

Evaluation of a Visual Metaphor of Suicide Risk Factors: Results from a Pilot Randomized Controlled Trial in Psychology Students

M Alyami^{1,*}, H Alyami², F Sundram³, B A Haarhoff⁴

¹School of Psychology, Massey University, Auckland, New Zealand

²Consult Liaison Psychiatry, Starship Hospital, Auckland District Health Board, New Zealand and South Auckland Clinical Campus, The University of Auckland, New Zealand

³Department of Psychological Medicine, Faculty of Medical and Health Sciences, The University of Auckland, Auckland, New Zealand

⁴Senior lecturer and Registered Clinical Psychologist, Massey University, Auckland, New Zealand

*Corresponding author: mohsen.alyami.1@uni.massey.ac.nz

Abstract Background: Although comprehensive knowledge of suicide risk assessment is fundamental, training programs for such an essential skill often include passive and didactic methods that may not facilitate recall. **Objectives:** To examine the efficacy of a recently published novel visual metaphor (VM) for teaching suicide risk factors as an adjunct to traditional teaching methods in a group of novice learners. **Methods:** A pilot non-blinded randomized controlled trial (RCT) was conducted. 22 first-year undergraduate psychology students were randomly assigned to either a control group, where they received traditional teaching (TT) or an intervention group, where they received traditional teaching and the visual metaphor (TT+VM). Participants then completed post-learning assessment including immediate free recall of suicide risk factors and knowledge application based on a clinical vignette. Cognitive load and participants' satisfaction were also assessed. Descriptive statistics and the Mann-Whitney U test were used to analyse the data. **Results:** The TT+VM group demonstrated significantly better immediate free recall of suicide risk factors (mean= 14.56, SD= 3.2, $p=.026$), and superior application in the clinical vignette (mean= 14.33, SD= 1.00, $p=.036$). Furthermore, the TT+VM group also reported significantly less cognitive loading while learning suicide risk factors (mean= 3.44, SD= .88, $p=.001$) and significantly higher satisfaction levels (mean= 26.44, SD= 3.6, $p=.001$). The differences between the two groups on these domains ranged between medium and large effect sizes. **Conclusions:** Preliminary findings show that the use of TT+VM enhanced the learning of suicide risk factors. The VM could be a useful learning tool for novice learners but future large-scale studies are warranted to replicate this positive preliminary effect.

Keywords: visual metaphor, suicide risk factors, learning, cognitive load theory

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1. Introduction

There are gaps in suicide risk assessment training [1,2,3] and recently published work has suggested visual metaphor (VM) as a potential way of addressing these gaps [4]. For example, several studies have shown that only half of psychological trainees [5,6] and community nurses [7] received adequate risk assessment training. Similarly, a recent study indicates that 88% of surveyed health professionals reported having received no official training in suicide risk assessment or management [8]. Moreover, in non-mental health nurses dealing with high-risk groups such as oncology patients, only 1.1 % had very good knowledge about suicide and suicide assessment skills [9].

Available training programs rely heavily on didactic teaching methods which might not be the most effective way of converting knowledge about suicide risk factors into an applied clinical skill [3]. A review of the effects of didactic programs and interactive education on improving clinical practice concluded that didactic programs exhibited no-to-low effects; whereas, interactive programs demonstrated moderate-to-high effects [10]. VM has been proposed to help learn suicide risk factors ('the what'), rather than how to conduct comprehensive suicide risk assessment ('the how') [4]. VM is proposed as a means to reduce cognitive load and optimize working memory (WM) utilization, which in turn will enhance long-term memory processing [11,12].

The purpose of this study was to assess the efficacy of VM as an adjunct to traditional methods in teaching suicide risk factors to first-year undergraduate psychology

students. We hypothesized that the traditional teaching methods would be more effective in facilitating learning and recall of suicide risk factors when augmented by VM than traditional teaching methods alone.

2. Methods

2.1. Design and Participants

Following ethical committee approval (MUHECN15/042), this study was conducted in 2016 at a New Zealand university. Given the novelty and nature of the intervention as an educational tool, a non-blinded pilot randomized controlled trial (RCT) design was adopted targeting novice learners of suicide risk factors.

A convenience sample of 60 first-year undergraduate psychology students were invited to participate in this trial. All participants provided written informed consents. Inclusion criteria were: (1) participants with no prior exposure to suicide risk factors teaching in tertiary education; (2) participants in their first undergraduate year of psychology, and (3) participants must be fluent in English.

2.2. Intervention Overview

The intervention consisted of a visual metaphor of suicide risk factors. The design and interpretation of the visual metaphor is discussed in detail in previous work [4]. In summary, the visual metaphor aimed to: (1) facilitate the learning of suicide risk factors; (2) improve comprehension and recall, specifically by structuring the learning content in a meaningful manner, activating prior knowledge, increasing engagement, and enhancing attention. [Figure 1](#) depicts the visual metaphor.

2.3. Procedure

Participants received sealed envelopes containing computer-generated randomized numbers allocating them to either a control group, where they received traditional teaching (TT) or an intervention group, where they received traditional teaching and the visual metaphor (TT+VM).

Participants assigned to the TT group received traditional teaching in a university classroom. Teaching content primarily focused on evidence-based suicide risk factors, though general key points about the topic such as the epidemiology of suicide were also covered. Information was presented using PowerPoint slides. The TT+VM group, on the other hand, received traditional teaching as described above, as well as the VM of suicide risk factors. The VM was first presented on a projector as a static image. The purpose and interpretation of the content in the VM was explained. Having gone through the static representation of the VM, a narrated animated video of the VM was presented to reinforce learning (available online at: <http://visualmetaphoria.com/animated-video-of-the-visual-metaphor-of-suicide-risk-factors/>). At the end of the learning session, participants were asked to complete a number of questionnaires. The learning session lasted for 75 minutes; 50 minutes for teaching and 25 minutes to complete the measures. Finally, each participant received a \$20 voucher for participation in the trial.

2.4. Measures

The questionnaires that participants completed covered several domains including cognitive load, satisfaction, and memory recall. Additionally, a clinical vignette was used to assess knowledge transfer and more details are found below.

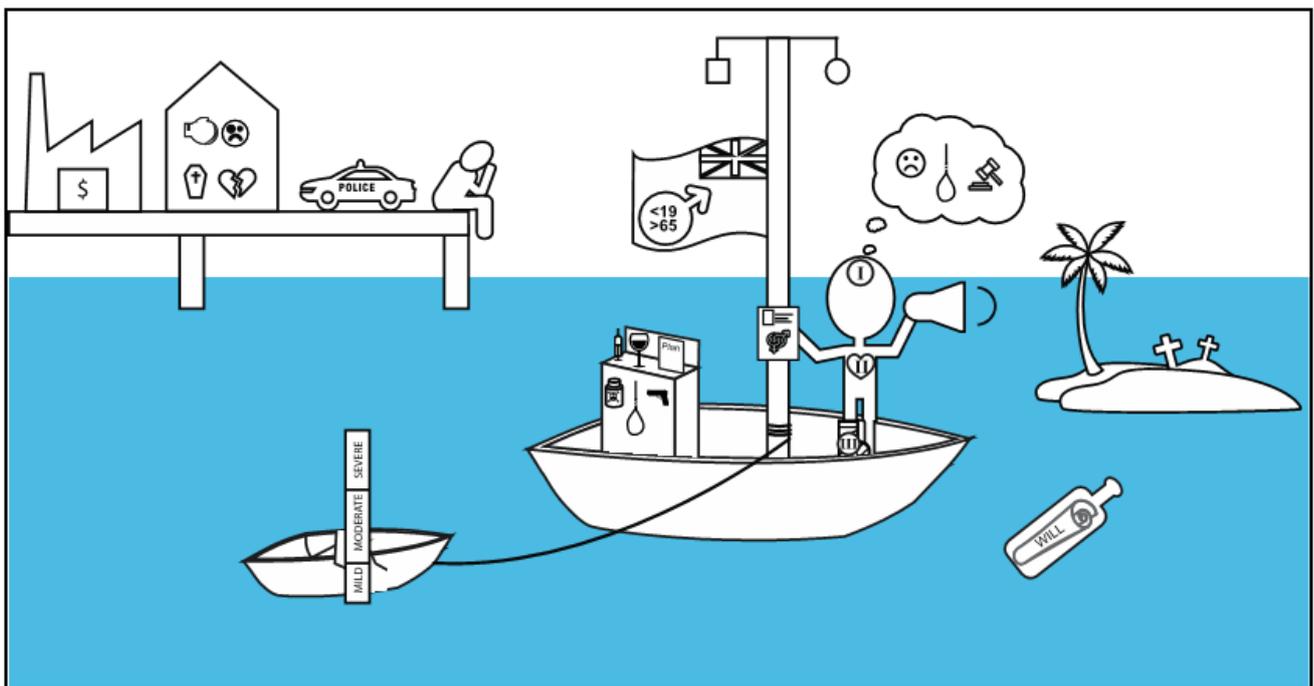


Figure 1. The visual metaphor of suicide risk factors. Adapted from [4]

2.4.1. Memory Recall of Suicide Risk Factors

Successful memory retrieval is an indicator of effective learning [13]. In order to test the participants' immediate post-learning free recall of suicide risk factors, participants were asked to write down as many suicide risk factor as they could. For each recalled risk factor, one point was allocated, with a total maximum of 23 points.

2.4.2. Knowledge Transfer: Suicide Risk Clinical Vignette

Application of new knowledge requires knowledge transfer [14,15] whereby successful knowledge transfer is measured by the learner's ability to apply the newly acquired information to novel situations and problem solving [14]. To measure knowledge-transfer, a clinical vignette was developed. The vignette included 17 suicide risk factors. Participants were instructed to read the vignette carefully and identify the factors that potentially increased the person's risk of suicide. For each correctly identified risk factor, one point was allocated, with a total of 17 points. See Appendix A for the clinical vignette.

2.4.3. Cognitive Load

Cognitive load was measured by the Paas Cognitive Load Rating Scale [16], which assesses the amount of mental effort invested. Participants completed a 9-point Likert scale where: 1= very low mental effort, and 9= very high mental effort and this scale has shown acceptable psychometric properties [16]. Recent research shows that the subjective Paas scale is equally valid as objective physiological measures such as pupillometry in measuring cognitive load [17].

2.4.4. Satisfaction

The use of an existing, validated, and standardized satisfaction questionnaire was not possible because none were applicable to the context of the current study.

Therefore, a satisfaction questionnaire was developed by the authors, informed by a review of satisfaction surveys found in the literature. The survey contained seven items, scored on a 5- point Likert scale where: 1 =strongly disagree and 5 =strongly agree. See Appendix B.

2.5. Statistical Analysis

Data was analysed using SPSS version 23 [18]. Descriptive statistics were obtained and the Mann-Whitney U test was used to determine statistical significance at $p=.05$.

3. Results

A total of 60 first-year psychology students were invited to participate and 22 agreed to be enrolled in this trial. The TT and TT+VM groups consisted of 13 and 9 participants respectively. Demographic characteristics of the sample are presented in Table 1.

The TT+VM group achieved significantly better scores in the free recall test and the clinical vignette (Table 2). On the free recall test, participants in the TT+VM group were able to recall more suicide risk factors than those in the control group (mean= 14.56, SD= 3.2, $p= .026$) with a medium effect size ($r=.416$). Similarly, when compared to the TT group, the TT+VM group demonstrated superior application of the newly learnt information to novel situations, obtaining significantly higher scores when presented with clinical vignette (mean= 14.33, SD= 1.00, $p=.036$). The difference between the two groups was medium ($r=.387$). Furthermore, the VM caused significantly less cognitive loading on the TT+VM group's working memory in contrast to TT group (mean= 3.44, SD= .88, $p=.001$) and this difference was large ($r=.819$). Finally, significantly greater satisfaction levels with the teaching was reported by the TT+VM group (mean= 26.44, SD= 3.6, $p=.001$) with a large effect size of .723.

Table 1. Demographic characteristics of the sample

Characteristic		TT group (N=13)	TT+VM group (N=9)
Age	19	8	9
	20	3	
	21	2	
Gender	Female	12	7
	Male	1	2
Ethnicity	Caucasian	10	9
	Asian	2	
	Middle Eastern	1	

Table 2. Comparison of the two groups based on means, standard deviations and Mann-Whitney U Test

	Group	Mean	SD	Mann-Whitney U test	1-tailed p value
Immediate free recall	TT+VM group	14.6 ^a	3.2	29.5	.026*
	TT group	11.8	2.6		
Knowledge transfer	TT+VM group	14.3 ^a	1.00	31.5	.036*
	TT group	11.4	.87		
Cognitive load	TT+VM group	3.4 ^b	.88	2.0	.001*
	TT group	7.0	.82		
Overall satisfaction	TT+VM group	26.4 ^a	3.6	8.0	.001*
	TT group	17.9	3.9		

^a= Higher mean scores denote better performance

^b= Lower mean score denotes less cognitive load imposed on the working memory

*1-tailed significance at $p=.05$.

4. Discussion

This is the first study to assess the efficacy of a novel VM for teaching suicide risk factors as an adjunct to traditional teaching methods in a group of novice learners. Results show that the use of a VM enhanced the learning of suicide risk factors as demonstrated by significantly better performance on the post-learning free recall test and knowledge-transfer test. The VM also reduced the cognitive load imposed on participants' WM and increased their satisfaction with the teaching significantly.

The WM is commonly regarded to hold up to seven items (plus or minus two), and process two to three items of information simultaneously [19]. Effective learning occurs when information is consolidated from the WM into the long-term memory [20]. However, when the amount of information presented exceeds the limits of the WM, ineffective learning occurs [21]. Novice learners may find it challenging to acquire knowledge on suicide risk factors, as there are a number of static and dynamic risk factors. The VM of suicide risk factors may help overcome the limited processing and storage capacity of the WM.

In the present study, the complexity and interactivity of the content was managed as best possible. This was achieved by introducing suicide risk factors gradually, commencing with those that are potentially less complex such as the static risk factors [age and gender], and followed by the more complex dynamic risk factors. Also, the strategies by which information was presented to the learners such as distracting extraneous load was reduced. The VM included no redundant information, utilized multimodal explanatory statements (visual and auditory as appropriate, as opposed to image and written text), and presented information in an integrated format (symbols appeared in the visual metaphor sequentially and adjacent to each other).

Furthermore, the germane load (effective learning that occurs) was optimized as much as possible by several ways including schema construction [22,23,24]. Learners hold cognitive schemas in their long-term memories. A schema is defined as domain-specific knowledge within the long-term memory [25] or as "a construct that permits us to treat multiple elements of information as a single element" [26]. According to the Schema Theory, cognitive schemas allow the learner to organize related information in a meaningful way, able to be recalled later as a single unit rather than multiple elements [22], and thus reduces WM cognitive load [22,27].

The VM of suicide risk factors, as the name implies, is a visual and metaphorical representation of risk factors. The literature shows that images and drawings of concepts result in better free recall than when expressed textually [28]. This can be further explained by the Dual Coding Theory [29]. The theory posits that language [verbal or text] and images are encoded and processed in the brain differently. Images of familiar objects or symbols are encoded, both visually and verbally, while text or words are encoded only verbally [30]. 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.

4.1. Limitations and Future Directions

The small sample size was an obvious limitation. A second limitation was that, although this experimental pilot RCT included random assignment and allocation concealment, blinding was not possible given that the nature of the teaching content (the presence or absence of the VM). Therefore, non-blinding might have influenced how participants responded to the questions, which in turn may have limited the 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.

Future studies should aim to replicate the current study with a larger sample. This will allow for broader generalization regarding the effectiveness of the visual metaphor of suicide risk factors. It would also be useful to test the efficacy of this VM with various disciplines including psychology interns, psychologists, and senior clinicians. Investigating the impact of the VM on the learning performance of participants with different learning styles would also be useful.

5. Conclusions

Findings suggest that incorporating the VM of suicide risk factors with traditional teaching methods improved the learning of suicide risk factors. The VM of suicide risk factors could be a useful learning tool for novice learners. This preliminary finding was encouraging given the diversity, complexity, and large number of suicide risk factors. However, future large-scale studies are warranted to confirm this preliminary data.

Contributors

All authors were involved in the planning of this study and in the drafting and revising of this manuscript. The execution of this study was carried out by the corresponding author.

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Conflict of Interest

The authors have no competing interests.

Ethical Approval

Ethics application was approved by the university's ethical committee (MUHECN15/042).

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Appendix A

Suicide Risk Factors Clinical Vignette

Based on the clinical vignette below, what are the suicide risk factors John is presenting with?

John is a 65-year-old male of a Polynesian origin, referred from the Emergency Department after attempting to end his life. John presented with low mood, sadness, loss of interests, lack of sleep, emotional dysregulation, irritability, chronic feelings of emptiness, alcohol dependence, and high blood pressure (hypertension). Along with these symptoms, John had been experiencing major problems including relationship conflicts with his family, which led to being socially isolated. He also had unstable employment and poor adherence to healthcare treatment. He had attempted to take his own life by hanging himself in the garage 2-years ago, after his wife's death. Two weeks ago, John wrote a suicide note and planned to end his life with a gun that he had bought for this purpose. He reported feeling hopeless and not wanting to live anymore. After his recent suicide attempt, his older son, Michael, brought him to the Emergency Department. John is currently in inpatient psychiatric unit that specializes in the treatment of co-occurring disorders such as chronic depression.

Suicide risk factors are:

Appendix B

Satisfaction Questionnaire

Please rate the extent to which you agree or disagree 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