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Improving road safety education in developing countries; Ghana

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Executive Summary

In many developing countries children represent a particularly vulnerable group of road users, and yet few schools actually include Road Safety Education in any of their lessons (Sayer and Downing, 1996). Two major obstacles have been identified:

- a lack of teaching resources
- a lack of knowledge by teachers how to teach road safety, and what should be taught.

It was therefore, evident that there was an immediate need to raise the awareness of the road accident problem in developing countries, provide teachers with effective materials and approaches for teaching road safety, and to improve children's and teachers' road safety knowledge and attitudes.

This report discusses the design of a Road Safety Education Resource, and an evaluation of its effectiveness in Ghana. The report includes a full copy of the Resource, entitled 'Safe Ways' along with accompanying Teacher Training materials.

'Safe Ways' is designed to be used by teachers of 10 and 11 year olds - in Ghana this is the P5 class. As well as forming part of the highest risk age group, children of this age are in a position to pass information down to younger children for whom they often have responsibility. The resource contains five lessons which cover the following teaching points: walking safely; observing the road environment; using protected crossings; crossing where there are no protected crossings; choosing safe routes.

The resource was designed in Ghana, and is tailored to the educational context within which it is to be used. The general ethos of 'Safe Ways' is one of active participation.

The Teacher Training materials, that were written in parallel to the resource, contain all the information needed to run teacher training workshops. These workshops serve to give teachers the knowledge and enthusiasm they need to use the 'Safe Ways' resource and thus, include Road Safety Education in their classes and schools.

The evaluation phase used an interviewer-administered questionnaire to test 10 and 11 year old children's knowledge of three areas of pedestrian safety. These were knowledge of safe behaviour, knowledge of unsafe behaviour and knowledge of crossing behaviour. The groups of children who were exposed to the resource demonstrated a significant knowledge increase in each of these three areas, compared with a control group. Thus, there is clear evidence that the 'Safe Ways' programme has been successful in achieving its aims. It is acknowledged that ideally the evaluation would have focused on changes in behaviour, rather than changes in knowledge. Unfortunately, unobtrusive observation was not possible in the Ghanaian context.

Ghana is not the only country in need of Road Safety Education materials. The resource itself is the product of the wider perspective on Road Safety Education. In order that other countries may benefit from this approach, Good Practice Guidelines were developed. These have been published separately as TRL Overseas Road Note 17. In addition to outlining effective teaching methods and content, the Guidelines include recommendations for administrators and policy makers to enable sustainable and effective systems to be established.

A determined attempt has been made to make the 'Safe Ways' programme in Ghana sustainable. The approach is supported by a national road safety council and government initiatives. A local person (formerly of the Ghanaian Ministry of Education) has been employed to continue training primary teachers, through workshops, in Road Safety Education and in particular how to use the 'Safe Ways' resource with their classes.

On their own, increases in road safety knowledge are unlikely to bring down accident rates; there are too many variables working against this such as the building of new, faster roads and increases in vehicle ownership levels. It is important that any country interested in implementing the 'Safe Ways' approach is aware that an immediate reduction in accident rates will not be noticable. However, the study does show that the approach developed in Ghana brings about a significant increase in knowledge and an improvement in reported behaviour.

1 Introduction

In many developing countries, children are an unprotected, vulnerable group and one of the most serious threats to their health and well-being are road traffic accidents. On average, 20 per cent of pedestrian fatalities in developing countries involve pedestrians less than 16 years of age. In some African countries children form more than a quarter of pedestrian road accident deaths. For instance, in Ghana where this study took place, 33 per cent of pedestrians fatally injured in road accidents were child pedestrians.

Research in developing countries has shown that children's road user knowledge was poor when compared with of children studied in the UK (Downing and Sayer, 1982). A later study showed that although the percentage of all road accidents fatalities who were children under the age of 16 years old, ranged from 22 per cent in Zimbabwe to 36 per cent in Papua New Guinea, only 16 per cent of schools questioned in Zimbabwe, Pakistan and Botswana had taught road safety in the year before the study (Sayer and Downing, 1996). Two major obstacles to the teaching of Road Safety Education were identified:

- a lack of teaching resources
- a lack of knowledge by teachers as to how to teach road safety, and what should be taught.

It was therefore evident that there was an immediate need to raise the awareness of the child pedestrian accident problem in developing countries, provide teachers with effective materials and approaches for teaching road safety, and improve children's and teachers' road safety knowledge and attitudes. It followed that there was also a need for teacher training materials, and good practice guidelines for senior administrators and curriculum development authorities, to make Road Safety Education sustainable.

Education occurs in a cultural context, and teaching methods must be sensitive to both the cultural norms of pupils and the specific teaching environment. The direct transfer of western educational materials into the primary schools of the developing world is therefore not a practical solution. It is important that the methods and materials for use in developing countries have been researched, developed and tested in the countries in that they are to be used.

Against this background and funded by the British Department for International Development (DFID), the Transport Road Laboratory, (TRL), began a study into improving Road Safety Education in schools in developing countries. The work carried out in Ghana is described in this report.

2 Study aims

The long-term aim of the programme is to bring about a sustained reduction in child pedestrian accidents and casualties (per unit exposure) in developing countries. In the pursuit of this aim, the study carried out in Ghana had five related objectives. They were to:

- investigate Ghana's child pedestrian accident problem
- produce and evaluate a Road Safety Education resource for use by primary school teachers
- identify a suitable teacher-training method for use in the developing world
- produce materials to be used for teacher-training
- provide good practice guidelines for policy makers, administrators, and advisors in the education field.

Although this report covers all five of these objectives, it concentrates primarily on the research component of the project, i.e. the evaluation of the resource. The design and nature of the resource are discussed in Section 5, along with the teacher training method. The evaluation is discussed in Section 6, and finally the Guidelines in Section 7. The Guidelines are also published separately as TRL Overseas Road Note 17.

3 The study country, Ghana

There were important reasons for choosing Ghana: A major review of its national curriculum was about to take place; it had a particularly serious child pedestrian accident problem; the existence of a road accident data collection system of reasonable quality; there were counterpart organisations (e.g. regional and district education offices) who were willing to cooperate; English was widely spoken by young children in school. Important also was the fact that the authorities in Ghana recognised the need for practical Road Safety Education materials tailored to meet the common problems and dangers faced by young Ghanaian road users. The high profile of the National Road Safety Committee (NRSC) was beneficial to the study because of its active promotion of pedestrian safety.

4 Road accident statistics

This part of the project was aimed at improving the understanding of the child pedestrian accident problem in Ghana and providing basic data needed for the teaching resource, the tutors' training book and the Good Practice Guidelines.

National road accident data (1991, the latest available) for the study were provided by the Building and Road Research Institute (BRRI), Kumasi. In Accra, traffic police provided a sample of road accidents involving pedestrians on specially prepared accident report forms.

4.1 National pedestrian casualty data

The 1991 national road accident data showed that 761 of the 2165 reported casualties (35 per cent) were pedestrians (see Table 1). Table 1 also shows that 14 per cent of the pedestrians reported were fatally injured; 40 per cent were hospitalised. In urban areas 12 per cent of pedestrian casualties were fatally injured. These, with the village fatalities, made up 94 per cent of the pedestrian casualties killed.

In total, about twice as many male (465) as female

Table 1 Ghana: pedestrian casualties

Severity	*Fatal*	*Not Hospital-ised*	*Hospital-ised*	*Total*
Location				
Urban	82	320	304	706
Per cent	(12)	(45)	(43)	(100)*
Rural	7	6	2	15
Per cent	(47)	(40)	(13)	(100)
Village	19	18	3	40
Per cent	(48)	(45)	(8)	(100)
Sample size	108	344	309	761
Per cent	(14)	(47)	(40)	(100)
Sex				
Male	73	208	184	465
Per cent	(16)	(45)	(40)	(100)
Female	34	126	112	272
Per cent	(13)	(46)	(41)	(100)
Sample size	107	334	296	737
Per cent	(15)	(45)	(40)	(100)
Age				
< 16 years	34	126	89	249
Per cent	(14)	(51)	(36)	(100)
16 - 55 years	45	171	162	378
Per cent	(12)	(45)	(43)	(100)
> 55 years	21	20	14	55
Per cent	(38)	(36)	(25)	(100)
Sample size	100	317	265	682
Per cent	(15)	(46)	(39)	(100)
Location				
Not at junction	55	208	177	440
Per cent	(13)	(47)	(40)	(100)
At junction	34	80	76	190
Per cent	(18)	(42)	(40)	(100)
Sample size	89	288	253	630
Per cent	(14)	(46)	(40)	(100)
Action				
Crossing road	76	233	206	515
Per cent	(15)	(45)	(40)	(100)
Other action	28	100	85	213
Per cent	(13)	(47)	(40)	(100)
Sample size	104	333	291	728
Per cent	(14)	(46)	(40)	(100)

** percentages are rounded to the nearest per cent.*

pedestrians (272) were injured. Of the male pedestrians injured, 16 per cent were fatally injured while 13 per cent of female pedestrian casualties were fatally injured.

Two hundred and forty-nine (33 per cent) of the pedestrian casualties were less that 16 years old.

Fifty-eight per cent of the pedestrian casualties were away from junctions; 13 per cent of which were of fatal severity. Eighteen per cent of pedestrians recorded as non junction casualties were fatally injured.

The majority, (68 per cent) of pedestrians were crossing the road when injured, 15 per cent of which were fatally injured.

It can be seen from Table 2 that 6 - 10 year old children formed 47 per cent of the 0 - 16 year old children reported injured in road traffic accidents. Seventeen per cent of the

Table 2 Ghana: pedestrian casualties, 0-16 years old

Severity	*Fatal*	*Not Hospital-ised*	*Hospital-ised*	*Total*
Age, years				
0 - 5	9	20	11	40
Per cent	(23)	(50)	(28)	(100)*
6 - 10	17	76	55	148
Per cent	(11)	(51)	(37)	(100)
11 - 15	8	30	23	61
Per cent	(13)	(49)	(38)	(100)
16 - 20	5	27	33	65
Percent	(8)	(42)	(51)	(100)
Sample size	39	153	122	314
Percent	(12)	(49)	(39)	(100)

** percentages are rounded to the nearest per cent.*

6 - 10 year old group were fatally injured. Thirteen per cent of the 0 - 16 age group injured were less than 5 years old. Of this group, 23 and 50 per cent were fatally and seriously injured respectively.

4.2 Accra pedestrian casualty data

Table 3 shows the characteristics of the data for pedestrians less than 16 years old collected by the police. It can be seen from the Table that 84 per cent of the total pedestrians injured, were injured when crossing a road. Twenty-five per cent of all the young pedestrian casualties were injured when facing the traffic and 34 were injured within 100 metres of their home. A higher percentage (43 per cent) of young females were injured within 100 metres of their home, than were young males 26 per cent. However, a higher percentage (71 per cent) of young males were injured between 101 metres and 10 kilometres from home, than females under the age of 16 (49 per cent). See Table 3.

Table 4 shows, for a sample of 63 injured pedestrians less than 16 years old, that 59 per cent were unaccompanied at the time of the accident, 16 per cent were accompanied by an adult and 16 per cent were with one or more children under 16 years of age. Forty-six per cent of these young pedestrians were either on or within 50 metres of a pedestrian crossing facility when injured.

5 The ‘Safe Ways’ education resource

As stated in Section 2, a central aim of the study was to produce and evaluate a Road Safety Education resource for use by primary school teachers. Features of the design and content of this resource, entitled ‘Safe Ways’, are discussed below. A full copy of the resource appears as Appendix A.

5.1 Target group and educational content

The first step in the production of ‘Safe Ways’ was to select the target age group. Children of 10 and 11 years were selected because they form a significant segment of

Table 3 Accra: pedestrian (less than 16 years old) casualty action

	Male	*Female*	*Total*
Action			
Crossing road	30	24	54
Per cent	(86)	(83)	(84)*
Moving along road	2	1	3
Per cent	(6)	(3)	(5)
Unknown	3	4	7
Per cent	(9)	(14)	(11)
Sample size	35	29	64
Per cent	(100)	(100)	(100)
Direction			
Facing traffic	5	5	10
Per cent	(23)	(29)	(25)
Back to traffic	3	0	3
Per cent	(14)	(0)	(8)
Unknown	14	12	26
Per cent	(64)	(71)	(67)
Sample size	22	17	39
Per cent	(100)	(100)	(100)
Approximate distance from home			
< 100 m	9	12	21
Per cent	(26)	(43)	(34)
101 - 400m	11	7	18
Per cent	(32)	(25)	(29)
401 - 1km	5	2	7
Per cent	(15)	(7)	(11)
1 - 10km	8	5	13
Per cent	(24)	(17)	(21)
> 10km	1	2	3
Per cent	(26)	(25)	(5)
Sample size	34	28	62
Per cent	(100)	(100)	(100)

* Percentages rounded to nearest 1 per cent

the highest road accident risk group. Also, children of this age are often given the responsibility of looking after younger children and it was envisaged that Road Safety Education aimed at this upper primary (P5) group would filter down to the younger children. Similarly, it was hoped that children of this P5 age would be able to influence their parents.

The level of English language of upper primary children was considered the optimum necessary for the viability of the project. It was essential for the study to be able to test and talk to the children without the use of a translator. Children below this age generally did not have the requisite command of the English language.

Having selected the age group, the next stage was to decide on the subjects to be addressed and the design of the lessons. For this the Ghanaian accident data was analysed and the accident problems considered. Particularly relevant were the facts that:

- most casualties happen in urban areas
- most pedestrian casualties are to primary school age children
- most accidents to pedestrians are away from junctions
- most pedestrians are crossing roads when accidents happen.

Table 4 Accra: pedestrian casualties less than 16 years

	Number	*(Per cent)**
Accompanied		
Pedestrian unaccompanied	37	(59)
Accompanied by person more than 16 years old	10	(16)
Accompanying a person less than 16 years old	10	(16)
Accompanied by adult and child less than 16 yrs	4	(6)
Unknown	2	(3)
Location		
Accidents were on crossing facility	11	(17)
Accidents were within 50 m of crossing facility	18	(29)
No crossing facility within 50m of accident site	34	(54)
Sample size	63	(100)
Accidents occurred at:		
Uncontrolled junction	27	(66)
Controlled junction	6	(15)
Other	8	(20)
Sample size	41	(100)

** Percentages rounded to nearest 1 per cent*

Following the selection of these road safety goals, a vital pilot phase was established to enable the development of an effective and appropriate educational programme to take place.

In the pilot study five schools were selected and teachers consulted about the concept, the problems and the practical implications of Road Safety Education. In a workshop setting, the teachers studied materials from the UK and were encouraged to give their opinions about what would be the most suitable type of Road Safety Education resource for Ghana.

Following the pilot study discussions with teachers, visits to a variety of schools within Accra and liaising with educational administrators, several important considerations emerged, affecting the creation of the resource. For example, the design of the lesson. It was found that the design of the lessons themselves had to be sensitive to the educational context within which the lessons were to be taught. Schools in the West are very different from those in Ghana. Most schools in Ghana are single storey buildings with corrugated iron roofs and shuttered windows without glass which swing out to let in the light. Very few have electricity, telephones or adequate teaching resources. Catchment areas tend to be wide and for the best private school, pupils could live 12 miles away.

Public schools operate a double shift system with pupils changing from a morning to an afternoon shift every two weeks. Classes can contain as many as 120 pupils with only one teacher per class. Almost all schools have children sharing desks.

Budgets are small and teachers generally have to pay for educational materials out of their own pockets; so it was decided that the lessons could not be based around materials that cost a lot of money. Lessons were therefore based around materials that might be at hand in the local environment, e.g. a piece of rope or some stones that are also inexpensive.

Taking into consideration all of these points and relevant information the following teaching points were selected for inclusion in the road safety resource 'Safe Ways':

- walking safely
- observing the road environment
- using protected crossings
- crossing where there are no protected crossings
- choosing safe routes.

The resource was designed so that each lesson builds on the previous lessons, and provides a broad experience of road safety. Lessons were designed to be presented once a week in periods of about one hour each, ensuring that learning was gradually increased. Each lesson included a list of objectives for the lesson, details on preparation, suggestions for activities both inside and outside the classroom (including practical work), and a homework section. 'Safe Ways' was designed so that it could be used as a stand alone resource or included as part of other curriculum subjects.

The general ethos of the 'Safe Ways' resource is one of active participation. Rather than teaching children sets of rules, which can be learnt by rote and are typically poorly understood by pupils, 'Safe Ways' attempts to teach children by involving them in the learning process and giving them real practical experience near roads.

5.2 Appearance

In addition to the educational content of the resource, other factors had to be considered. Visits to Ghana had revealed that expensive books tend to be locked in the headteacher's office and only rarely, if ever, get used. It was important therefore, that the resource was attractive, practical and easy to use but not so attractive that it became imprisoned in school libraries. Thus, it was designed to have a coloured cover showing faces of local children. Pictures within the text were to be local scenes in black and white. 'Safe Ways' was deliberately designed such that it could be replaced cheaply by photocopying.

Each lesson was split into distinct sections, and these sections themselves were also split according to the nature of the activity (shown vertically up the side of the page). This allows easy reference for the teachers.

5.3 Teacher training

Using the information gained from the teachers in the pilot study a decision was made on how to distribute and disseminate the information to teachers using 'Safe Ways' in the future and so creating a sustainable resource. As previously discussed, one of the problems in providing Road Safety Education was the lack of knowledge of the subject amongst teachers themselves. Thus, distributing the 'Safe Ways' resource to teachers without proper instruction would not achieve its educational objectives. To overcome this problem, teacher training workshops were prepared.

The pilot study work had shown how successful the workshop method could be in training teachers. Teachers enjoyed the strong element of discussion, the sharing of ideas and experiencing at first hand the practical nature of the resource. Teaching children near roads was a novel idea for the teachers and was initially met with some scepticism, until they had experienced it for themselves when the scepticism turned to enthusiasm. Teachers soon realised that it was an achievable goal for their classes.

In addition to the practical element, the workshops were designed to raise awareness of road safety issues in Ghana and stressed the importance of teaching road safety to children. Workshops also gave teachers the opportunity of studying 'Safe Ways' in detail, described how it should be taught and provided the necessary information for teaching it. Just as with the 'Safe Ways' lessons, the workshop design had to be sensitive to the local environment. Workshops therefore, require no expensive electrical audiovisual equipment. The workshops consisted of four, two-hour sessions which fitted in well with their teachers' other school commitments. Workshop sessions covered raising awareness, teaching Road Safety Education, how to use the 'Safe Ways' resource and details of plans for the future of the programme.

Workshop experiences and notes were later collected and used to produce 'Teaching the Teachers' (see Appendix B). 'Teaching the Teachers' is an illustrated guide providing teachers with all they require to run teacher training workshops successfully. It has details of structured sessions with large board notes to highlight major teaching points. The only assumption made is that the person using the guide has lecturing or teacher experience, preferably in health, education or social studies.

6 Evaluation of the resource

6.1 Introduction

An explicit aim of the study was to evaluate the effectiveness of the 'Safe Ways' resource as a learning aid. Exposure to information is an essential part of learning and there are (potentially) many sources of road safety information to which Ghanaian children may have access:

- existing Road Safety Education
- National Road Safety Committee publicity
- practice/observation over time.

The source which is of particular interest to this study is the 'Safe Ways' resource book. The point of the evaluation is to separate the effects of this resource on children's knowledge from the effects of the other sources of road safety information. Ideally, the evaluation would focus on the resource's effects on children's behaviour, in addition

to that of knowledge. Monitoring childrens' behaviour requires some form of unobtrusive observational methods. In Ghana researchers from the West are extremely conspicuous, as would be any sophisticated video technology and it was decided that unobtrusive monitoring of school children taking part in the study was not a practical proposition.

'Before' and 'after' studies were used to show changes in children's road safety knowledge and attitude. The 12 schools taking part in the study were split into two matched (see below) groups of six schools each.

Upper primary teachers from one of the groups received training in the use of the 'Safe Ways' resource and taught it to their children. P5 teachers from the remaining group of schools had no training or access to the 'Safe Ways' resource during the course of the experiment. Matching ensured that the two groups of schools were educationally equivalent. Thus, differences in the two groups of childrens' 'before' and 'after' test results were, as far as possible, associated with the exposure to the 'Safe Ways' educational materials and nothing else.

6.2 Study design

To demonstrate the effectiveness of the resource, it is essential that the children in the experimental group (exposed) know more after exposure than they did before. In isolation, however, this is not sufficient to conclude that the resource is successful; in the exposure period other factors (e.g. NRSC publicity) may have also had an effect, and indeed this effect could be the dominant one.

To be able to eliminate this possibility it is important to compare any increase in the experimental group to those in the control group, who have not been exposed to the resource, but have been exposed to all other sources of information. One is only able to conclude that the resource is effective if the experimental group show a significantly greater increase in knowledge than the control group.

In addition there is reason to believe that males and females have a different risk of accident involvement. It is therefore reasonable to suppose they may have different experience of Road Safety Education, even if they have the same exposure. The design was thus expanded to include sex differences.

In the language of experimental theory, the evaluation had a 2 (experimental vs control) * 2 (male vs female) repeated measures (before and after) design.

6.3 Subjects

From the 17 previously selected primary schools taking part in the research programme, five had been used in the pilot study. The remaining 12 schools took part in the 'before' and 'after' studies and were split into two groups of six (six control and six experimental), schools. Schools in each of the two groups were matched for class size, location, public/private status and pupil male-female ratios. Control and experimental school group size was determined by the need to have a pupil sample size in the region of 150 and the time available for carrying out the interviews with the children.

Using randomly selected pupils from the control and experimental schools, one-to-one interviews were carried out with 153, P5 age group (10 - 11 year old) pupils. The pupil sample represented about 20 per cent of the children available.

In total 153 children were used in the evaluation process. Details of these subjects are given in Table 5.

Of the 153 participating children, 79 were exposed to the 'Safe Ways' resource and 74 were not. The Table suggests that both groups were fairly closely matched, i.e. 80 per cent or more of the children interviewed walked to school, the average age was about 11 years old and on average, each child crossed about 1.5 roads on journeys to and from school.

6.4 Children's road safety knowledge questionnaire

6.4.1 Design

An interviewer-administered questionnaire was developed specifically for the evaluation task. It was decided that this would be conducted in English by the research team; there was a concern that the use of a Ghanaian language would have removed any control the research team had over the process.

The questionnaire was designed in Ghana during the 'pilot' phase through a rolling set of trials over a period of approximately three weeks. Initially the team spoke with children to get a feel of the level of English and the vocabulary used. This resulted in the production of a rudimentary questionnaire that was then refined through a further set of interviews. Finally, the questionnaire was formalised and piloted on a small number of children to ensure that the questions were readily comprehended.

There were a number of factors that had to be taken into consideration in the design phase. The first was language; although the standard of English in the P5 age group is

Table 5 Comparison between control and experimental schools

	Experimental vs Control group					
	Male	*Female*	*Total*	*Male*	*Female*	*Total*
Sample size	39	40	79	37	37	74
Mean age years	11.3	10.7	11.0	11.3	11.0	11.1
Per cent walking to school	79.5	80.0	79.8	88.9	1.7	90.3
Mean number of roads crossed travelling to school	1.4	1.7	1.6	1.6	1.3	1.5
Mean teacher's rating*	6.3	6.8	6.6	6.1	6.1	6.1

** Teacher's general assessment of children's ability on a nine point scale (1 = 'worst child in my class'; 9 = 'best child in my class').*

fairly high there is a marked difference between the accents of the subjects and the interviewers. A second consideration was the level of difficulty at which the questions were set. It is clear that if both experimental and control groups attain 100 per cent in the 'before' trials then the questionnaire has failed in its task; similarly if both groups fail to answer any question correctly in the 'after' trials. A third consideration was the length of the interview. Children's conception of time is different to that of adults, and about 15 minutes is generally considered the maximum time for a test of this type.

The questionnaire contained four areas of subject matter:

- introductory / general questions
- knowledge of dangerous behaviour
- knowledge of crossing behaviour
- knowledge of safe behaviour.

The introductory questions were designed to put the subjects at ease, and to familiarise them with the interviewers' accents. A number of these questions used photographs to which the pupils only had to point. Other questions were designed to test vocabulary relating to road safety. The final three subject areas are those identified by Rothengatter (1981), as constituting essential road safety knowledge. Apart from in the introductory section, the questions were not split into discernable groups in the questionnaire.

6.4.2 Procedure

Children were withdrawn from the classroom individually and the questionnaire interview was conducted orally by a member of the TRL team. A second member of the team recorded responses. It had been feared that this format - two foreign adults to one child - would create an intimidating atmosphere and inhibit the willingness of the subjects to participate in the exercise. The 'pilot' trials had demonstrated that this was not the case.

Pupils were randomly selected from the P5 class in each school. Upon entering the room they were made to feel welcome, the task was explained, and it was made clear that the task was not a test, and that 'don't know' responses were acceptable.

The interviews were conducted according to a strict protocol that dictated question wording and a number of prompts for each question. However, in exercises such as this it is not always possible to adhere exactly to a predetermined format, and inevitably small deviations occurred. There was no reason to suspect that these deviations prejudiced any of the results.

The 'before' interviews were held in October 1995; the 'after' interviews in February 1996. The intervening period allowed teachers of the experimental group to complete the five 'Safe Ways' lessons, but kept to a minimum the time between the end of the teaching period and the beginning of the 'after' interviews during which time extraneous influences might have influenced respondents' answers to questions.

6.5 Results

As discussed in Section 6.2 a repeated measures design was used. Each subject's 'after' performance was therefore compared with their 'before' performance. Data from questionnaires such as that used in this evaluation tend not to yield parametric data, and thus two non-parametric statistical tests were used.

Some questions have identifiable correct and incorrect answers. In such cases the proportion of subjects giving a correct answer can be calculated for each experimental condition, and the significance of this difference can be calculated using simple statistical techniques. The output from such tests is a z-score, that can be directly translated into a significance rating.

Other questions have answers that have degrees of 'correctness'. In such cases the set of answers are ordered and given a rank in terms of their precision. The Wilcoxon matched-pairs signed-ranks test examines the net increase or decrease in precision between 'before' and 'after' conditions for each group.

At all stages of the analysis reported below, significance levels are quoted for one-tailed tests. This is justified in that there is no reason to believe that any of the factors tested will result in a decrease in knowledge over time.

Results from the introductory/general questions (Table 6), show that about 90 per cent of both the control and experimental groups identified a 'road' from the photographs presented to them.

Both groups showed statistically significant increases in the 'before' and 'after' surveys of children identifying a 'footpath/pavement'. In the 'pilot' trials many children were not familiar with the word 'pavement/footpath'. To help put children at ease in this early part of the interview, interviewers sometimes substituted the word 'roadside' for 'pavement'.

Virtually none of the children questioned knew the word 'kerb' or could identify a kerb in the photographs. This is an interesting result. Later in the interview children were asked to describe how to cross a road. Nearly all replied with the 'Kerb Drill'. This suggests that children learnt the 'Kerb Drill' by rote without any real understanding of its significance.

The statistically significant increase in the percentage of children exposed to the 'Safe Ways' resource being 'scared' to cross roads in the 'after' survey suggests that these children's awareness to the dangers of crossing roads had been increased.

Table 6 also shows that significantly more children exposed to the 'Safe Ways' materials were helping younger children to 'keep safe' by 'saying things to help them keep safe' in the 'after' survey. There was no change in either group with children physically 'helping younger children keep safe'.

Table 6 shows for the experimental group that except for more girls being 'scared to cross roads' in the after' period, there were no significant differences between male and female replies.

Children's replies to naming relevant things that they saw on roads and footpaths (roadside) were listed and counted. Such data do not yield 'correct' and 'incorrect'

Table 6 Children's replies to the general/introductory questions*

	Experimental vs Control group					
	Experimental			*Control*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Can you point to the road in the photographs?	89.9	92.3	n.s.	91.993.2	n.s.	
Can you point to the pavement / footpath in the photographs?	63.3	97.4	$p < 0.01$	39.1	71.6	$p < 0.01$
Can you point to the kerb in the photographs?	*Children in Ghana did not know the word kerb*					
Does crossing the road ever scare you?	62.8	78.5	$p < 0.05$	59.2	63.0	n.s.
When you are walking with younger children do you do anything to help them keep safe?	59.3	73.1	n.s.	71.9	70.6	n.s.
When you are walking with younger children do you say anything to help them keep safe?	63.0	86.2	$p < 0.05$	76.7	71.8	n.s.
	Males vs Females: Experimental group					
	Male			*Female*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Can you point to the road in the photographs?	92.3	92.3	n.s.	87.5	92.3	n.s.
Can you point to the pavement / footpath in the photographs?	76.9	97.4	$p < 0.01$	50.0	97.4	$p < 0.01$
Does crossing the road ever scare you?	65.8	71.8	n.s.	60.0	85.0	$p < 0.01$
When you are walking with younger children do you do anything to help them keep safe?	54.5	62.5	n.s.	62.5	77.8	n.s.
When you are walking with younger children do you say anything to help them keep safe?	63.6	100	$p < 0.05$	62.5	81.0	n.s.

** Data show per cent of respondents giving correct reply.*

answers, but obviously three relevant answers is an improvement on two. The Wilcoxon test is used to analyse this data (Table 7).

Analysis of the 'dangerous behaviour' knowledge questions was carried out by calculating the percentage of each group giving the correct answer in the 'before' and 'after' periods. Results of the analysis are shown in Table 8.

Four of the five questions shown were to do with the children's own behaviour near roads and it can be seen from Table 8 that there was a statistically significant improvement for the experimental group in four of these five questions. Both groups improved in knowing that it was 'safe to walk near the road'. The one non-significant improvement in both groups was the question related to other people's behaviour.

There was little difference between the male and female experimental groups. Table 8 shows that the boys 'knowledge' about safe walking and running near roads improved. For the girls, it was 'knowledge' about knowing why 'it was not safe to run near roads' that improved significantly.

For the questions shown in Table 9, children could have provided one or more answers. To allow for this, each answer was analysed separately.

It can be seen from the Table that few children in either the experimental or the control groups in the 'before' survey could name safe places to cross roads. In the 'before' survey about 60 per cent of all the children questioned mentioned 'zebra crossings' as a safe place to cross. 'Lollipop stands', 'traffic lights', 'footbridges', and 'under supervision', were seldom mentioned.

Table 9 shows that from the children in the experimental group there were statistically significant improvements in the number of places mentioned as safe places to cross. For the control group, the only significant improvement was for 'crossing at traffic lights'.

Crossing roads near parked cars is dangerous for children and it was interesting that the group exposed to the 'Safe Ways' lessons showed a statistically significant improvement in replying to a question about this; the control group did not.

The question 'What should you do before crossing?' was analysed using the Wilcoxon matched-pairs signed ranks test. The response categories were arranged in order such that the best responses were given a value of 1 and the worst a value of 7 (Table 10).

Table 7 Wilcoxon test results on introductory question data

		Experimental vs Control group				
What things do you see on roads?	Experimental:	$z = -5.77$	$p < 0.01$	Control:	$z = -0.98$ n.s.	
What do you see on pavements?	Experimental:	$z = -6.03$	$p < 0.01$	Control:	$z = -3.20$	$p < 0.01$
		Male vs Female: Experimental group				
What things do you see on roads?	Male:	$z = -3.81$	$p < 0.01$	Female:	$z = -4.50$	$p < 0.01$
What do you see on pavements?	Male:	$z = -4.19$	$p < 0.01$	Female:	$z = -4.35$	$p < 0.01$

Table 8 Knowledge of dangerous behaviour*

	Experimental vs Control group					
	Experimental			*Control*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Is it safe to play near the road?	74.4	85.9	p < 0.05	76.1	78.1	n.s.
Is it safe to walk near the road?	83.5	94.9	p < 0.05	84.5	93.2	p < 0.05
Is it safe to run near the road?	61.5	85.9	p < 0.01	72.9	73.0	n.s.
Why is it not safe to run near the road?	31.3	49.3	p < 0.05	48.0	51.9	n.s.
Do you see other people doing dangerous things near the road?	35.0	46.2	n.s.	37.5	37.3	n.s.
	Male vs Female: Experimental group					
	Male			*Female*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Is it safe to play near the road?	74.4	87.2	n.s.	74.4	84.6	n.s.
Is it safe to walk near the road?	84.6	100	p < 0.01	82.5	89.7	n.s.
Is it safe to run near the road?	53.8	92.3	p < 0.01	69.2	79.5	n.s.
Why is it not safe to run near the road?	42.9	47.2	n.s.	22.2	51.6	p < 0.05
Do you see other people doing dangerous things near the road?	34.5	48.0	n.s.	35.5	44.4	n.s.

** Data show per cent of respondents giving correct reply.*

Table 9 Knowledge of crossing behaviour*

	Experimental vs Control group					
	Experimental			*Control*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Can you name a safe place to cross the road?						
a - lollipop stands	1.3	22.8	p < 0.01	8.1	5.4	n.s.
b - zebra crossings	59.5	77.2	p < 0.01	63.5	66.2	n.s.
c - traffic lights	21.5	51.9	p < 0.01	18.9	31.1	p < 0.05
d - footbridges	1.3	22.8	p < 0.01	17.6	17.6	n.s.
e - under supervision of policeman / city guard / other adult	13.9	26.6	p <0.05	9.5	6.8	n.s.
Why are some roads more dangerous to cross than others?	26.0	30.3	n.s.	30.6	32.9	n.s.
Where do you stand when you are trying to cross?	25.0	60.0	p < 0.01	40.3	42.9	n.s.
Why do parked cars make it difficult to cross the road?	16.9	34.7	p < 0.01	14.3	17.1	n.s.
	Male vs Female: Experimental group					
	Male			*Femal*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Can you name a safe place to cross the road?						
a - lollipop stands	2.6	30.8	p < 0.01	0.0	15.0	p < 0.01
b - zebra crossings	69.2	87.2	p < 0.05	50.0	67.5	p < 0.05
c - traffic lights	30.8	59.0	p < 0.01	12.5	45.0	p < 0.01
d - footbridges	0.0	25.6	p < 0.01	2.5	20.0	p < 0.01
e - under supervision of policeman / city guard / other adult	15.4	33.3	p < 0.05	12.5	0.0	n.s.
Why are some roads more dangerous to cross than others?	29.7	33.3	n.s.	22.2	27.0	n.s.
Where do you stand when you are trying to cross?	28.6	68.4	p < 0.01	21.4	51.4	p < 0.01
Why do parked cars make it difficult to cross the road?	31.6	44.7	n.s.	2.6	24.3	p < 0.01

** Data show per cent of respondents giving correct reply.*

Analysis of the six questions that children were asked about ‘safe behaviour’ are shown in Table 11. Of the six questions, the experimental group showed a significant improvement in four. The question asking ‘ on what side of the road should you walk’ (children were shown a coloured photograph of a traffic-free rural road and asked which side of the road they should walk), showed no improvement in the ‘after’ period survey. Answers to this question and a question asking ‘where should you walk’ (the question was asking about footpaths/sides of the road), showed a statistically significant improvement for the control group in the ‘after’ survey (see Table 11).

Table 11 shows no clear picture for male/female differences. In the ‘after’ survey, females showed a statistically significant improvement for the question ‘where should you walk’ (see above). Similarly, females also showed a significant improvement when asked about knowing when vehicles were approaching from behind.

Table 10 What should you do before crossing?

	Experimental vs Control group	
	Experimental	*Control*
What should you do before crossing?	z = - 2.05 p < 0.05	z = - 0.75 n.s.
	Male vs Female: Experimental group	
	Males	*Female*
What should you do before crossing?	z = - 0.67 n.s.	z = - 2.13 p < 0.05

Males however, improved significantly when explaining reasons for walking facing the traffic. This question was related to the one asked immediately earlier.

Overall, the 'before' and 'after' comparison revealed significant gains in knowledge for the experimental group over that for the control group. Thus, it is reasonable to conclude that these knowledge gains were associated with the 'Safe Ways' programme.

7 Good practice guidelines

The final objective of the study was the preparation of 'Road Safety Education in Developing Countries, Guidelines for Good Practice'. This was done to help ensure sustainability of Road Safety Education in Ghana and in assisting with transferring the Ghanaian experience to other developing countries. The Guidelines have been published separately as Overseas Road Note 17. This document is the first of its kind written for the developing world. The Guidelines illustrate the importance of Road Safety Education in developing countries and show how a country might put in place a system ensuring that primary school children receive the Road Safety Education that they deserve. The Guidelines were written for Ministries of Education, curriculum development staff, education advisors, policy makers and administrators. Lecturers in colleges of education, heads and classroom teachers would also find it useful.

The document is divided into 5 sections. The introductory chapter gives a background to Road Safety Education, why the Guidelines have been written, and a discussion on accidents and accident prevention. The next section shows how a country can develop a structure to make Road Safety Education work at a national level. It states that for progress to be made nationwide in accident prevention Road Safety has to be designed as a national goal with efficient management structures set up at national as well as at local levels. It shows in a simplified way how Road Safety Education can reach primary children by following certain steps - collecting information, creating a Road Safety committee, forming a policy and delivery structure, implementing the policy, and monitoring and evaluating the Road Safety Education. It stresses that all of this requires commitment, co-ordination and communication at all levels to reach implementation. To assist people with responsibility for children's safety and education two organisational models are given to help with this task.

Section 3 details the 5 important points in teaching Road Safety Education. They are presented as the 5 'Ps':

begin PRE-SCHOOL
be PRACTICAL
follow PRINCIPLES of child development
be PRESENTED frequently
have a PLACE in the school timetable.

The chapter also contains detailed curriculum links with the 'Safe Ways' programme and the subject areas of science, English, mathematics and environment/social

Table 11 Knowledge of safe behaviour*

	Experimental vs Control group					
	Experimental			*Control*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Where should you walk?	76.7	87.2	p < 0.05	66.7	85.3	p < 0.01
Do you know a safe place to play?	84.8	88.5	n.s.	94.5	94.6	n.s.
On which side of the road should you walk?	38.8	52.2	n.s.	21.3	53.6	p < 0.01
Why should you walk on which side?	6.3	21.3	p < 0.01	6.7	11.0	n.s.
How can you tell when there is a car behind you?	54.5	72.4	p < 0.05	56.2	67.1	n.s.
When you are walking with your friends, how should you walk?	44.4	66.7	p < 0.01	56.5	67.6	n.s.
	Male vs Female: Experimental group					
	Male			*Female*		
	Before	*After*	*Sig*	*Before*	*After*	*Sig*
Where should you walk?	83.8	87.2	n.s.	69.4	87.2	p < 0.05
Do you know a safe place to play?	81.6	84.6	n.s.	86.8	92.3	n.s.
On which side of the road should you walk?	35.3	54.5	n.s.	42.4	50.0	n.s.
Why should you walk on which side?	6.1	27.0	p < 0.05	6.5	15.8	n.s.
How can you tell when there is a car behind you?	73.7	86.5	n.s.	35.9	59.0	p < 0.05
When you are walking with your friends, how should you walk?	42.9	75.0	p < 0.01	45.9	59.0	n.s.

** Data show per cent of respondents giving correct reply.*

studies. The Ghanaian curriculum is used as an example.

The document progresses to a chapter on children's universal learning objectives with details for four different age groups. It points out that in considering children's needs there should be a gradual progression from total protection to total independence. This involves interaction with parents/carers, teachers, and peer groups, with their importance varying at different times. Each stage builds upon and re-enforces previous learning.

The final section presents actual examples of good practice in Road Safety Education from Ghana, Nepal and Papua New Guinea with photographs and other illustrations.

8 Discussion and conclusions

Road accidents involving young pedestrians are increasingly being recognised as a major cause of death in developing countries and in the face of rapid traffic growth, considerable resources have been spent trying to contain the problem through engineering and enforcement measures. The problem, however, remains. Surveys carried out in Ghana revealed the following points:

- over a third of reported road casualties were pedestrians
- about twice as many males as females were injured and killed as pedestrians
- most pedestrian casualties were away from junctions
- the majority of pedestrians were crossing the road when injured
- over a third of pedestrian fatalities were aged less than 16 years
- most accidents to children happen to the 6 - 10 year olds.

The problem of road accidents can be addressed, in part, by providing appropriate Road Safety Education materials and teaching approaches, and by generally raising the awareness of the importance of road safety in schools among Ministries of Education, teachers, administrators and pupils.

As Road Safety Education initiatives evolve, it is important that they take account of current research findings. Traditionally, Road Safety Education has generally relied on improving children's knowledge about traffic. It was assumed that good knowledge acquired in the classroom led to improved road behaviour. Experience and research have shown that such transference was not readily apparent. Current Road Safety Education practice concentrates on bringing about changes in children's traffic behaviour through practising the behaviour to be learnt or modified and not just by improving what children can say or know about crossing roads. The 'Safe Ways' resource makes full use of these recent approaches to teaching Road Safety Education.

The evaluation phase has provided clear evidence that the 'Safe Ways' programme has been successful in achieving its aims. Children who had been exposed to the materials showed statistically significant improvements in all three areas of road safety knowledge (safe behaviour, dangerous behaviour and crossing behaviour). It is acknowledged that ideally the evaluation would have focused on changes in behaviour. However, unobtrusive observation of behaviour was not possible in the circumstances.

Despite our best effort, road accidents to child pedestrians in Ghana are likely to rise because of the increase of traffic and the building of new roads. Realistically, we cannot hope for a drop in the statistics because of this increase in traffic. We can however, be reasonably confident that lives will be saved and the increase in accidents mitigated through our efforts in Road Safety Education.

Monitoring the effect of a Road Safety Education project is always difficult, particularly in terms of behaviour or accidents. Even in developed countries it has not been possible to accurately and conclusively associate changes in accident rates with Road Safety Education initiatives. Generally, there are too many confounding variables which have to be considered over prolonged periods of time. In developing countries where data collection and the reporting of accidents are often weak, the task becomes even more difficult. It is important that any country interested in implementing the 'Safe Ways' approach is aware that an immediate reduction in accident rates is not a viable objective. However, we do know this study has shown a significant increase in the road safety knowledge and reported safe behaviour of the children who used the 'Safe Ways' resource.

A determined attempt has been made to make the 'Safe Ways' programme in Ghana sustainable. A local person (formerly of the Ghanaian Ministry of Education) has been employed to continue training primary teachers, through workshops, in Road Safety Education and in particular how to use the 'Safe Ways' resource with their classes. The Teacher Training materials have been designed so that these primary teachers have the skills and enthusiasm to act as catalysts within their schools. There is a strong possibility that primary teachers from outside Accra will be encouraged to attend similar workshops. This could be achieved by training more trainers to get maximum benefit from our initial work. Eventually finances to continue will have to be found from other sources.

It is hoped that the 'Safe Ways' material will soon be part of the Ghanaian primary curriculum, perhaps in the proposed new Environment curriculum, where it would fit well. This would further enhance the chances of Road Safety Education being taught on a continuous basis. Making Road Safety Education part of Initial Teacher Training would also be worthwhile pursuing. Some attempt at achieving this has been made by contacting the DFID Support for Teachers Education Project (STEP) team in Accra, but more work needs to be done.

'Safe Ways' focuses on the priority upper primary age group. Thought needs to be given to Road Safety Education for young children in Ghana. This might logically precede the 'Safe Ways' material, that was specifically designed for 10 and 11 year olds. Every young child in Ghana would benefit from a clearly planned Road

Safety Education Programme, that was structured, developmental and taught on a regular basis throughout a child's primary life. Further researched Road Safety Education programmes are required to meet these needs.

Finally, we need to consider how best to transfer the experience gained in Ghana to other countries. The development and publication of good practice guidelines (Overseas Road Note 17) represents an important first step in this process. Further research is needed in other developing countries in order to enhance this experience transfer practice.

9 Acknowledgements

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10 References

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Road Safety Education in Developing Countries, Guidelines for Good Practice in Primary Schools. TRL Overseas Road Note 17, Transport Research Laboratory, Crowthorne (in preparation)

Abstract

Few schools in the developing world include Road Safety Education in their timetable, despite the fact that children represent a vulnerable group of road users. Two reasons for this were identified: A lack of teaching resources, and a lack of knowledge by teachers how to teach road safety and what should be taught. This report discusses the design and evaluation of a Road Safety Education resource designed for teachers of 10 and 11 year old children and the development of good practice guidelines. The central educational theme of the resource, called 'Safe Ways', is that children learn best by active participation. 'Safe Ways' includes five lessons, each covering a different aspect of road safety.

The evaluation took place in Ghana. An interviewer-administered questionnaire was used to test 10 and 11 year old children's knowledge of three areas of pedestrian safety: Knowledge of safe behaviour, knowledge of unsafe behaviour and knowledge of crossing behaviour. The groups of children who were exposed to the resource showed a significant increase in each of these three areas, compared with a control group.

The report also includes a full copy of the 'Safe Ways' resource, and the Teacher Training notes which accompany it.

Related publications

*ORN17 *Guidelines for good practice in primary schools* (TRL Overseas Road Note 17) (in preparation)

*TRL227 *Pedestrian accidents and road safety education in selected developing countries* by I A Sayer and A J Downing. 1996

*SR713 *Driver knowledge of road safety factors in three developing countries* by I A Sayer and A J Downing. 1981

*SR646 *A preliminary study of road-user behaviour in developing countries* by G D Jacobs, I A Sayer and A J Downing. 1981

*SR771 *A preliminary study of children's road-crossing knowledge in three developing countries* by A J Downing and I A Sayer. 1982

* For these reports, please apply to Overseas Centre, TRL, Old Wokingham Road, Crowthorne, Berks, RG45 6AU