# It's Fun but Do They Learn Anything?  Student Learning at an Interactive Road Safety Exhibition

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**Biography**
Stephen Gray is a road safety consultant with interests in research, behavioural issues and road safety education.  Prior to becoming a consultant, Stephen was the Manager, Road Safety at NRMA Motoring and Services for 5 years.  Before joining the NRMA, he had eleven years experience as a curriculum consultant, road safety consultant and classroom teacher within the catholic education system.

Stephen has long held an interest in student learning, particularly in relation to road safety education.  He is currently completing his Ed.D with Charles Sturt University researching this issue.

**Abstract**
Education for school students in road safety is a key approach to developing safer road users.  To complement in-school road safety education programs, interactive road safety exhibitions have been developed and utilised, with the NRMA's RoadZone being one of the first examples of this educational approach.

This research project investigated student learning at RoadZone to identify if learning in road safety was taking place, and if so, what factors might support and enhance that learning. The underlying theory which was used to investigate this learning was constructivism, which holds that new learning or understanding occurs through interrelation with the world, is characterised by perception and action, and builds upon on existing knowledge.

Data was collected from 5 school groups which visited RoadZone in the period between May and November, 2000.  The methodology used was to have children create concept maps about their knowledge and understanding of road safety in relation to the specific user groups of passenger, pedestrian, cyclist and driver prior to and after their visit to RoadZone. This provided emerging themes related to the children's collective understanding of road safety in relation to those issues before and after their visit to the exhibition.

The groups were also video taped during their visit to the exhibition.  The video tapes were divided into segments called episodes and analysed for evidence of learning. (Note that a sample of these video episodes on CD ROM is available with the full thesis.  However it was not possible to include the sample with this paper in the proceedings.)  Finally, six selected students were identified and studied in depth by linking their specific pre and post visit concept maps with video episodes showing them interacting with exhibits.  These data studies provided triangulation with the analysis of the collected concept maps and the overall themes emerging from the video analysis.

The results of the pre-visit concept map analysis indicated that students were identifying road safety issues reflecting current road safety education and media campaigns.  Post-visit additions to the concept maps were closely or directly related to issues being promoted within RoadZone and provided evidence of new learning taking place.

From the analysis of the video data a set of indicators of student engagement in learning processes was developed which supported the evidence of new learning in road safety provided by the concept maps.

## 1.  INTRODUCTION

A key component of the integrated approach to road safety in NSW has been the introduction of road safety education in schools.  Since 1987, primary and high schools in NSW have had access to classroom resources and professional support aimed at assisting teachers to integrate road safety into their work programs.

NRMA Motoring and Services has been a key stakeholder in road safety since its inception in the 1920s.  As part of this role, NRMA developed the concept of a road safety exhibition for children that would complement and reinforce the road safety education being provided by schools.  Together with project partners Questacon, The National Science and Technology Centre in Canberra, NRMA developed and launched RoadZone, an interactive road safety exhibition for 9 - 14 year olds.

By the time RoadZone has finished its program in late 2003, NRMA will have committed 10 years of effort to the concept of interactive learning of road safety.  But what has been the outcome of this effort?  Are children learning about road safety from a visit to an interactive exhibition, and, if so, what are they learning?  This study attempted to answer these questions.

While this study did not attempt to evaluate RoadZone as an educational program, the nature of the data does provide a basis for determining the exhibition's level of success in enhancing learning.  To the extent that interactive exhibitions are established to help the user learn about a concept or issue, conclusions can and will be drawn about learning in RoadZone from this study.  It is important though to keep in mind the focus of this study - it attempted to identify and analyse student learning in an interactive educational environment that focuses on road safety.  Because of my links to NRMA and to the exhibition, RoadZone provided the vehicle to be able to explore these questions about student learning.

The specific research questions investigated in this study were:

- Are children learning, and if so, what are they learning about road safety from a visit to an interactive exhibition?
- What role does the interactive nature of an exhibition play in facilitating learning?
- What effect, if any, does the interaction between children themselves at an exhibition have on their learning?

The context within which these questions were explored was the NRMA RoadZone Road Safety Education Exhibition.

## 2.  METHODOLOGY

The sample for this study consisted of five school groups which visited RoadZone at two venues during 2000.  The groups ranged from Year 3 to Year 8 with a total of 229 students.

Data collected took the form of student concept maps and video recording of students at RoadZone.  Prior to visiting the exhibition each student filled in a concept map at school which outlined their knowledge and understanding of road safety.  After their visit, each student was given the opportunity to add to their concept map.  This occurred directly after the visit to RoadZone at the exhibition for four school groups, and the next day at school for one group.  The concept maps were analysed for emerging road safety themes and issues, and for evidence of new learning on the post-visit maps.

During each school group's visit to RoadZone, a camera was used to capture video footage of students interacting with the exhibition and with each other.  This footage was divided into

48 discreet episodes totalling 136 minutes of video, and analysed for evidence of indicators of student engagement in learning, and the nature of interaction between the students. Finally, six individual students were studied in-depth by linking their concept maps with their behaviour on the video recording to triangulate the data from both sources and identify specific learning taking place. These students were selected because they student appeared several times on the video using a range of exhibits and appeared to be involved and interested in the exhibits.

## 3. ANALYSIS OF PRE-VISIT CONCEPT MAPS

A number of key themes emerged from the analysis of the pre-visit concept maps. The top five issues identified by all students across all schools were as follows (percentage of all students who identified each issue is in brackets):

1. Wear a seatbelt (85%)
2. Don't drink and drive (66%)
3. Wear a helmet (60%)
4. Don't speed (53%)
5. Look, listen and think when crossing the road (40%)

These themes are consistent with the themes of road safety education programs and public education campaigns run by the major road safety stakeholders in NSW and indeed around Australia. They represent the main forms of road use characteristic of children and young people - pedestrians, passengers and cyclists. Drink driving and speeding relate to safe driving behaviours, and while students in the age groups in this study would not be driving, they clearly have assimilated some of the key public messages about safe driving. It was also interesting to note that the majority of responses on the concept maps were identified in directive language – 'do this' or 'don't do that'. This type of language is a feature of many school and community education campaigns run by road safety authorities where a call to action is generally included in the message.

## 4. ANALYSIS OF POST-VISIT CONCEPT MAPS

The number of students who were able to make additions to their concept maps after their visit to RoadZone was noteworthy. Overall, 80% of students added at least one issue to their concept map, with many making numerous additions. The top five issues identified by all students across all schools were as follows (percentage of all students with post-visit additions who identified each issue is in brackets):

1. Look out for others on the road (30%)
2. Airbags improve safety (29%)
3. Wear a seatbelt (21%)
4. Make sure tyres are in good condition (12%)
5. Wear a helmet (10%)

These issues signal a change in the cognitive processes from the pre-visit concept maps. While the pre-visit maps were dominated by issues which reflected mainstream road safety messages, the post-visit issues are substantially different. "Look out for others on the road" suggests that RoadZone is highlighting the need to be aware of other road users, be they pedestrians, cyclists, passengers or other road users. This signals a change in thinking from the self-focused issues such as 'don't drink and drive', 'wear a seatbelt' and 'don't speed' which were prominent in the pre-visit maps.

"Airbags improve safety" also highlights a change to a much more specific issue than the pre-visit maps. Airbags and their effectiveness is a key issue in RoadZone and the concept

is built into a number of the exhibits.  Further, it is a vehicle safety issue, like "Make sure tyres are in good condition", while most of the issues identified in the pre-visit maps were behavioural issues.

Another theme which emerged from the post-visit concept maps was the number of new road safety issues which were identified in comparison to those which were identified in the pre-visit concept maps.  For each school approximately half of the issues identified post-visit were new: that is these issues had not been identified by any student in that school group in the pre-visit session.

A characteristic of the post-visit concept map additions, and one that is most evident in the new issues identified above, is the higher level of language used in comparison to the pre-visit concept maps.   Some students described a level of quality of safety by using comparative terms: "Airbags make you safer", "Airbags improve your safety".  The concept of risk assessment and avoidance was also noted: "Don't take risks", "Make the right decision", "Be careful of hazards".  The words 'risk' and 'hazard' were hardly used in the pre-visit concept maps.

Higher order cognitive skills were also evident in students linking risk with consequence: "The faster you go, the longer it takes to stop", "Don't give keys to a drunk driver", "You can kill people if you drive too fast", "Don't take risks because you might die", "Don't speed because it endangers your life", "Stick to the speed limit because it takes a long time to completely stop".  This is an important finding because the overall aim of Roadzone was to demonstrate how risk taking can lead to danger.  Most exhibits were designed to allow student choice, and to demonstrate the consequences of those choices.

There was also a greater level of specificity evident in some of the post-visit responses.  Examples include: "When there is a pedestrian, slow down about 10 metres away", "Look at the driver to show you want to cross", "Even though the seatbelt protects your body, your head still moves around", "When driving, stop and look near zebra crossings", "When buying a car, make sure it has all the proper safety requirements".

## 5.  ANALYSIS OF VIDEO DATA

The video data was treated through a three-phase analysis process of descriptive coding using a grounded theory methodology (Glaser and Strauss, 1967; Strauss and Corbin, 1998).  This process is outlined in detail in Gray (2003).  A set of indicators of student engagement in learning processes was developed from the work of Janette Griffin (1998) and applied to the data.  Table 1 outlines the results of this process.

*Table 1: Indicators and sub-indicators of student engagement in learning processes, and percentage of video episodes where these processes were evident.*

| Indicator | Sub-indicator and % of episodes where it was observed |
|---|---|
| 1 Showing responsibility for and initiating their own learning | **5%**   Talking to themselves<br>**72%**  Deciding where and when to move |
| 2 Actively involved in learning | **85%**  Standing and looking/reading<br>**95%**  Exhibiting curiosity and interest by engaging with an exhibit<br>**77%**  Absorbed, close, concentrated examination<br>**79%**  Persevering with a task<br>**74%**  Reacting to exhibit |
| 3 Purposefully manipulating and playing with objects and ideas | **87%** Handling exhibits with care and interest<br>**82%** Purposefully playing with exhibit elements/using hands-on exhibits as intended<br>**38%** Repeating activities to improve performance/score |

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|---|---|---|
| | **38%** | Repeat activities to experiment |
| 4  Sharing learning with peers/experts | **85%** | Talking and pointing |
| | **12%** | Pulling/summoning others to show them  something |
| | **8%** | Willingness to be pulled/summoned to see others' interests |
| | **72%** | Group members talking and listening |
| | **51%** | Asking each other questions |
| | **21%** | Talking to adults/experts |
| 5 Showing confidence in personal learning    abilities | **5%** | Asking questions of displays |
| | **82%** | Explaining to peers |
| | **51%** | Reading to peers |
| 6 Working cooperatively with others | **72%** | Cooperating in using exhibit |
| | **51%** | Making group decisions |
| | **31%** | Urging the group on (to persevere, to    succeed)/celebrating success |

## 6.  ANALYSIS OF DATA STUDIES

When the data from the concept maps of the six students who were studied in-depth was triangulated with the video data of the exhibits they used and the behaviour they exhibited, it was clear that new learning could be attributed directly to RoadZone exhibits.  Each student recorded at least one new road safety issue on their post-visit concept map which linked to a specific exhibit where that concept was promoted.  This clearly demonstrated that interaction with exhibits in RoadZone did lead to new learning in road safety.  The detailed analysis of these data studies can be found in Gray (2003).

## 7.  DISCUSSION

### 7.1 Are children learning, and if so, what are they learning about road safety from a visit to an interactive exhibition?

The data collected in the pre and post visit concept maps, and the video of students at the exhibition demonstrate very clearly that children are learning from a visit to RoadZone.

The pre-visit concept maps identified a baseline of students' understanding of road safety. The themes which emerged were characterised by the key issues covered in road safety education in NSW schools and the road safety messages common in media advertising.

The video data of each school group's visit to RoadZone indicated that the exhibition enhanced learning in 48 episodes which repeatedly demonstrated student engagement in learning processes.  Of the sub-indicators of engagement in learning processes which were identified in this study (see Table 1), 15 were present in at least 50% of episodes, and many of these in more than 70% of episodes:

- Talking and pointing (85%)
- Explaining to peers (82%)
- Purposefully playing with exhibit elements/using hands-on exhibits as intended (82%)
- Persevering with a task (79%)
- Absorbed, close, concentrated examination (77%)
- Reacting to exhibits (74%)
- Deciding where and when to move (72%)
- Group members talking and listening (72%)
- Cooperating in using the exhibit (72%)

Overall this represented evidence of strong, sustained and positive engagement in learning processes by the students who visited the exhibition.

The outcomes of this engagement with RoadZone were evident in the construction of new learning which emerged in the post-visit concept maps.  Of the 229 students who filled in post-visit concept maps, 183 were able to add at least one new issue or idea following their visit.  These were examples of constructivism in action, with students' new learning or understanding occurring through interrelation with the exhibition, characterised by perception and action which built upon their existing knowledge of road safety issues.

The major area of new learning was a shift from an introspective to an encompassing view of the road environment and road users.  While the pre-visit concept maps focused significantly on what an individual should do in regard to his or her own behaviour, the post-visit maps focused more on being aware of other road users and the impact their behaviour might have on an individual's safety.

A second key area of new learning was related to issues other than road user behaviour.  In the road safety field it is considered that there are three main areas or factors which contribute to crashes or affect their outcome: road user behaviour, road environment safety , and vehicle safety, or more simply put, the person, the road and the car.  The focus of the pre-visit concept maps was firmly in the area of the person.  Behavioural issues were most often identified with only minor identification of the vehicle, and virtually no identification of the road environment as an issue.  In the post-visit concept maps, vehicle safety improvements featured strongly, particularly the use of airbags to improve safety.

While the road environment itself did not emerge as a major post-visit issue, there was a greater understanding of the interrelationship between the vehicle and the road, such as issues relating to braking distance, maintaining a safe following distance from another vehicle and slowing down in wet weather.

Another area of new learning was the concept of risk.  This issue was not mentioned at all pre-visit, but was identified on post-visit concept maps.  Most often, identification of this issue was generalized rather than being related to specific risks.

**7.2 What role does the interactive nature of an exhibition play in facilitating learning?**

The interactive nature of RoadZone facilitated learning for the visiting students by creating an environment that stimulated, questioned, supported and rewarded them.  RoadZone created a 'world' within which road safety could be explored in safety, rather than in the real environment of the road system.

RoadZone's effectiveness as a learning environment should be measured against the characteristics of interactive exhibitions which support and enhance learning (see for example: Ramey-Gassert,1997; Falk and Dierking, 1998; and Hein and Alexander, 1998).  These can be summarised as:

- Personalise the learning experience and promote personal meaning making
- Allow the learner to choose and have individual scope to direct their own learning
- Demonstrate the consequences of individual choices
- Allow the learner to explore related aspects of the same issue
- Engage the learner through supporting intimate interaction with exhibits
- Provide a variety of outcomes depending on choices
- Relate to life experiences through a variety of learning modes

Each student could explore RoadZone in their own way.  There was no set path which had to be followed, and students were free to choose which exhibit to explore, how long to interact with it, and where to move on to.

A key aspect of the exhibits was the opportunity for learners to make decisions and see the consequences of their decisions. For example, this could be done by:

- adjusting the speed of cars and identifying how this affected their stopping distance *(Stopping Distance)*
- making decisions under the influence of peer pressure and seeing the consequences played out on video *(Peer in Your Head)*
- choosing to vary the safety aspects of a car and the road environment and then crash testing the car to determine the likelihood of injury *(Crash and Crumple)*
- deciding on a combination of safety and comfort accessories in a car before performing a virtual crash test *(Buy a Car)*
- choosing whether or not to fasten a seat belt on a crash dummy and then watching the crash test result on video replay *(Belt Up)*

All these exhibits are examples from RoadZone where choice and consequence were directly linked through creative interactives. These examples, and other exhibits, also allowed for a variety of consequences depending upon choice. These consequences could be safe outcomes, near misses or crashes. The level of injury from a crash could vary, and in some cases a quantitative 'score' of safety was provided to the user. The video data showed regular examples of students repeating activities to improve their score, and have a safer outcome.

Related aspects of the same issue were reinforced across the exhibits. Each of the key road user groups – passengers, drivers, cyclists and pedestrians, were represented in several exhibits with different but related themes. For example the following exhibits highlighted varying aspects of pedestrian safety:

- *Corner of Your Eye* – explored the issue of limited peripheral vision for child pedestrians
- *How Bright are You* – highlighted the problems posed for pedestrians by conspicuity at night
- *How Fast?* – required the child as a pedestrian to judge the speed of an approaching vehicle
- *Stepping Out* – the child had to cross a virtual road
- *Street Quiz* – included questions related to pedestrian safety
- *Who's to Blame* – explored the precedents and antecedents of a pedestrian crash

Students were able to get 'up close and personal' with RoadZone. There were exhibits they could stand on, stand in, sit on, surround, wear, touch, spin, and push. This close interaction was rewarded with responses across a variety of learning modes. They could watch video from a range of perspectives, listen to the responses of characters, or the outcomes of crashes, read information, results, and directions, and physically balance while trying to split their attention between two activities. The learning taking place was linked to real life experiences through extensive use of real life video of people, road environments and vehicles. Virtual environments also allowed experimentation which would not be possible in real life – crash test facilities, standing in front of an oncoming vehicle, and spotting hazards while riding at night were all virtual environments made available through RoadZone.

The data studies demonstrated that learning outcomes could be directly attributable to interaction with specific exhibits. In each study, the student's post-visit concept map additions were related to one or more specific exhibits they were captured using in the video data. For example, Darren, Year 3, spent some time interacting with *Crash and Crumple*, verbalised his experiment of putting the airbag on the exhibit, then added the word "airbag" to his post-visit concept map. Paul, Year 5/6, used *Belt Up* with some friends, was highly experimental in his use of the seatbelt and crash dummy, then added "must wear a seatbelt"

to his post-visit concept map.  Teresa, Year 6, listened to all the characters in *Keys Please*, had a discussion with another student about how many drinks a P plate driver could have, and then added to her post-visit concept map: 'If you gone to a party and you have drunk a lot, call a taxi'.

**7.3 What effect, if any, does the interaction between children themselves at an exhibition have on their learning?**

The 'world' of a visit to RoadZone included not only exhibits but other students.  Generally students were not given instructions to move around RoadZone individually or in groups, but in practice most students immediately formed small groups and began to interact with exhibits.  In some cases these small groups remained intact throughout the exhibition.  There was also evidence of groups re-forming with different students as the groups moved around.  This would often happen while students were moving between exhibits, but also occurred while a group was using an exhibit.

None of the schools divided students into groups prior to or upon arrival at RoadZone.  It was observed that, as each school was 'released' from their initial orientation to the exhibition and invited to go and interact with the exhibits, the students instinctively and immediately formed pairs, or groups of three or four.

The indicators and sub-indicators which emerged during the video data analysis demonstrated the level of student to student interaction which occurred during RoadZone. The analysis of the video data against these indicators of student engagement in learning highlights the key role of student interaction in interactive learning situations.

Almost three quarters of the 48 video episodes featured students cooperating in using an exhibit even though the exhibition was not specifically designed for group use.   Just over half the episodes showed groups making group decisions – discussing options and then agreeing on a course of action.  Almost one third of episodes demonstrated evidence of individuals urging the group on, or celebrating success as a group.

Other sub-indicators also demonstrated the positive aspects of student interaction.  Verbal interaction was very common in the video data.  This was evident through talking and pointing (85% of episodes), group members talking and listening (72%), asking each other questions (51%), explaining to peers (82%) and reading to peers (51%).  Such interaction is likely to create cognitive conflict, the resolution of which results in development which supports the effectiveness of any learning taking place (Thompson et al, 1996).

When compared to the characteristics of positive and successful peer collaboration outlined by Thompson et al (1996) related to conceptual advance and dialogue between peers, the interaction between students at RoadZone was likely to support effective learning. Observation of each school group as they began to use the exhibits indicated that most students started in a friendship based group.  Students tended to move around in pairs or groups of three or four with specific characteristics:
- close physical contact such as linked arms, pulling of arms, and leaning against each other
- reasonably constant dialogue
- joking, laughing and 'playing'

These characteristics would seem to be consistent with groups being based on friendship.

There were examples of the role of this interaction and discussion being a catalyst for change.  These episodes generally involved a change of decision or option related to particular exhibits following an exchange between students using that exhibit.  That different

ideas were discussed often in these episodes was clear from the video data, even though the audio component was not always clear. The methodology of this study did not allow for identifying individual resolution of cognitive conflict which may have arisen from this discussion and exchange. However, it is reasonable to surmise that some of the post-visit additions to the student concept maps may have been the result of such resolution.

Two components of the characteristic of dialogue which were strongly evident in the video data were students providing explanations to their peers and a range of dialogue from disorderly to orderly. Most of the 48 video episodes demonstrated students explaining to their peers. Some students even stayed at an exhibit while their friendship group moved on in order to play the role of 'expert' when new groups arrived. There were also examples of students calling or pulling another student over to an exhibit where they knew the student had been before in order to ask them what to do.

A wide range of dialogue was also clearly evident in the video data. There were numerous episodes where students could be seen having disorderly dialogue characterised by students raising their voices, interrupting each other, ignoring comments or questions from others and arguing about choices within exhibits. Similarly, there were other episodes where students conducted comparatively orderly dialogue. These were characterised by students listening to each other, not interrupting each other, physically standing back from exhibits to discuss options and agreeing on a course of action before taking it.

Overall, the data indicated that the interaction between students supported and enhanced their learning at the exhibition.

## 8.  CONCLUSION

The outcomes from this study clearly demonstrated that students can learn from a visit to an interactive road safety exhibition. New learning was identified by the vast majority of students in the study, and this new learning was enhanced and supported by the interaction between students and the exhibits, and by the interaction between students themselves. The new learning in road safety was characterised by an increased understanding of the role of vehicle safety features in reducing injury, of sharing the road with other users, and of the concept of risk in the road environment. These outcomes support the use of interactive learning approaches in road safety education and should be considered by stakeholders involved in developing approaches to teaching students about road safety.

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