@hotmail.com
Subject: Re: Permission to use your cognitive load scale 1992
Date: Mon, 22 Feb 2016 16:29:41 +0000

Dear Mohsen,

Sure, you can use the scale. I have attached it to this mail.

Good luck with your studies and best wishes,
Fred

Fred Paas, Ph.D. | Professor of Educational Psychology

Department of Psychology, Education & Child Studies | Erasmus University
Rotterdam | Netherlands | paas@fsw.eur.nl

Early Start Research Institute | University of Wollongong | Australia | fredp@uow.edu.au

On 22 Feb 2016, at 13:16, Mohsen Alyami <mohalyami@hotmail.com> wrote:

Dear prof Paas,

Hope my email reaches you sound and well.

My name is Mohsen Alyami, a postgraduate student at Massey University, Auckland, New Zealand.

I am conducting a pilot RCT study to determine the efficacy of a visual metaphor that we have developed to enhance students' learning of suicide risk factors. One of the outcome measures is the amount of mental effort invested in learning the risk factors. I hereby ask you kindly if i can use your 1992 cognitive scale in my study?

Kind regards

Mohsen Alyami
Massey University
School of Psychology
New Zealand

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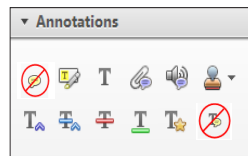
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Article Number: 657695

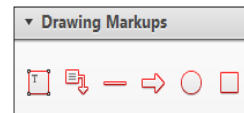
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Enhancing suicide risk assessment: a novel visual metaphor learning tool

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Gary Cheung Senior Lecturer, Department of Psychological Medicine, The University of Auckland, New Zealand and Consultant Psychiatrist, Auckland City Hospital, Auckland, New Zealand

Beverly A Haarhoff Senior lecturer and Registered Clinical Psychologist, Massey University, New Zealand

Mataroria P Lyndon Clinical Lead, Ko Awatea (Centre of Health System Innovation and Improvement), Counties Manukau District Health Board, New Zealand

Andrew G Hill Professor of Surgery and Head of the South Auckland Clinical Campus, The University of Auckland, New Zealand

Abstract

Objective: Suicide risk assessment is variably taught and learnt by health professionals. The literature indicates that training programs of this fundamental competency need to be enhanced. To facilitate teaching and learning of this core clinical skill, we propose a novel visual metaphor in order to conceptualize suicide risk factors. The design of the proposed visual metaphor was informed by the Cognitive Load Theory to enhance deep learning of the various suicide risk factors.

Conclusion: The visual metaphor depicting suicide risk factors can potentially improve memory and recall. It activates prior knowledge and is based on educational theory informed design principles.

Keywords: suicide, suicide risk factors, evidence-based risk factors, visual metaphor

Assessment and management of risk of harm to self and others is one of the core competencies in the Royal Australian and New Zealand College of Psychiatrists Fellowship Program (a Stage 2 mandatory Entrustable Professional Activity).¹ Mental health professionals are expected to conduct comprehensive suicide risk assessments; however, adequate training for this essential skill has been lacking.^{2–4} A US national survey found that only one-fourth of psychiatric residency training programs provided formal training aimed at building skills directly related to suicide risk assessment.⁵ More recent studies have also showed inadequacies in risk assessment skills amongst some psychiatrists.^{3,6} Furthermore, a number of studies have shown that only half of psychology trainees⁷ and community nurses⁸ have received risk assessment training. Similarly, only a quarter of social workers

have received risk assessment training.⁹ A survey of 238 pre-doctoral psychology interns found that approximately 49% of interns reported that their training did not include any formal training in risk assessment.² Training delivery methods have included passive and didactic formats during supervision or seminar sessions, which were not aimed at risk assessment skill building. Overall, current suicide risk assessment training is deemed insufficient.^{3,6,10}

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Email: haly282@aucklanduni.ac.nz

It is recognized that knowledge of the various suicide risk factors is the foundation for accurate risk assessment and management.¹¹ However, training programs often rely on didactic teaching methods, which might not be the most effective way of converting knowledge into an applied clinical skill.³ This possibly arises because the information provided does not automatically translate into the deep learning required for risk assessment competency. The most popular methods of teaching suicide risk assessment as identified by chief residents of psychiatry training programs in the US include formal teaching such as lectures, workshops and seminars, grand rounds, and case conferences, which often lack audio/video materials.¹⁰

Visual metaphor is commonly discussed in the literature as a tool of knowledge visualization and organization.¹² Visual metaphors are found in advertisements, newspapers, campaigns and scientific literature. For instance, 'tip of the iceberg' is a visual metaphor frequently used to describe the subject being discussed, encountered, felt, or experienced as a relatively small portion of a much larger concept, situation or problem that remains hidden.¹³

The present paper describes the use of an innovative visual metaphor of suicide risk factors developed by first and second authors. These risk factors are drawn on the evidence-based literature as a teaching and learning tool.^{14,15} The purpose of this visual metaphor is to assist trainees and clinicians in mental health and non-mental health services alike, to not only easily learn but also recall and explore suicide risk factors while conducting a clinical assessment.

Methods

In developing the current visual metaphor for suicide risk factors, the authors utilized the design principles informed by the Cognitive Load Theory (CLT).¹⁶ This theory is based on what is known about the architecture of memory, in particular the working memory and its limited processing and storing capacity.¹⁷ It identifies three types of cognitive loads that affect the working memory and hence learning. These are: (i) the intrinsic load (the amount of mental effort imposed on the working memory by the complexity of the taught material); (ii) the extraneous load (the amount of mental effort imposed on the working memory by the design and delivery of the teaching content) and (iii) the germane load which is the amount of learning that occurs.¹⁸ CLT posits that the extraneous load should be minimized through optimizing teaching material design and delivery. This will minimize information overload, thus freeing some of the working memory cognitive resources that can be directed at learning the content, hence optimizing the germane load.¹⁸

As life can be considered a journey,¹⁹ so could suicide.²⁰ As journeys could be via land, sea or air, a seafaring

journey was deemed most appropriate to incorporate the various aspects of suicide risk assessment within the same visual metaphor. When a patient experiences a number of psychosocial stressors on land, they could potentially embark on a journey whereby the destination may be an island of death. On this journey, they have their static and dynamic, internal and external risk factors. In an attempt to reduce the cognitive load associated with the complete visual metaphor, we have broken down the metaphors into three figures followed by a final summary figure.

Results

Static suicide risk factors are those characteristics that cannot be modified and often have limited implications for treatments.²¹ These include age (<19 and >65), gender, ethnicity, history of past suicide attempts and lethality, and family history of suicide. Figure 1 visually depicts these elements, which are further explained in Table 1.

Dynamic risk factors are those that can be modified and are often the target of intervention.²¹ These dynamic risk factors are represented in Figures 2 and 3.

Figure 2 includes DSM-IV-TR Axis I, II and III disorders, gender dysphoria, hopelessness, suicidal ideation and intent, help seeking behavior, alcohol and substance abuse, suicide plan, suicide note and access to lethal methods. These risk factors are further explained in Table 2.

Dynamic risk factors further include issues with the legal system, unemployment, recent bereavement, relationship break ups, childhood abuse and social isolation. Figure 3 visually depicts these risk factors, which are further explained in Table 3.

Each of these visual metaphors are then grouped together as in Figure 4.

Discussion

Benefits and limitations of visual metaphor

Several reports have identified a number of benefits when using visual metaphor as a tool to facilitate learning,

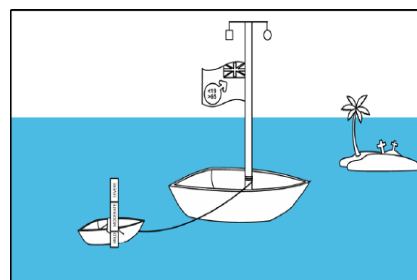


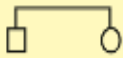


Figure 1. Visual metaphor of static suicide risk factors.

Note: Adopted from Visual Metaphoria.²²

Table 1. Static suicide risk factors and their visual metaphors

<i>Risk factor</i>	<i>Metaphorical description</i>	<i>Visual metaphor</i>
Age Gender Ethnicity	<19 & >65 Male gender sign Flag	
Previous suicide attempts and lethality	Sunken broken boat, with a severity ruler	
Family history of suicide	Genogram	

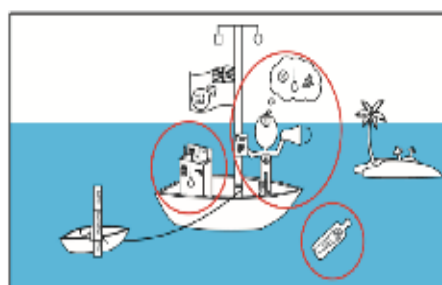


Figure 2. Part one of dynamic suicide risk factors.

Note: Adopted from Visual Metaphoria.²²

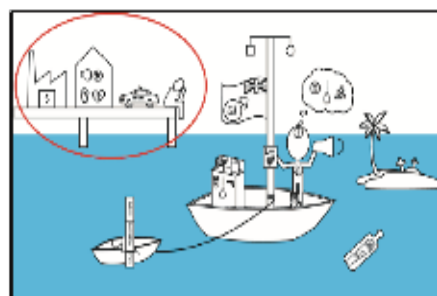


Figure 3. Part two of dynamic risk factors.

Note: Adopted from Visual Metaphoria.²²

knowledge organization and sharing. Visual metaphor enhances cognitive abilities due to its ability to optimally organize and structure the content.²³ Although visual metaphor is not the only tool for knowledge visualization and organization, it has benefits over related tools. According to Eppler (2006), well designed and presented visual metaphors have low-to-medium levels of difficulty and lead to enhanced understanding and memory in comparison to concept mapping and conceptual diagrams.¹² Other advantages of visual metaphors include increased engagement with audiences and enhanced attention, comprehension and memory.¹²

Visual metaphors can help learners to incorporate newly learnt material with prior knowledge²⁴ and hence foster deeper learning and knowledge transfer. It has been demonstrated that visual metaphors are fundamental cognitive processes and products of thought as well as language that can be utilized in learning.²⁵ In the same vein, visual metaphors simplify complex and abstract scientific concepts by using familiar visual symbols and organizing the content in a meaningful way.²⁶ Another benefit of visual metaphor is that it

allows knowledge and information transfer across cultures.²⁷ This could be attributed to the fact that well-designed visual metaphors reduce the use of written communication, if any, to a minimum, in order to eliminate ambiguity.

There are limitations when applying visual metaphors in the educational sphere. Firstly, developing a novel and innovative visual metaphor to conceptualize a complicated scientific principle is a lengthy process that requires time and energy, and potentially several attempts at designing and re-designing.²⁸ Secondly, visual metaphors are susceptible to misinterpretation, which may then cause errors in understanding.²⁹ Consequently, visual metaphors should be accompanied by written or verbal descriptions to avoid such misunderstanding.²⁸ Thirdly, there may be some images that are culturally specific and could confuse or, in some instances, offend certain groups e.g. a cross representing death or a flag signifying ethnicity may correspond to colonialism for some people. The efficacy and utility of this visual metaphor is planned to be tested in a future trial.

Table 2. Dynamic suicide risk factors and their visual metaphors


















<i>Risk factor</i>	<i>Metaphorical description</i>	<i>Visual metaphor</i>
Presence of Axis I disorders (Psychiatric disorders)	Roman numeral (I)	
Presence of Axis II disorders (Personality disorder or intellectual disability)	Roman numeral (II)	
Presence of Axis III disorders (Medical conditions)	Roman numeral (III)	
Gender dysphoria	Interlinked gender signs on an ID like card	
Hopelessness Suicidal ideation Suicide intent	Hopeless face Noose Judge's gavel	
Help seeking behavior	Megaphone	
Alcohol abuse	Wine Glass	
Substance abuse	Syringe	
Suicide plan	Plan on a piece of paper	
Suicide note	Note in a bottle	
Access to lethal methods	Firearms, noose and poison or stockpiling medications	

Table 3. Dynamic suicide risk factors and their visual metaphors (continue)

<i>Risk factor</i>	<i>Metaphorical description</i>	<i>Visual metaphor</i>
Issues with the legal system	Police car	
Unemployment	Factory	
Recent bereavement	Coffin	
Relationship break up	Broken heart	
Childhood abuse	Boxing glove and a black eye	
Social isolation/lack of social support	Person sitting alone	

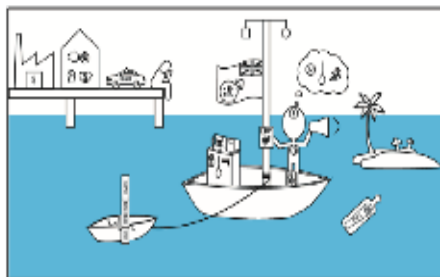


Figure 4. The complete suicide risk factors visual metaphor.
 Note. Adopted from Visual Metaphoria.²²

Conclusion

Overall, the benefits of visual metaphor should be considered as a complementary tool for teaching suicide risk assessment. The suicide risk factors visual metaphor could potentially improve memory and recall as it activates prior knowledge through educational theory informed design principles.

Disclosure

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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