# Concept Mapping Workshop: New South Wales Fire Brigade

Project C7 (Development of an Evaluation Framework for Community Safety Policy and Programs for Bushfire) team members:

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Concept mapping workshops have been held across Australia with the aim of eliciting the views of fire agency personnel and community members on what changes and improvements should occur to make residents and their neighbourhoods safer from bushfires. The Project C7 team thanks all who participated in these workshops.

# Concept Mapping: Method

## The Overall Concept Mapping Process

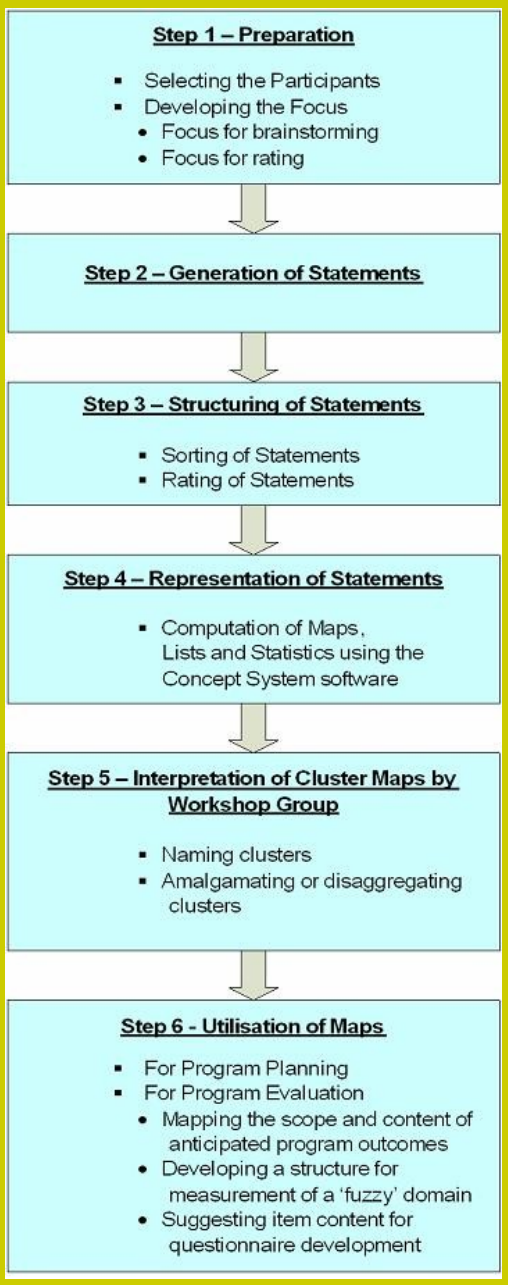



**Chart 1**

## How Your Concept Map was Created

- The researchers involved in project C7 used a technique known as 'concept mapping' to identify outcomes for bushfire safety policies and programs that stakeholders consider important. The particular method of concept mapping used was developed by William M.K. Trochim of Cornell University. Trochim's concept mapping process, as it relates to the workshop conducted with members of the Blue Mountains community, is outlined below.

- Step 1: Seven agency personnel from the New South Wales Fire Brigade (NSWFB) were invited to attend a concept mapping workshop. The workshop took place at NSWFB headquarters.

- Step 2: Participants were asked to brainstorm ideas in response to the statement 'Thinking as broadly as possible, generate statements that describe specific changes or improvements you think need to be achieved to make households and neighbourhoods safer from bushfires'.

- Step 3: Participants sorted all statements in a way that made sense to them as well as rating (on a scale of 1 to 5) each statement for its importance and difficulty of implementing it.

- Step 4: Computer assisted analysis of the sorted statements (multi-dimensional scaling and cluster analysis) produced a representation of how each statement related to all others (the Concept Map). Clusters of statements that had similar ideas were formed.

- Step 5: Participants were asked to individually name each cluster of statements. This was followed by a group discussion where consensus was reached on cluster names as well as highlighting any changes the participants felt should be made to the concept map.

**Here is the statement list your group generated:**

1. People are aware of their own level of risk
2. Town planning and building codes are appropriate especially in the initial stages of developing area
3. Residents of bushfire prone areas receive education by multiple methods (eg. Brochures, fire brigades, media etc)
4. People in local communities know where nearest hydrant is (able to inform fire fighters)
5. Councils involved in direct advertising in fire prone areas
6. People are educated about fire behaviour and what a bushfire really does
7. People have sufficient knowledge that understanding replaces fear (uninformed fear)
8. Obtain and structure feedback from people in local communities about what they think they need - not one size fits all approach
9. Do work post-incident to understand what worked and didn't work in particular communities
10. Broader community awareness of emergency management plans (community level - communication/evacuation)
11. Clearing and backburning by property owners on the interface
12. Public ensure clear passage and access for fire vehicles to enter their street/property
13. High visibility messages regarding fire-safety (keep at front of peoples mind's)
14. Children are educated in schools
15. People living on the interface have their own water source, independent of the water mains
16. Consistency of delivery of services by fire brigades (for internal reasons and so that the COMMUNITY KNOWS WHAT TO EXPECT)
17. Preventive & mitigative activities delivered consistently across fire regions (not at the whim and interest of the local personnel)
18. Greater community awareness of and funding for, proven community education approaches such as the CFU program
19. People (CFUs) are not only educated but assisted with equipment and skills to take on a defensive role to protect local properties
20. Building codes require homes on the interface have water tanks with hoses attached
21. Local stations establish relationships with local communities so community are aware of fire service role (including preventive role)
22. People receive education to understand heightened risk at time of drought
23. People understand implications of drought for fire-fighting and need to develop alternative water sources
24. Strategies (including community education) to enable use of grey water if necessary
25. Community workshops in fire prone areas to provide an opportunity to people who want to learn more
26. Councils have knowledge and education necessary to establish appropriate building codes and make appropriate planning decisions
27. People are educated in workplaces and have knowledge of prevention/protection requirements
28. Able to overcome complacency (it will never happen to me)
29. Consistent and sustained messages presented in ways that still capture peoples attention
30. Information and ideas effectively shared between all fire services and sections of the organisation
31. People understand specific actions that will make their homes safer
32. People understand simple strategies that will make their home more defensible in case of a fire (eg. Fill gutters with water)
33. People understand that they need to take responsibility for themselves
34. People understand to listen to community radio to remain informed during a fire
35. People understand clothing to wear and means of personnel protection during a fire
36. Households are adequately prepared to be able to defend properties in the case of a fire (defensible properties)
37. Householder expectation of the capacity of fire-services are realistic - need to know the probability they will need to defend their own property
38. People know what they should take in case of evacuation

# An Explanation of the Workshop

The initial stage of the computer assisted analysis uses a technique known as multi-dimensional scaling. The concept map is constructed by amalgamating the sorted statements of each participant. Each point (statement) is positioned on the map in relation to all the others, with statements sorted together by more participants (similar in meaning) appearing closer together and those that were not sorted together (dissimilar in meaning) being further apart. In order to represent the concept map in a way that makes sense the Concept System program creates a two dimensional graphic (Map 1). This is necessary, because to show exactly how the statements relate to each other would require the number of dimensions equal to the number of statements minus one. For example 38 statements means 37 dimensions would be required to present the data precisely. While presenting data in two dimensions makes it easier to understand and interpret, distortions can occur.

Following the multi-dimensional scaling an additional analysis is conducted to form clusters (Map 2). The Concept Systems program groups statements that are close together (have a similar meaning). For example, cluster 1 consists of statements 1, 6 and 7. Participants, individually, then as a group name each cluster based on what they believe to be the common theme in each of the statements making up the cluster. To continue with the earlier example, all the statements in cluster 1 were concerned with individuals' understanding of the risk posed by bushfire. Thus, it was decided that an appropriate name for the cluster would be 'Realistic understanding of fire and risks'.

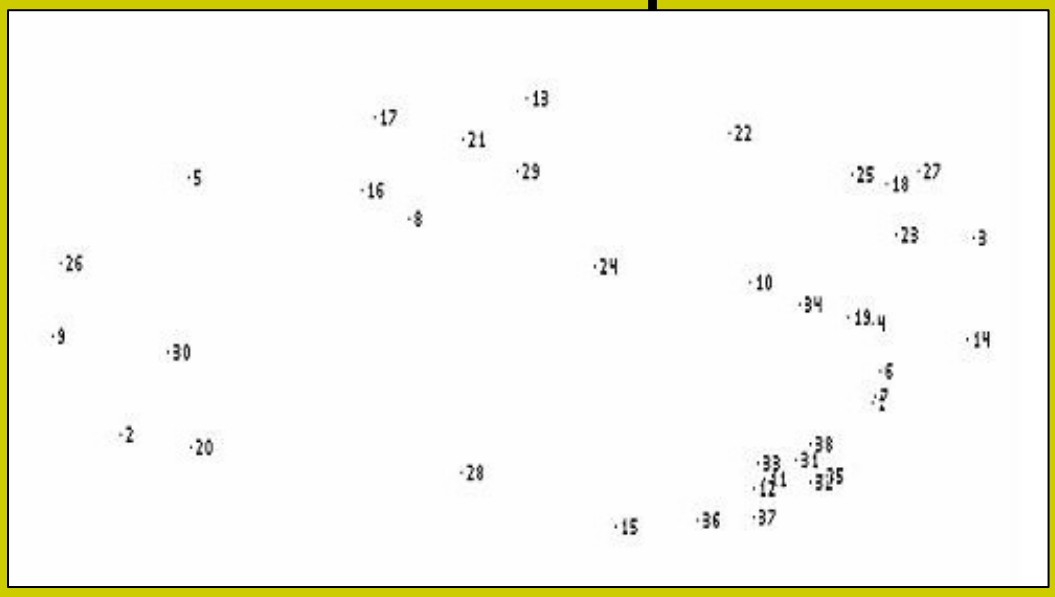
In addition to naming individual clusters, participants identified two groupings of clusters that were related. Clusters 2 and 3 were differing aspects of education. Clusters 4 and 5 were all related to preparation. The identification of these broad themes and the more specific cluster names will provide a starting point for the researchers to ascertain the importance of various interventions.

It is important to recognise that cluster analysis is not as robust a process as multi-dimensional scaling. As there is no, one, 'correct' method used to determine the number of clusters, or which points belong in which cluster (the Concept System program starts with approximately the number of clusters equal to 1/5 of the number of statements). For this reason, an important step in the construction of a concept map is for participants to have the opportunity to change parts of the map with which they do not agree.

The following is a summary of the changes participants in the New South Wales Fire Service workshop believed should be made:

- Statement 33: from cluster 4 to cluster 1;
- Cluster 4 joined with cluster 5;

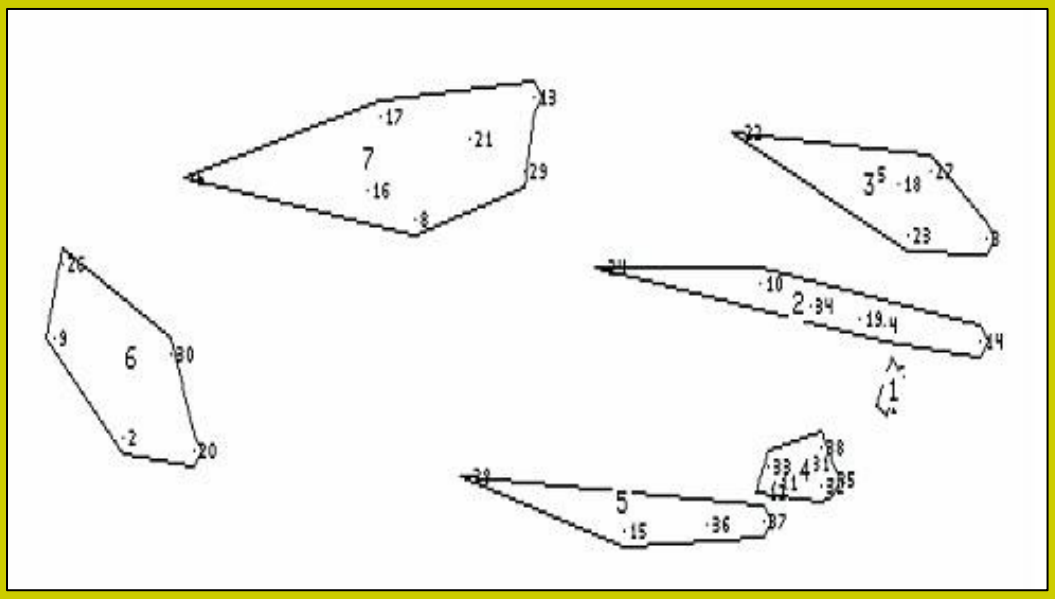
# The Concept Maps Generated During the Workshop



**Map 1**

## Cluster Names

- Cluster 1: Realistic understanding of fire and risks
- Cluster 2: Education – emergency arrangements
- Cluster 3: Education – responsibilities/ prevention
- Cluster 4: Community and household prevention activities (understand and do)
- Cluster 5: Actions based on understanding in cluster 4
- Cluster 6: Agency driven improvements/application (policies, legislation – appropriate, workable)
- Cluster 7: Communication strategy (methods and characteristics – based on relationships and understanding need



**Map 2**

# The generation of 3-dimensional concept maps

Following the concept mapping workshop, the researchers used the raw data that had been collected to gain a greater understanding of what community members and agency personnel believe is important to improve bushfire safety.

The researchers used a program developed by David Wishart of St. Andrews University to analyse the data. Clustan™ allows data to be presented in three dimensions, producing a more accurate representation of how the statements are related to each other than a two dimensional concept map.

After the three-dimensional concept maps had been produced the researchers named the clusters and dimensions (where possible broad themes were identified at each of the x and y axes), using the same process as that in the workshop. That is, each researcher named the clusters and dimensions, then as a group consensus was reached.

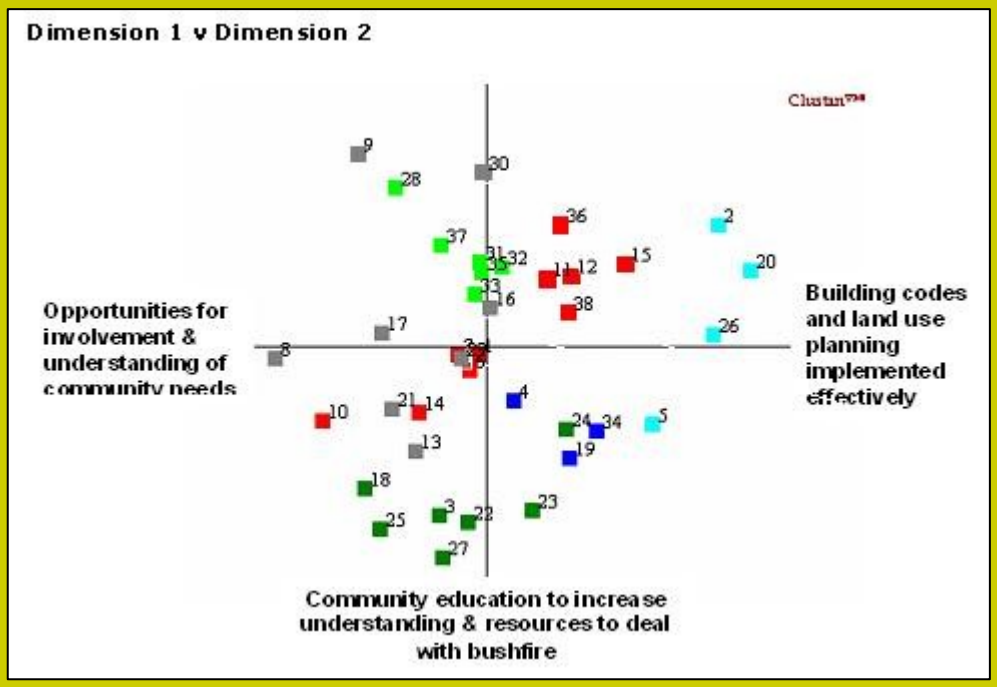
After three-dimensional concept maps had been constructed for each workshop (eleven in total) a broad range of themes related to community safety outcomes were identified. To identify and clarify these themes the researchers, as a group, sorted the pool of cluster names from individual workshops according to the similarity of the ideas represented in each. This enabled a combined solution of all the workshops to be formed.

As with the 2-dimensional concept map, broad themes were identified in the 3-dimensional maps. They were:

- Dimension 1 (right: Maps 3 & 4):Building codes and land use planning implemented effectively
- Dimension 1 (left: Maps 3 & 4): Opportunities for involvement and understanding of community needs
- Dimension 2 (top: Map 3): Due to the spread of statements a theme was not identified for this dimension
- Dimension 2 (bottom: Map 3): Community education to increase understanding and resources to deal with bushfire
- Dimension 3 (top: Map 4): Community brigade relationship to enable consistent delivery of messages
- Dimension 3 (bottom: Map 4): Householders self reliant, informed and prepared

The dimensions are an amalgamation of a number of clusters and statements. They represent the high-level or overarching ideas that are important when trying to make communities safer from bushfire. The clusters and statements can be seen as different aspects of the more general themes, whether they are the identification of an important outcome or the means of implementing that outcome. The dimensions can be seen in terms of processes and outcomes. For example 'Community brigade relationship to enable consistent delivery of messages' is one process whereby the outcome of 'Householders self reliant, informed and prepared ' can be achieved.

Beginning with these broad categories and working back down to the individual statements, it is hoped participants and researchers will gain a clearer understanding of what they believe will help improve community safety programs for bushfire.



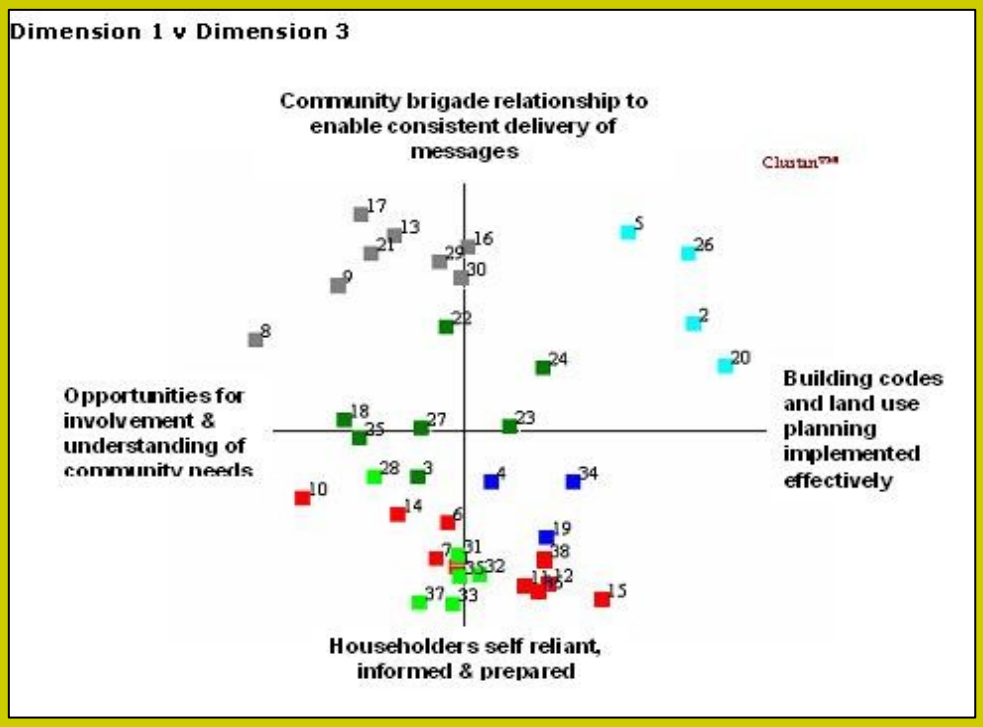

Map 3

## Cluster Names

- Cluster 1 (Statements 1, 6, 7, 10, 14, 11, 12, 15, 36 & 38): Community understands bushfire and the risks it poses
- Cluster 2 (Statements 4, 19 & 34): Community informed about effective preparedness and response measures
- Cluster 3 (Statements: 3, 18, 22, 23, 24, 25 & 27): Broad range of education types/ methods of delivery

# 3-Dimensional Concept Maps

- Cluster 4 (Statements 28, 31, 32, 33, 35 & 37): Individual understanding of risk reduction and preparation measures
- Cluster 5 (Statements 2, 5, 20 & 26): Appropriate building codes
- Cluster 6 (Statements 8, 13, 16, 17, 21, 29, 9 & 30): Assessing/ knowledge of individuals' mindset and capacity to create appropriate interventions




Map 4

# Importance and Difficulty Ratings

During the workshop participants were asked to rate, on a five point scale, each statement for its importance (in making people and neighbourhoods safer from bushfire) and the difficulty of implementing the changes or improvements suggested by those taking part in the workshop. Following the workshop the mean importance and difficulty for each statement was calculated. These data were sorted and the mean calculated for each cluster.

The means for each cluster were entered into an SPSS spreadsheet and a scatterplot showing importance by difficulty was created for both the two (Chart 2) and three (Chart 3) dimensional solutions.

The scatterplots allow the researchers to identify actions or ideas that could be used as a starting point in community safety programs. Clusters in the top left-hand corner of the scatterplot are perceived as important in making people safer from bushfire while being relatively simple to implement.

In relation to the planning and implementation of community safety programs for bushfire the scatterplots raise some interesting questions. For example, do current programs address those areas that community members feel are important? Are community members focusing on unimportant or less important areas of bushfire safety? Are these messages reaching the whole community, or only sections? What role has bushfire education played in supporting or creating these perceptions? And if community members are focusing on the 'right' messages are they putting them into practice?

When using the 'importance by difficulty' scatterplots, whether it be for planning or as an aid to facilitate discussion, it is important to keep in mind that the cluster analysis gives different results for the two and three dimensional solutions. This means that while clusters may have similar names, it is likely that the statements that make up the clusters will differ. For this reason, the two should not be directly compared.

Finally, it should be emphasised that academic arguments about the merits of one solution over the other should not limit any discussion. If it is felt one scatterplot provides better or more interesting results for a particular purpose, then that one should be used.

# Importance by Difficulty Based on the 2-Dimensional Concept Map

**Cluster Names Derived from the Two-Dimensional Concept Map**

Cluster 1: Realistic understanding of fire and risks

Cluster 2: Education – emergency arrangements

Cluster 3: Education – responsibilities/ prevention

Cluster 4: Community and household prevention activities (understand and do)

Cluster 5: Actions based on understanding in cluster 4

Cluster 6: Agency driven improvements/application (policies, legislation – appropriate, workable)

Cluster 7: Communication strategy (methods and characteristics – based on relationships and understanding need

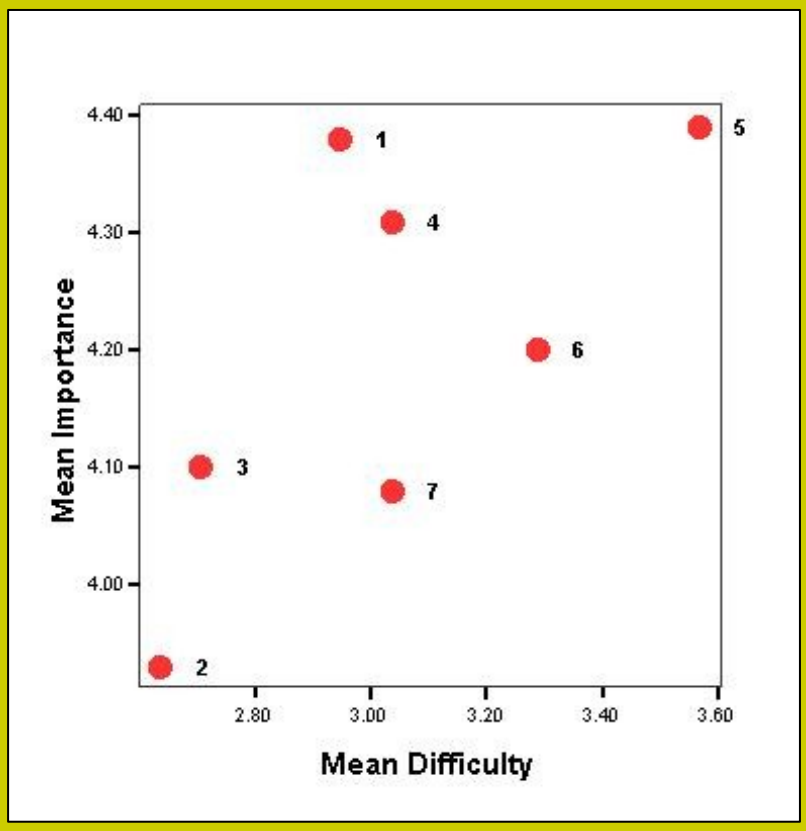



**Chart 2**

| Cluster No. | Mean Imp. | Mean Diff. |
|---|---|---|
| 1 | 4.4 | 3.0 |
| 2 | 3.9 | 2.6 |
| 3 | 4.1 | 2.7 |
| 4 | 4.3 | 3.0 |
| 5 | 4.4 | 3.6 |
| 6 | 4.2 | 3.3 |
| 7 | 4.1 | 3.0 |

| Importance Scale | |
|---|---|
| 1 | Unimportant |
| 2 | A little important |
| 3 | Moderately important |
| 4 | Very important |
| 5 | Essential |

| Difficulty Scale | |
|---|---|
| 1 | Very easy or already achieved |
| 2 | Not difficult |
| 3 | Moderately difficult |
| 4 | Very difficult |
| 5 | Extremely difficult |

# Importance by Difficulty Based on the 3-Dimensional Concept Map

**Cluster Names Derived from the Three-Dimensional Concept Map**

Cluster 1: Community understands bushfire and the risks it poses

Cluster 2: Community informed about effective preparedness and response measures

Cluster 3: Broad range of education types/ methods of delivery

Cluster 4: Individual understanding of risk reduction and preparation measures

Cluster 5: Appropriate building codes

Cluster 6: Assessing/ knowledge of individuals' mindset and capacity to create appropriate interventions

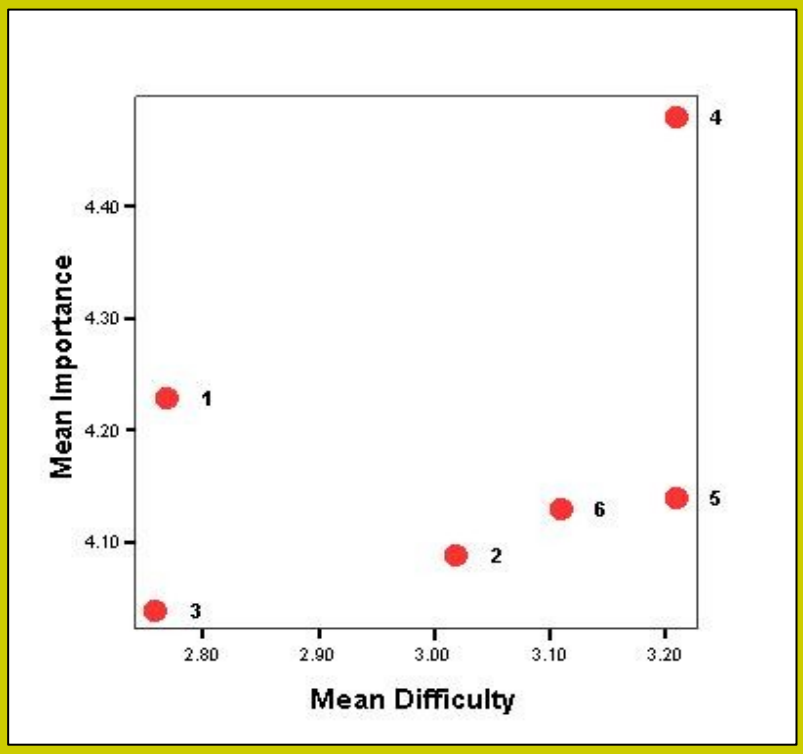



**Chart 3**

| Cluster No. | Mean Imp. | Mean Diff. |
|---|---|---|
| 1 | 4.2 | 2.8 |
| 2 | 4.1 | 3.0 |
| 3 | 4.0 | 2.8 |
| 4 | 4.5 | 3.2 |
| 5 | 4.1 | 3.2 |
| 6 | 4.1 | 3.1 |

| Importance Scale | |
|---|---|
| 1 | Unimportant |
| 2 | A little important |
| 3 | Moderately important |
| 4 | Very important |
| 5 | Essential |

| Difficulty Scale | |
|---|---|
| 1 | Very easy or already achieved |
| 2 | Not difficult |
| 3 | Moderately difficult |
| 4 | Very difficult |
| 5 | Extremely difficult |

# Statistically Significant Differences Between Clusters: 2 & 3-Dimensional Concept Maps

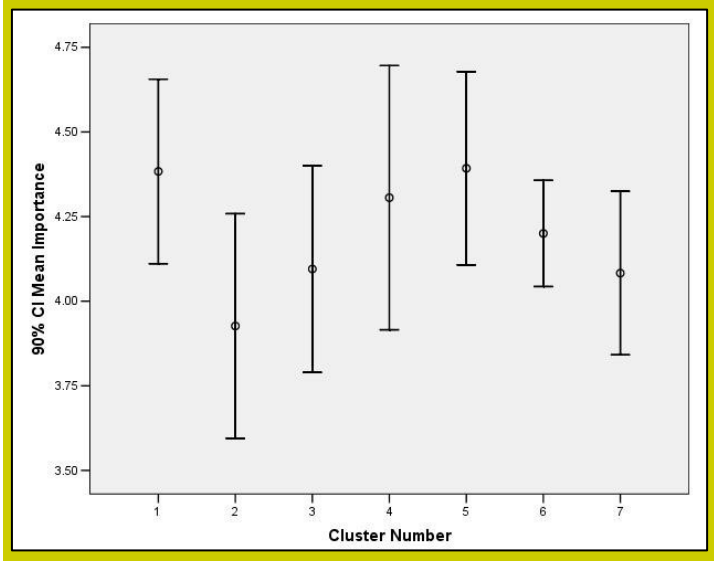



**Chart 4**

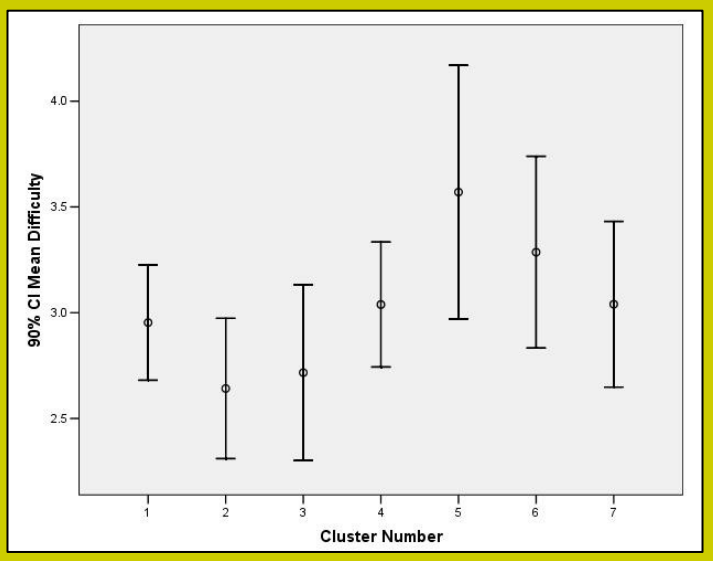



**Chart 5**

For both the two-dimensional (charts 4 & 5) and three-dimensional (charts 6 & 7) solutions the researchers used SPSS to create error bars for each cluster by importance and difficulty. Due to the low number of statements in each cluster, the confidence interval was lowered to 90% (rather than the customary 95%). The four charts give the researchers a further idea about how much the concepts that emerged during the workshop differ. For example, chart 3 shows those who took part in this workshop believed cluster four (Individual understanding of risk reduction and preparation measures) is more important to achieve than cluster three (Broad range of education types/ methods of delivery) when making households and communities safer from bushfire. Chart 6 shows that this difference is statistically significant (if the error bars do not overlap the difference is statistically significant).

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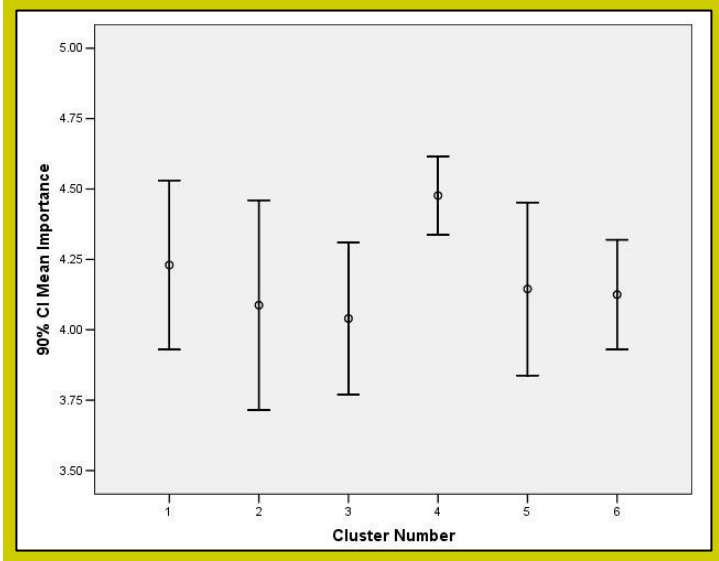


**Chart 6**

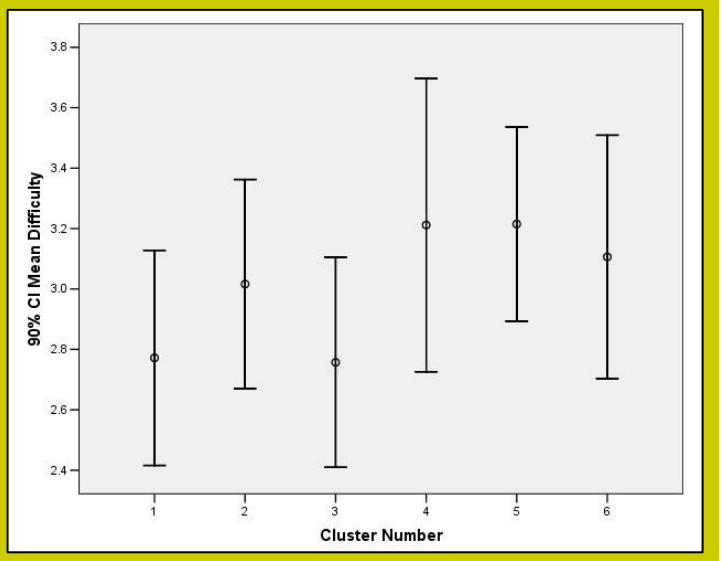


**Chart 7**