PRE-PRIMARY CHILDREN'S AWARENESS AND USE OF ROAD SAFETY RULES

A Report to the Federal Office of Road Safety

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EXECUTIVE SUMMARY

Review of Literature

- young children's characteristics and road safety
- preschool-based road safety education

Preschool Teaching Program on Road Safety

 comparison of teaching methods (teacher guidance, learning centre, free play)

Results of the Teaching Methods

- talking with children about play on road safety themes can increase their road safety knowledge
- teacher interaction with children during road safety play increases awareness of road safety
- teaching road crossing rules can elicit related skills in supervised contexts

Conclusions

- preschools can have an effective, but limited, part in the road safety education of young children

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1. INTRODUCTION

In Western Australia, early childhood teachers are expected to program for road safety education as part of the pre-primary health education syllabus. Teachers often use traditional play approaches to extend direct teaching of road safety rules although little is known about the effectiveness of such methods for increasing road safety skills. The present study investigates the effectiveness of play-based teaching methods for achieving the road safety objectives of the Western Australian pre-primary health education syllabus.

1.1 Road Safety Education and Young Children

Road safety education provides a particular challenge in the early childhood years because of the perceptual, cognitive, and physical immaturity of young children (Moses 1987; Ross & Seefeldt 1978). In this regard, studies of young children's general safety knowledge have implications for road safety education. In a study of 3- to 8-year-old children's ability to recognize safe and unsafe situations, Coppens (1986) recorded age-related differences in children's understanding of safety and prevention which were associated with cognitive development. Causal reasoning and cognitive style were significant predictors of performance on safety recognition and prevention tasks based on a set of photographs. Coppens (1986) suggested that "the focus of safety education programs should be on helping children identify preventive measures through encouraging the development of an understanding of cause-effect relationships existing between accident agents and potential injury" (p. 200).

Social and environmental factors may mediate age-related differences. Grieve and Williams (1985) identified age-related differences in the abilities of 3- to 6year-old children to perceive dangers commonly involved in childhood accidents, but also obtained an effect associated with socio-economic (SES) level. Higher SES children obtained higher recognition scores than lower SES children in the 5- and 6-year-old groups. Grieve and Williams suggested that the ability of young children to identify and recognize some potentially dangerous situations indicates that young children do have a concept of danger, and that instruction needs to focus on the dangers inherent in particular contexts. The SES effect in this study raises questions about the amount and quality of safety instruction received by low SES children.

Cross and Mehegan (1988) interviewed 5- to 9-year-olds about their conception of speed in terms of distance travelled and the time taken by vehicles. Children were asked to respond to several play tasks with matchbox cars in which the speed of car (fast, slow), type of road (long, medium, short) and time taken to reach destination were systematically varied by the interviewer. The authors found that younger children held naive conceptions of the relationship between distance, time and speed which would place them at risk when crossing roads. In a related study Cross and Pitekethly (1988) successfully modified naive conceptions of speed held by children in their third and fourth years at school by teaching a unit on speed in the context of science studies. While this study does not extend to children's behaviour in a road situation, the authors do note that the modification of naive concepts is an important prerequisite for improving children's judgements and road crossing behaviour. On this basis it can be argued that incorporating road safety education within school curricula is a worthwhile, if not sufficient, approach to road safety education. Young children's perceptual limitations may place them at risk when crossing the road. Ampofo-Boateng and Thomson (1991) found that 5- and 7-year-olds exhibited poor skills when identifying dangerous road-crossing sites depicted on a large traffic mat, compared with 9- and 11-year-olds. Younger children failed to use all available cues when making judgements about safety, and fixated on a single strategy for deciding whether it was safe to cross the road, even when they knew the 'Green Cross Code', a road crossing drill which was widely used in road safety education. This limitation can be explained in terms of young children's poor scanning abilities as well as their tendency to centre on one aspect of a situation. On the other hand, training may help to reduce the effects of perceptual limitations. Young and Lee (1987) have argued that 5-year-old children have the visuo-motor capacity to learn to cross the road safely in traffic. These researchers designed a simulated road adjacent to a real road which enabled children to practise the skills required to cross safely through gaps in traffic, as cars proceeded along the `real' road. As a result of training 5-year-olds became more skilled at using gaps to cross the road, reaching adult levels of proficiency on some of the criterion variables. McKelvey (1984) has also argued that children should be trained to use safe crossing intervals between cars, in preference to road safety drills. In the McKelvey study, film training methods were used to train children aged 5 to 12. With this method, children reached adult levels of proficiency by fourth grade.

Other community-based approaches to pedestrian safety training have been reported. Yeaton and Bailey (1983) reported an improvement in young children's crossing behaviours after crossing guards participated in a training program designed to improve the quality of safety instruction and feedback. Van der Molen, Van der Herik and Van der Klaauw (1983) found that the active involvement of parents in a pedestrian training program for children improved the quality of traffic behaviour for both parents and children.

Behavioural methods, based on learning theory principles, have also yielded some positive changes in children's safety behaviours. Sowers-Hoag, Thyer and Bailey (1987) used behavioural practice, assertiveness training, and reinforcers to produce gains in seat belt use by young children, which were still evident 2 to 3 months after the intervention. However, Lehman and Geller (1990) reported mixed effects of incentive-based training in the use of seat belts.

In summary, studies of young children's road safety skills indicate, firstly, that there are age-related differences in children's road safety knowledge and skills; and secondly, that intervention programs can improve young children's performance on measures of these skills.

1.2 Preschool-based Safety Education

The training studies reviewed so far have used specially designed procedures which have been conducted by researchers who have used additional personnel to implement training programs or made use of out-of-school settings, such as `After School Care' programs. The one exception to this pattern, the study by Cross and Pitekethly (1988), implemented a curriculum unit with children in grade three, however, it cannot be assumed that this approach could be generalized to preschool-aged children. One study which has been carried out in kindergarten classes used simulation games to teach traffic safety rules (Renaud & Suissa 1989). The games, which used finger puppets and a plan of a town, had been proposed as a component of Quebec's preschool program, consequently, it is likely that this approach could be more readily integrated with the teacher's normal program than approaches which required additional personnel or specialized resources.

Other techniques used with preschoolers which have the potential to be incorporated into preschool programs are the use of storybooks based on the child's character and Sesame Street characters, to teach children about safe places to play (Embry 1981), and the use of photographs of safe and unsafe situations to develop the ability to identify dangerous situations (Zapata 1980).

A New Zealand study of early childhood injury prevention (Podmore & Lealand 1990) has recommended that "educational approaches used with young children to prevent them from being injured should be consistent with and/or part of early education and care centres' programmes" (p.22). Podmore and Lealand cited Trenwith's (1985) study of safety education in New Zealand kindergartens which found that teachers generally believed that parents were responsible for safety education, and that kindergartens had limited safety education material available. Parents, in contrast, while they felt they were responsible for safety education also believed that teachers and the media were sources of reinforcement of safety messages.

In Western Australia the importance of road safety education has been acknowledged as part of the health education syllabus for preschools and preprimary centres, yet few research-based guidelines about appropriate teaching methods are available for teachers. This study, therefore, aims to provide information for early childhood teachers about the effectiveness of different methods of teaching road safety. Accordingly, the teaching interventions were designed to be implemented by teachers as part of the normal teaching program, using procedures consistent with the play-based philosophy which underpins most Western Australian preschools. The two interventions, a reflective dialogue approach and a learning centre approach, involved variations of play-based methods for extending direct teaching in informal play situations, while the no-intervention control condition involved a free play condition.

The reflective dialogue approach evolved from research on metacognition; that is, the ability to reflect on one's thinking and learning and to control decisions and actions on this basis. Pramling (1988, 1990) has shown that when preschool children participate in metacognitive (i.e., reflective) dialogues about their learning their awareness of their own learning increases. Young children's awareness of their learning is associated with the acquisition of cognitive skills such as literacy (Cullen & Bosich 1987; Cullen 1991). Road safety education involves both a cognitive component and behavioural skills and is, therefore, an appropriate area of the preschool curriculum in which to extend this line of research. This study provides a test of the hypothesis that talking with children about their learning on the topic of road safety will increase their awareness of road safety rules and their ability to apply the rules appropriately. Specifically, it was expected that children who participated in a reflective dialogue condition would achieve higher scores on measures of road safety knowledge and skills than children in learning centre or free play conditions. Further, it was expected that children in a learning centre condition, which focussed children's play on road safety themes, would achieve higher scores than those in a free play condition.

2. METHOD

2.1 Design of the Study

The teaching interventions were carried out in three pre-primary centres attached to government primary schools in Perth. Pre-primary centres offer sessional preschool programs for children in the year in which they turn five.

Pre-primary centres have two sessions (Groups A and B), which are staffed by the same teacher and teacher's assistant. This organization allowed a natural experiment to be conducted within the same centre, with each group receiving a different teaching condition.

The interventions comprised two teaching conditions (reflective dialogues and learning centre) and a no-intervention control (free play), according to the following design:

	Group	Condition
Centre 1	A B	learning centre reflective dialogues
Centre 2	A B	free play learning centre
Centre 3	A B	reflective dialogues free play

The above design incorporated a control for teacher effects (Centre 1), and a no-intervention control group for each teaching intervention to control for the effects of history and maturation (Centres 1 and 2).

2.2 Sample

The three centres were selected from schools in Perth, WA, which had two fiveyear-old pre-primary groups. The original sample comprised 111 children who were attending the centres at the beginning of the study; data analyses were based on 88 children for whom a complete data set was gathered. The loss of student numbers from illness or transfers produced unequal group numbers, with smaller numbers in the two RD groups compared with their comparison groups. This pattern would not have affected the outcomes of the study as comparison group numbers did not differ significantly at the time of the teaching interventions. Mean age at mid year, when the study commenced, was 4 years 11 months. The six comparison groups did not differ significantly in age (F(5,82) = .95, p = .46, NS). The three centres were selected from lower SES areas, however, the nature of the neighbourhoods in which the schools were located did differ qualitatively. School 1 was located in an inner city, previously working class suburb, which was changing in character as professionals moved into the area. School 2 was located in a newer outer suburb, in which stable working class families live. School 3 was located in area noted for its mobile population associated with high levels of unemployment and unstable family situations.

2.3 Procedures

Phase 1. Individual interviews were conducted with each child at the beginning of Term 3 in order to provide pre-test data on the children's knowledge of road safety prior to the teaching interventions.

Phase 2. Two weeks after the initial interviews at each centre the teacher carried out a three-week teaching module on road safety. Teachers and the researcher planned the content and guidelines for the teaching module prior to the commencement of the study, however, variations did occur as a result of differences in teaching style and availability of resources in the three centres.

In week one all children were introduced to the road safety topic to ensure that every child received the basic road safety program for pre-primary classes. A different road safety rule was discussed each day and was followed by related language-based activities and art and craft. Content covered: walking safely in traffic and crossing the road, playing in safe places away from traffic, the importance of wearing seat belts, recognition of common road signs, and the safe use of bicycle paths. Teachers used ideas from the `WA Health Education Syllabus' (Education Dept of WA, no date) and the Federal Office of Road Safety (1991) 'Out and About - Pre-school' materials. The same set of road safety posters, and sections of the 'Out and About' video tape, which featured Australian animal characters in road safety situations (seatbelts, roads. footpaths, playing), were used as stimulus for discussion. Additional materials from the `Out and About' kit (activity posters, stickers, booklets) were used for extension activities. Children practised road safety skills in realistic settings by going on a class walk in the local area with the teacher and assistant.

Teaching interventions were introduced in week two, according to the following guidelines:

Learning Centre. An indoor learning centre was provided during activity time to stimulate sociodramatic and constructive play on a road safety theme. In this study, the term `learning centre' is defined as a play area which is designed to focus children's play-based learning on a specific topic, i.e., road safety. In Centres 1 and 2 the main learning centre was established in the block area using miniature road safety signs and vehicles to stimulate play. In Centre 3 the main learning centre comprised a table top plan of a town, with miniature vehicles and road safety signs; a block area was also available for road safety play. The teacher and assistant were available to extend child-initiated play but did not suggest themes. At the conclusion of the activity time, the teacher conducted a short mat session in which road safety rhymes and songs were practised.

Reflective Dialogues. The same learning centres were provided for these children, but, in addition, teachers used available opportunities to encourage children to talk about their activities during the play period. At the concluding mat session, the teacher questioned the children about their play encouraging them to reflect on what they had learned about road safety and how they could use this knowledge in their play.

Free Play. Resources which were available in the learning centres in the previous conditions were available for these children during activity times, however, they were not presented as a specific learning centre and teachers did not suggest play themes or intervene in their play. A short mat session followed the activity time to equate for direct teaching time. The teacher did not focus specifically on road safety although road safety songs and rhymes were used if requested by the children.

In week three the teaching interventions were established in the outdoor play areas. In each centre a system of roads, pedestrian crossings, and child-sized road safety signs (stop, children's crossing, traffic lights) were provided. In Centre 1, tricycles and vehicles were available; in Centres 2 and 3 children used vehicles which they had constructed from large cardboard boxes.

Video recordings were made of indoor and outdoor play in order to provide qualitative data on the nature of play in different conditions.

Phase 3. Short-term and long-term post-test data were obtained. Two weeks following the teaching interventions a second interview was conducted with

each child to assess short-term knowledge gains. A long-term follow-up assessment was conducted in November, comprising: (1) a symbolic task, and (2) a behavioural task.

2.4 Assessment Procedures

All data collection procedures were conducted by the same female research assistant who was a qualified early childhood teacher. Both interviews and the symbolic task were conducted informally using a natural conversational style.

Interview 1. A set of eight photographs depicting situations relating to road safety were used as a stimulus for discussion. The photographs comprised: car parked in driveway, bicycle path, children's playground in park, children's crossing sign/flag by main road, pedestrian crossing with button/walk sign, median strip outside shop, stop sign at intersection, traffic lights at intersection. Each child was asked an initial standard question (e.g., "Is this a safe place to play/go?") and probe questions were used to clarify the child's initial response. Interviews were tape-recorded, and brief notes compiled for each child to record any incident or factor which could have affected the child's response to the interview.

Each interview was transcribed and analysed by a research assistant. Interjudge reliability was established with a second assistant who scored 18 percent of the transcripts yielding 95 percent agreement. Each of the first five items (driveway - pedestrian crossing) was coded initially for recognition of the correct road safety response to the standard question (Yes or No); the child's reasoning about the situation was then scored according to whether it reflected the conventional road safety interpretation of the depicted situation. One point was obtained for the correct response; two points for the conventional reason, yielding a possible score of three for each item. If probe questions were required to elicit a conventional response one point only was awarded for the child's reason. For the last three items (median strip - stop sign), two points could be gained, one for recognition of the sign and one for understanding its function.

Interview 2. The second interview was designed to see if the children could reflect about what they had learned about the road safety topic. The interviewer commenced by saying she wanted to ask the children what they could remember learning about road safety, then focussed questioning on specific aspects; namely, crossing the road safely, use of seatbelts, and recognition and use of the three signs available in the outdoor play areas (i.e., the children's crossing sign, stop sign and traffic lights). Miniature signs were used as prompts if the child did not spontaneously recall the signs. Each of the five focal aspects could obtain three points; one for recalling the rule/sign, and two for understanding its conventional safety reason/function. A maximum score of two was awarded for partial knowledge or if a prompt was required to elicit a response. In addition, transcripts were scored for the number of safety ideas referred to in addition to those targeted by the interview questions.

Interviews were transcribed, and coded by a research assistant who was blind to the teaching conditions. Reliability was established with a second assistant who coded 16 percent of the transcripts yielding a percent agreement of 89 percent.

Video-recordings. The films were analyzed by three persons: the assistant who filmed the children and who was expected to have an informed knowledge of the nature of children's play in each centre which could clarify ambiguous incidents; the researcher, and a second assistant, both of whom independently

scored the number of road safety incidents which were evident in the children's play. A reliability estimate of 95 percent agreement was based on the latter two scores. Any disagreements were interpreted on the basis of the first assistant's interpretation. A thematic method was used to identify road safety incidents, focussing on meaningful play sequences rather than discrete behaviours. This method was considered to be more appropriate for clarifying the nature of children's play than quantitative analyses of coded behaviours.

Symbolic Task. A felt board set was used to assess each child's ability to apply road safety knowledge in a symbolic situation. The felt background picture depicted a road with a T intersection, a house with a driveway, a shop on the opposite side of the road from the house, and a park further down the road from the house. Footpaths were marked on each side of the road. Felt cars and people could be manipulated by the child to indicate his/her response to the interviewer's questions. The Symbolic Task was presented as a picture-story which the child could help to tell. The interviewer introduced the story by saying "This is Jenny (Peter). She (he) is five and lives in this house with her (his) mother and father and big brother (sister)." The big brother and sister were included as it was found in the previous interviews that the children often said that it would not be safe to be in a park or on a footpath unless mother, father or an older brother or sister were there. In the course of the story the child was asked to indicate, by placing the felt pieces on the board, the correct `safety' response to the following situations: a safe place to walk to the park, where to play safely at the park, what to do if a ball went on the road, when it was safe to cross the road to the shop, a safe place to be when Jenny's father was backing his car down the driveway, what Jenny should do when going for a ride in the car.

Responses were recorded on a protocol sheet. Symbolic scores were obtained by awarding the child one point for `safe' responses, yielding a total score of seven. Interjudge reliability, based on 20 percent of the sample, was 99 percent.

Behavioural Task. Each child was observed crossing the road outside the preprimary centre during a pre-primary session. The children were supervised by the teacher who indicated when each child should approach the kerb. Videorecordings were made as the children crossed the road and coded according to the following categories: pauses at kerb, looks both ways, looks while crossing. Each category was awarded one point yielding a total score of three. A fourth category (walks straight across) was not included in the score as all children performed this action correctly. Reliability assessments were based on 20 percent of the sample, yielding 93 percent agreement.

3. RESULTS

3.1 Pre-test Data

A one-way analysis of variance (ANOVA) of Interview 1 scores failed to yield any significant differences between the six comparison groups (F(5,82) = .81, p = .54). Tableÿl reports means and standard deviations for Interview 1 scores for the six comparison groups.

TABLE I

Centre	Group	Ν	М	SD
1	LC RD	18 13	14.67 15.38	4.16 3.73
2	FP LC	17 14	15.24 15.00	3.46 3.70
3	RD FP	12 14	16.67 13.79	3.14 4.30
TOTAL		88	15.07	3.77

Means and Standard Deviations for Interview 1 Scores

*Maximum score = 21

3.2 Post-test Data

Although comparison groups did not differ significantly on Interview 1 scores a significant correlation was obtained between Interview 1 and Interview 2 scores (r = .31, p < .01, 2-tailed). Accordingly, analysis of covariance (ANCOVA) with Interview 1 scores as covariate was used to eliminate any pre-existing differences among subjects when testing for intervention effects. One-way ANCOVAS were performed on Interview 2, Symbolic Task, and Behavioural Task scores, treating each centre as a separate analysis. The reasons for this decision were twofold: firstly, the design of the study constituted neither a full factorial design, nor a completely nested design, consequently, the use of two-way ANCOVAS to test interaction effects of condition and group was not feasible; secondly, teaching styles differed considerably across the three centres therefore it was not meaningful to combine groups across centres to test for condition effects. As the LC-RD, FP-LC, RD-FP comparisons constituted planned comparisons (Winer 1971), F ratios were converted to t values to perform 1-tailed significance tests.

Means, standard deviations, F ratios and t values for Interview 2 scores, and Number of Ideas in Interview 2, are reported in TableÿII. On Interview 2 scores, Centre 1 RD children scored higher than the LC group (t(29) = 2.10, p = .025) while in Centre 3 the RD group obtained higher scores than the FP group (t(24) = 1.87, p = .05). In Centre 2 results were in the expected direction (M(LC) = 10.86, (M(FP) = 9.94) although the difference was only marginally significant (t(29) = 1.40, p = .10). A significant effect was obtained in Centre 2 for Number of Ideas with LC children obtaining higher scores than FP children (t(29) = 3.21, p = .005). Number of Ideas did not differ significantly in Centres 1 and 3.

TABLE II

Means, Standard Deviations, F Ratios and T Values for Interview 2# and Number of Ideas (Interview 2)

Centre	Group	N	М	SD	F	t	Ρ
1	LC RD	18 13	8.83 10.31	1.58 2.18	4.40	2.10	.025*
2	FP LC	17 14	9.94 10.86	1.68 1.79	2.19	1.40	.10
3	RD FP	12 14	11.92 9.29	1.98 2.79	3.46	1.87	.05*
Number	of Ideas						
1	LC	18	1.89	1.57			

	RD	13	2.85	1.57	2.67	1.63	.10
2	FP LC	17 14	2.35 4.14	1.84 1.35	10.28	3.21	.005*
3	RD FP	12 14	2.25 2.00	1.14 1.24	0.74	0.86	NS

*Significant at .05 level or better, 1-tailed. #Maximum score = 15.

Interview 2

Table III presents means, standard deviations, F ratios, and t values for Symbolic Test scores. Analyses of the Symbolic scores failed to yield a significant differences between groups in any centre.

TABLE III

Means, Standard Deviations, F Ratios and T Values for Symbolic Test#

Centre	Group	Ν	М	SD	F	t	Ρ
1	LC RD	18 13	5.33 5.46	1.19 0.66	0.05	0.22	NS
2	FP LC	17 14	6.29 6.21	0.77 1.05	0.08	0.28	NS
3	RD FP	12 14	6.33 6.14	0.49 1.17	0.04	0.20	NS

#Maximum score = 7.

TableÿIV presents means, standard deviations, F ratios, and t values for Behavioural Test scores. Behavioural scores differed significantly in Centres 1 and 2, but not in Centre 3. In Centre 1 the RD group obtained higher scores than the LC group (t(2) = 4.84, p = .0005), while in Centre 2 the LC group obtained higher scores than the FP group (t(29) = 2.48, p = .01).

TABLEÿIV

Means, Standard Deviations, F Ratios and T Values for Behavioural Test#

Centre	Group	Ν	М	SD	F	t	Р
1	LC RD	18 13	1.50 2.85	0.92 0.38	23.42	4.84	.0005*
2	FP LC	17 14	1.88 2.50	0.78 0.52	6.15	2.48	.01*
3	RD FP	12 14	2.67 2.43	0.49 0.51	1.57	1.25	NS

*Significant at .05 level or better, 1-tailed. #Maximum score = 3.

3.3 Qualitative Differences in Play

Analyses of the video recordings indicated that children in the RD groups participated in more extended play sequences on traffic themes than were children in the associated comparison group. Centre 1 groups, for example, differed in the number of road safety incidents revealed in videos of both indoor and outdoor play. The RD children were more likely than the comparison LC children to incorporate road safety signs into play themes and to use language to extend this play. For example:

RD indoor play. Boys continue to move cars on and around the road system they have created in the block area. One boy approaches a set of moveable traffic lights with his car and stops. He picks up the sign and checks the colour, then moves on. As he goes slowly along the road each sign is carefully looked at. "Crosswalk coming up" says boy 2; the first boy stops car at crosswalk.

RD outdoor play. Two boys and one girl wait at crossing. Boy pushes car along and stops. The three children then cross over and car moves on. Children then turn round, getting ready to cross from other direction; stop and look both ways. As truck approaches crosswalk boy standing near crosswalk sign walks out, motions with his hands for it to stop. The two girls cross holding hand. They chant together how to cross the road and do the actions simultaneously. Boy with truck moves on.

LC indoor play. Three boys playing with blocks; boy 1 is building a road, boys 2 and 3 are pushing trucks around the mat. Traffic signs are unused on edge of mat area. Boy 4 kicks road

accidentally which is replaced. Traffic lights are put in and then removed by boy 1. Three boys leave blocks. Boy 4 pushes truck around mat, away from road structure. Boy 3 returns and adds stop sign; boy 2 moves sign and drops on carpet; `talk' unrelated to traffic.

LC outdoor play. Boys on trikes on cycle path; one boy stands on base of children's crossing sign, watching trikes move past. Girl stands in front of crosswalk with hands up; boy on trike continues without stopping. Boy moves stop sign at end of path, two boys on trikes rush past, boy moves sign to crosswalk; boys on trikes ignore sign and continue without stopping.

What appears to be distinguishing the play in these episodes is the failure of LC children to co-ordinate their play with others in order to extend road safety themes. While LC play was focused on a traffic theme attempts to incorporate safety aspects were brief and not extended by other children. RD children, in contrast, made more effective use of the road signs and equipment and engaged in more cooperative play. The Centre 3 teacher also reported a marked difference in the type of play occurring in the RD and FC groups with FP children more likely to ignore road safety equipment or to use it in a cursory way.

In Centre 2, where cooperative extended play episodes were also recorded with LC children, it was apparent from the videos that interaction with an adult (teacher or assistant) in this condition, was effective in extending play. Possibly, the LC condition which, in this centre, was compared with free play, functioned as a de facto RD teaching method, in that adult comments, questions, and suggestions appeared to refocus children's play explicitly on safety aspects. In contrast, in Centre 1 the LC condition with children during play. The following extract from Centre 2 video transcripts illustrates the contribution of adults to play themes in the LC condition.

Outdoor crosswalk with crosswalk sign and flag. At crossing girl says "This is a people crossing not a car one" and walks across. Boy in box car races up to crossing, stops, looks, then runs off. As cars move along roadway, boy at side of crosswalk holds flag out to stop each car. This continues many times. Teacher enters, shows girl how to walk out into the middle of the road with the flag, saying "Hold it up so the cars can see". A line of girls crosses as flag holder stands in middle and tells three cars to stop. Teacher says to car driver "Vehicles can't go; once she's off the road you can go". To girl who is walking very slowly "You need to walk quickly ... you could have got run over then, the lollipop lady has gone". Play continues at crosswalk for several minutes; child demonstrates to a newcomer how to use the crosswalk flag to allow children across.

The teacher interaction recorded in this video extract is similar to the type of teacher interaction in the Centre 3 RD condition. For example, the following episode illustrates teacher modelling and instructions on safety rules which are subsequently recorded in child-child interactions.

RD outdoor play. Witches hat form a figure `8'. At one end there is a crosswalk set up with children's crossing sign. Where the figure 8 crosses there is a hoop and a stop sign. Teacher shows children in box cars how to move around and give way at the

hoop. `Policeman' stands at hoop and directs traffic ... Teacher comes in dressed as policeman; stands in front of crosswalk, stops cars saying "This is a crosswalk" ... Girl playing with ball on road, "Don't play on the road".

4. DISCUSSION

4.1 The Teaching Methods

The results of this study provide support for the effectiveness of reflective dialogues procedures for increasing young children's awareness of road safety skills. In both centres in which reflective dialogue procedures were used children who participated in discussions with their teachers about their play on road safety themes indicated greater ability to recall and to reason about road safety conventions than children who had not engaged in teacher-initiated discussions about their play. A comparison of Interview 2 records from Centre 3 groups illustrates a qualitative difference in children's reports of their learning on the road safety theme. For example:

RD. We had to stop at the crosswalk. Mrs T. put the children's sign out and we stopped. (Q. Who stopped - the children or the cars?) The cars stopped then the children could cross ... when the sign was up the children could cross 'cos the car stops.

FP. There was a sign and cars. (Q. What was the sign for?) To stop.

Although children from both groups recalled the equipment available for play and type of play activities, overall, RD children were more likely to expand their answers to the interviewer's questions and to reveal a more detailed understanding of the safety theme. Such differences are of particular interest in view of the fact that both groups received identical content and teaching methods in the first week of the road safety module, and that the teaching interventions occurred for a relatively short period of time (2 weeks).

The failure to find differences in the number of road safety ideas referred to on the post-test interviews in Centres 1 and 3, the two centres which used the reflective dialogue procedure, suggests that basic ability to recall information relating to road safety (e.g., signs, road features) is not affected by the dialogue approach. Possibly availability of these resources in the centres, the `Out and About' video, and the initial teaching period, were sufficient to assist children's recall. In this regard, the higher scores obtained by Centre 2 LC children on Number of Ideas is of interest. It is plausible that this result can be explained by the difference in the type of abilities reflected in Interview 2 and Number of Ideas. Whereas the first measure included a reasoning component which appeared to differentiate teaching conditions in Centres 1 and 2, Number of ideas was strongly influenced by children's recall of teaching aids (e.g., road safety booklets) and equipment available for children's use (e.g., roundabout sign). Centre 2 appeared to have more road safety resources (e.g. number of signs) available for play, and children from this centre were also able to recall a number of features in the simulated traffic system in a nearby park, which they had visited with their teacher. It is possible that the adult interaction, referred to above, in the LC condition drew the LC children's attention to these features, thereby facilitating recall.

The failure to obtain significant differences on the Symbolic Test could be explained in several ways. This measure appeared to have a ceiling effect in

that all children performed well. The nature of the task, in which children manipulated people and cars in basic road safety situations, reflected the type of situations experienced in the initial teaching period in which all children received the basic road safety content of the curriculum. The success of all the children on the symbolic measure suggests that a direct teaching approach can be effective for long-term retention (2 months) of safety ideas, when assessed on symbolic situations which require only limited ability to generalize to other situations.

On the Behavioural Test results are more complex. As expected, Centre 1 RD children exceeded the LC group, while in Centre 2 LC children exceeded the FP group. In contrast, Centre 3 scores were high for both groups and significant differences were not obtained. Variance was high for the Centre 1 LC and Centre 2 FP groups, which may partially explain the lower scores of these groups on the basis of a few children. The results provide some support for the notion that the extra teacher interaction experienced in the Centre 1 RD and Centre 2 LC conditions did increase the children's awareness of road crossing skills when demonstrating these in a supervised context. The exact mechanisms responsible for the obtained differences in behavioural results are, however, unclear. As the task was supervised by the teacher, it is possible that teacher presence elicited greater awareness of the appropriate response. This factor could also explain the high levels of performance in both Centre 3 groups. In this centre the teacher had a lively style of teaching which could facilitate recall of the road crossing drill.

In view of the studies which indicate the complex judgements involved in road crossing skills (e.g., Ampofo-Boateng & Thomson 1991; Van der Molen 1983; Young & Lee 1987) it is unlikely that the short-term interventions in the present study would make a significant impact on the perceptual/cognitive components involved in crossing roads in traffic situations. Nevertheless, the small, significant correlation of the Behavioural Test with Interview 2 (r = .27, p = .01, 2-tailed), but not with the Ideas or Symbolic scores, does suggest that a reasoning component is involved in appropriate road-crossing behaviour. If this assumption is correct, the finding is consistent with Coppen's (1986) road safety education suggestion that should encourage children's understanding of cause-effect relationships between accident agents and potential injury.

4.2 The Importance of Learning in Context

Several researchers (e.g., Young & Lee 1987) have argued that road safety skills should be taught and practised in a behavioural context, namely, in realistic situations. The results of the present study provide evidence of a different sort that children's knowledge and beliefs about road safety are affected by the specific context in which they are learned. For example, children's awareness of `stranger danger' was very apparent in their responses to questions about safe places to play. This was particularly evident in Centre 2 which was located with its associated primary school alongside a large secondary school where there was a resident community policeman who had spoken to the children about the topic earlier in the year. Centre 3 children also made frequent reference to the `stranger danger' concept, a pattern which seems likely to reflect several factors. The teacher at this centre planned related themes on `the safety house` and `the police station' around the time of the road safety module, and also reported that the focus on `stranger danger' was ongoing throughout the year because of the nature of the neighbourhood.

A further example of context-related learning was evident in the extent to which children referred to their parents' words or actions when responding to interview questions. Attitudes reflected in the statement of the child who was explaining why cars had to stop at stop signs, "The policemen might get them", clearly reflect parental influences. On a more positive note, children referred frequently to parental instructions ("stay on the footpath") or practices (holding child's hand when crossing the road). Responses to individual items on Interview 1 also reflected the limited nature of young children's traffic experiences. For example, the children's crossing item was generally not answered well, and even on Interview 2, children were less certain about the function of this sign than they were of the stop and traffic signs. A plausible explanation of this result is the fact that pre-primary children are usually delivered to school by parents, and because sessional programs did not always correspond with the start of the school day, would have less direct experience with the use of supervised children's crossings. Another example of the important role of experience was evident in responses to the bikepath item in Interview 1, Children who referred to family outings on bikepaths were better informed about the function of bikepaths than children who had not used bikepaths.

5. CONCLUSIONS

Pless and Arsenault, in a 1987 review of health education studies, concluded that "health education, as currently practiced, is a necessary but insufficient basis for preventing injuries among children" (p. 100). A similar conclusion can be drawn from the results of this study. Early childhood teachers can increase children's knowledge and awareness of road safety as a result of focussed teaching modules on road safety which incorporate some of the traditional play components of preschools. The teaching conditions in this study have indicated further that teacher interactions which focus children upon their learning can facilitate children's awareness of that learning. This result is consistent with recent perspectives on teaching which stress the importance of teacher scaffolding' of children's learning through the use of comments, examples, questions, and prompts (Cullen 1991; Wood 1988). In the early childhood program these conditions are unlikely to be met by a traditional free-play program which does not incorporate teacher guidance. The present findings indicate that a more focussed learning centre approach to play, which incorporates adult interactions and discussions which focus children on their learning, can be effective in developing their road safety knowledge.

With regard to the skills component of road safety education, this study revealed positive effects of the road safety teaching module on road-crossing behaviour, although the association with teaching conditions is not clearcut. However, these findings are qualified by the limitations of the test situation in that few cars were evident at the time in which the children demonstrated their skills. In addition, the training procedures were largely restricted to a roadside drill, which would be unlikely to affect judgements about complex traffic procedures.

Clearly, road safety education of the type developed in this study can have only a restricted role in preventing traffic injuries with young children. As Pless and Arsenault (1987) have argued, health education strategies need to be supplemented with other preventive strategies such as legislation and environmental changes. Furthermore, road safety education in preschool and school contexts is constrained by the resources and time normally available to classroom teachers. For example, systematic road-crossing training, of the type investigated by Young and Lee (1987), would make considerable inroads into limited class time. Similarly, the successful crossing guard program described by Yeaton and Bailey (1983) would require additional financial and personnel resources. The important role that parents have in the road safety education of young children has also been indicated in the interviews with children. In this regard the early childhood teacher could assist parents to extend children's learning about road safety by communicating the objectives of the teaching program.

In the Western Australian context, the extension of the community police involvement in schools to preschools and pre-primary centres does seem warranted. The police visitor could provide an effective initial stimulus for road safety topics with young children who need stimulating and realistic experiences for effective learning to occur. Such visits could also encourage early childhood teachers to plan additional road safety learning experiences. Teachers in the three centres commented on the limited availability of resources to stimulate interest in road safety. In this regard, the `Out and About' materials, while useful, are also limited in their effectiveness in that packs routinely distributed to centres contain insufficient materials for the two groups at each centre. While the present study has indicated that early childhood teachers can develop effective programs on aspects of road safety education, their effectiveness is necessarily limited by the restricted availability of resources for road safety education at the pre-compulsory level of education.

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