**UNIVERSITY OF SOUTHAMPTON**

FACULTY OF ENGINEERING AND THE ENVIRONMENT

Civil, Maritime and Environmental Engineering and Science

# Child Pedestrian Road Safety; Practical Training and Interactive Learning Environments to Improve Road Safety

by

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Thesis for the degree of Engineering Doctorate

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ABSTRACT

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Pedestrian training is one method of road safety education used to improve roadside behaviour and crossing skills in order to improve road safety. 'Kerbcraft' is a comprehensive pedestrian training scheme, recommended by the United Kingdom government, which has been demonstrated to be effective in improving pedestrian skills at the roadside. Very few Local Authorities have adopted Kerbcraft in its entirety due to cost and time constraints, with just five out of 57 local authorities surveyed operating a full Kerbcraft scheme. With a lack of comprehensive evaluation, the effectiveness of these adapted schemes is unknown. Many local authorities supplement on-street training with in-class activities that are generally designed to target knowledge acquisition, rather than behavioural improvements. Interactive Video has been shown to have potential to improve 'hard' procedural skills such as those used when walking at the roadside. An interactive video has been developed, designed to improve skills when children cross between parked cars. The interactive video is shown to be a usable and engaging educational resource with primary school children and shows that it can positively influence on-street behaviour overall. The video was most successful in a junior school with a high level of engagement observed and least successful in a primary school where the level of observed engagement in the video was lower.

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## Declaration of Authorship

I, James Alexander Hammond, declare that the thesis entitled *Child Pedestrian Road Safety; Practical Training and Interactive Learning Environments to Improve Road Safety* and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- parts of this work have been published as: Hammond, Cherrett and Waterson (2013a), ,Hammond, Cherrett and Waterson (2013b) and Hammond, Cherrett and Waterson (2014).

Signed:

Date: 16/06/2014

## Acknowledgements

I would like to take this opportunity to thank my two academic supervisors: Tom Cherrett for his continued encouragement, advice and feedback, and Ben Waterson for all of his feedback on the research undertaken and help with statistical methods. I would also like to acknowledge the help and support of my Hampshire County Council industrial supervisors, Lyndsay Ellarby and Karen Dockree, in particular with their assistance in recruiting schools and for giving me an insight into their road safety programmes. This research would not have been possible without the enthusiasm of the schools and children that took part in the studies; in particular the head teachers, class teachers and learning support assistants who gave up their time to assist in facilitating data collection.

# Abbreviations

| | |
|---|---|
| CIVITAS | City-VITAlity-Sustainability |
| DfT | Department for Transport |
| DVLA | Driver and Vehicle Licensing Agency |
| GB | Great Britain |
| GBP | Great British Pounds (£) |
| GPS | Global Positioning System |
| IT | Information Technology |
| KSI | Killed or Seriously Injured |
| MDG | Millennium Development Goals |
| PDA | Personal Digital Assistant |
| QCDA | Qualifications and Curriculum Development Agency |
| QR | Quick Response |
| RoSPA | Royal Society for the Prevention of Accidents |
| RSE | Road Safety Education |
| RTC | Road Traffic Collision |
| TEL | Technology Enhanced Learning |
| UK | United Kingdom |
| UN | United Nations |
| USD | United States Dollars ($) |
| WHO | World Health Organization |

# Glossary of Terms

**Casualty**[1]: A person killed or injured in an accident. Casualties are sub-divided into killed, seriously injured and slightly injured.

**Collision**[1]: Involves personal injury occurring on the public highway (including footways) in which at least one road vehicle or a vehicle in collision with a pedestrian is involved and which becomes known to the police within 30 days of its occurrence. One accident may give rise to several casualties.

**Children**[1]: Persons under 16 years of age (except where otherwise stated).

**Killed**[1]: Human casualties who sustained injuries which caused death less than 30 days after the *collision*.

**Pedestrian**[1]: Includes children riding toy cycles on the footway, persons pushing bicycles, pushing or pulling other vehicles or operating pedestrian-controlled vehicles, those leading or herding animals, children in prams or buggies, and people who alight safely from vehicles and are subsequently injured.

**Serious collision**[1]: One in which at least one person is seriously injured but no person (other than a confirmed suicide) is killed.

**Serious injury**[1]: An injury for which a person is detained in hospital as an "in-patient", or any of the following injuries whether or not they are detained in hospital: fractures, concussion, internal injuries, crushing, burns (excluding friction burns), severe cuts, severe general shock requiring medical treatment and injuries causing death 30 or more days after the

[1] Source: DfT, (2011b) - Road Accidents and Safety, definitions guidance

accident.

**Slight collision**[1]: One in which at least one person is slightly injured but no person is killed or seriously injured.

**Slight injury**[1]: An injury of a minor character such as a sprain (including neck whiplash injury), bruise or cut which are not judged to be severe, or slight shock requiring roadside attention. This definition includes injuries not requiring medical treatment.

# Chapter 1

# Introduction

## 1.1 The global road safety issue

The World Health Organization reports that approximately 1.24 million people are killed on the roads annually; highlighting road safety as one of the many global issues affecting modern society (World Health Organization (WHO), 2013). As a result, Road Traffic Collisions (RTC) are the tenth most prevalent cause of death through disease or injury globally, with those in the age groups of 5-14 and 15-29 being most affected and with *vulnerable road users*, such as pedestrians, pedal cyclists and motorcyclists, at greatest risk (World Health Organisation, 2009).

The United Nations (UN) General Assembly describes global road fatalities as a "*major public health problem with a broad range of social and economic consequences which, if unaddressed, may affect the sustainable development of countries and hinder progress towards the Millennium Development Goals (MDGs)*"(UN Road Safety Fund, 2011). The MDGs are:

*Goal 1*: Eradicate extreme poverty and hunger

*Goal 2*: Achieve universal primary education;

*Goal 3*: Promote gender equality and empower women;

*Goal 4*: Reduce child mortality;

*Goal 5*: Improve maternal health;

*Goal 6*: Combat HIV/AIDS, malaria and other diseases;

*Goal 7*: Ensure environmental sustainability;

*Goal 8*: Develop a global partnership for development (UN, 2012).

Each of the MDGs, which can be considered as a metric of development, rely either directly or indirectly on a safe and efficient transport system to facilitate the transport of goods, services and people (Hook and Howe, 2005, UN Economic Comission for Africa, 2005); making the delivery of safer road networks and road users a driver of development.

Increasing the priority of improving road safety, the UN launched the *Decade of Action for Road Safety 2011-2020*; a global drive towards safer roads with the aim of preventing 5 million fatalities and 50 million serious injuries and generating a forecasted cost saving of $5 trillion USD (WHO, 2011). This further highlights the importance of the issue and while a detailed review of the global road safety issue is outside the scope of this chapter, it is pertinent to understand the overall road safety context from the outset of this thesis as successful road safety developments, such as new training and infrastructure, used in one country often become a framework for new interventions in others:

- Road traffic collisions result in the loss of approximately 1.3 million people every year. 20-50 million more are injured as a result of RTCs (WHO, 2011).
- RTCs have become the leading cause of death for people aged between 15–29 years (WHO, 2011) .
- Over 90% of road traffic fatalities and injuries occur in low-income and middle-income countries, which have only 48% of the world's registered vehicles (WHO, 2011).

- Forty six per cent of those killed each year are "vulnerable road users": pedestrians, cyclists and motorcyclists (WHO, 2011).

- Along with the social implications, grief and suffering caused; RTCs result in large economic losses to victims' families and the wider economy and this can cost countries 1–3% of their gross national product (WHO, 2011).

- In a no intervention scenario, where no further work is carried out to reverse trends in road traffic collisions, the number of RTCs are predicted to continue to grow with an estimated 1.9 million people being killed annually by 2020 (WHO, 2011).[2]

The extensive consequences of the death and injury caused by RTCs therefore require a multi-dimensional response in both developed and developing countries to a problem that is substantial, current and without intervention is likely to deteriorate further.

## 1.2 Statement of the Problem

Road traffic collisions in high income countries continue to be a large public health burden with, for example, approximately 2000 road traffic injury related deaths in the United Kingdom, 33,000 in the United States of America, over 2000 in Spain and over 3500 in France and Germany on an annual basis(World Health Organization (WHO), 2013). Even in countries with good road safety records and a developed sustainable travel agenda, such as Sweden, Denmark and the Netherlands have road traffic injury deaths numbering in the hundreds (World Health Organization (WHO), 2013).

Sustainable travel modes have wide reaching benefits. Regular exercise in the young is linked with increased levels of health, general wellbeing and a reduced risk of heart

[2] For more detailed information on the scale of the Global road safety issue the reader is referred to World Health Organization (WHO) (2013) Global status report on road safety 2013: supporting a decade of action. Geneva, WHO.

disease, stroke, diabetes and osteoporosis in later life (DfT, 2004, Boreham and Riddoch, 2001). Despite this, fewer children are walking to school and taking sufficient exercise which is leading to a corresponding rise in childhood obesity (DfT, 2004). Promoting active modes for school travel, such as walking, has risen higher up the political agenda in the United Kingdom over recent years (DfT, 2004, Tudorlocke, Ainsworth and Popkin, 2001, He, 2011), however there is a real risk of road traffic collisions (see Chapter 2) when walking to school which when combined with other safety fears, such as 'stranger danger', reduces the likelihood of parents allowing children to walk to school (McDonald, 2008, Pooley, Turnbull and Adams, 2005). With 68% of the 2272 reported child road traffic casualties in 2012 in Great Britain being pedestrians (DfT, 2013b)there is a clear requirement to develop interventions targeting a reduction in child pedestrian RTC involvement without discouraging walking.

Safe Routes to Schools programs, which focus on identifying and promoting safe walking a cycling routes to schools and are often implemented by Local Authorities, demonstrate one method of promoting walking, whilst attempting to ensure the safety of children during their school journey through interventions which include child pedestrian training. Child pedestrian training schemes are practical roadside programs that aim to improve roadside behaviour and skills, often targeting key crossing skills which become familiar over time though repetition; *finding safe routes*, *crossing safely at junctions* and *crossing safely between parked cars*. Since 2011, the United Kingdom government recommends 'Kerbcraft' as the basis for pedestrian training (Department for Transport, 2011).

Kerbcraft is a practical scheme based solely at the roadside and has been shown to be effective in improving roadside behaviour in all three aforementioned skills (Whelen, Towner, Errington and Powell, 2008). The quality of child pedestrian training programs in the United Kingdom has however suffered in recent years due to austerity measures and time pressures forcing local authorities to reduce the amount of practical training and increase the amount of less effective, but cheaper, paper-based classroom activities (Hammond, Cherrett and Waterson, 2013a). It is unclear to what extent this type of practical training scheme is delivered at the local, national or global scale.

## 1.3 Aims and Objectives

### 1.3.1 Aim

This project aims to understand the nature, context and extent of child pedestrian training in the United Kingdom, to what extent novel delivery mechanisms are being used and in what ways computer based interactive learning environments could aid the delivery of road safety training to the young and the demonstration of improved pedestrian skills on-street.

### 1.3.2 Research Questions

This thesis answers a number of research questions:

- How effective has pedestrian training been in past evaluations, focussing specifically on the effectiveness of Kerbcraft?

- How is child pedestrian training in the United Kingdom delivered in different authorities and what changes to training methodologies have developed since a national pilot of the 'Kerbcraft' child pedestrian training scheme was undertaken in 2002?

- In what ways can interactive learning environments aid children's educational development and to what extent can this be applied to teaching road safety skills?

- Can interactive road safety training videos be designed in order to positively impact on roadside behaviour?

- Is interactive video an appropriate medium to effect positive uptake of safe crossing behaviour in primary aged children?

### 1.3.3 Research Objectives

In order to address these research questions, the core objectives are:

- Investigate the extent to which pedestrian training is delivered in the United Kingdom and evaluate the content of and quality of training on offer.

- Understand how interactive media could be used to aid the delivery of pedestrian road safety training.

- Develop, deliver and evaluate an interactive video game designed to improve the crossing behaviour of children aged 5-8.

- Understand the usability and interaction issues that young children experience when using interactive video.

- Understand the impact of interactive video-based road safety games designed to improve children's roadside crossing skills by using a series of case study trials and quantify and qualify in what ways interactive video could add to and enhance existing child road safety training programmes.

## 1.4 The Scope of this research

This research will primarily have a focus on Great Britain with a particular focus on the county of Hampshire.

### 1.4.1 Terminology

Deaths and injuries associated with road traffic collisions make the subject highly emotive and there is much semantic discussion within the road safety community regarding the correct terminology for an event in which a vehicle collides with another vehicle, pedestrian, animal, debris or obstruction (Elvik, Hoye, Vaa and Sorensen, 2009). This discussion is considered to be outside the scope of this research and such an event will generally be considered a “Road Traffic Collision” (RTC) throughout. In this thesis RTC is considered synonymous with a road traffic accident/crash, motor vehicle accident and motor vehicle traffic collision and no implication regarding the nature or fault attribution (if applicable) of a collision is implied.

### 1.4.2 The potential implications of this research

This research establishes the methods by which pedestrian training is delivered in the United Kingdom, best practice and optimal training scheme design. The research also tests a prototype in-class learning resource to determine and demonstrate how such approaches can aid road safety training development in the future.

### 1.4.3 Dissemination of research findings

A number of contributions to the academic record have been produced during the period of candidature.

The following peer reviewed journal articles have been produced:

- Hammond, J., T. Cherrett, and B. Waterson, *The usability and effectiveness of Interactive Video as a complementary child pedestrian training activity.* International Journal of e-Education, e-Business, e-Management and e-Learning. Vol. 3, Issue. 5, 2013

- Hammond, J., T. Cherrett, and B. Waterson, *The Development of Child Pedestrian Training in the United Kingdom 2002–2011: A National Survey of Local Authorities.* Journal of Transportation Safety & Security, Vol. 6, Issue 2, 2014.

- Hammond, J., T. Cherrett, and B. Waterson, *Making in-class skills training more effective: The scope for interactive videos to complement the delivery of* *practical pedestrian training.* 2014 British Journal of Educational Technology. (Accepted and In Press)

The following peer reviewed conference papers have been produced:

- Hammond, J., T. Cherrett, and B. Waterson (2011). *An evaluation of child pedestrian training in the UK: the scope for interactive technologies to aid teaching.* At 43rd Annual Meeting of the Universities' Transport Study Group (UTSG), Open University, Milton Keynes, United Kingdom.

- Hammond, J., T. Cherrett, and B. Waterson (2013). *Interactive video as a tool to aid child pedestrian training programmes.* At 45th Annual Meeting of the Universities' Transport Study Group (UTSG), Oxford University, Oxford, United Kingdom.

- Hammond, J., T. Cherrett, and B. Waterson (2013). *Towards safer roadside behaviour on the school journey through interactive video training.* , At 92nd Annual Meeting of the Transportation Research Board, Washington D.C., United States of America.

## 1.5 Report Structure

The report is divided into nine further chapters (Figure 1.5.1). Chapter 2 begins by outlining Pedestrian road safety; issues, history and management. Starting generally the chapter explores broad range of road safety issues and concepts, with an overall focus on pedestrian RTAs in the UK. A brief outline of the history and management of road safety with a focus on the UK is also presented in order to put the research into context within the multi-faceted systems approach of road safety intervention. The chapter also sets out the framework and policy context of the Kerbcraft pedestrian scheme, the principals of which underlie the research undertaken.

Following on from the context of road safety and training, Chapter 3 presents key Educational Theories which attempt to explain the potential underlying mechanisms of learning that should be considered in the design of educational road safety interventions. Brief overviews are given of the main relevant learning theory and suggestions are made as to how this theory could impact on learning. The chapter also explores the concepts of skill acquisition; critical in road safety training where the fundamental outcome is improving skills.

Chapter 4, Understanding how child road safety training is currently delivered in the United Kingdom, fills a gap in the knowledge identified in Chapter 2; presenting results from a new local authority survey carried out as a fundamental element of this research in order to ascertain the variation in the delivery of pedestrian training in the UK. Mini case studies are presented to demonstrate the three main classifications of training identified by the survey that are delivered in the United Kingdom.

Following on, Chapter 5 enhances the background review by reviewing specific literature and presenting the evidence that indicates the potential for Interactive Video as a potential aid to child pedestrian training. A fundamental concept that applies throughout the thesis is that interactive video is presented as an aid for training and not a replacement.

Chapter 6 applies concepts from the background review, educational theories and previous work on interactive training and describes the development of a road safety interactive video & assessment methodology designed to test the effectiveness of interactive video in improving key roadside crossing skills in young children. The chapter is based upon a pilot study with one school and highlights issues and problems with initial video and assessment design, describing how these were addressed in later pilot studies as well as discussing the application to similar evaluations.

Chapter 7 presents results showing the impact of a road safety interactive video on behaviour. The results are based on several further pilot studies and outline how video performed in each school as well as at an aggregated level. Potential reasons for variations in effectiveness are discussed.

Chapter 8 presents results showing usability of and engagement with interactive road safety interactive video for young children. While usability is not a primary research topic in this thesis (as the overriding goal is to assess the effectiveness of interactive video), the chapter explores how children perceived the game and discusses issues based on observations during the pilot trials.

Chapter 9 outlines and discusses some of the practical implications of the study and Chapter 10 highlights the overall contribution of the research and recommendations for future research.

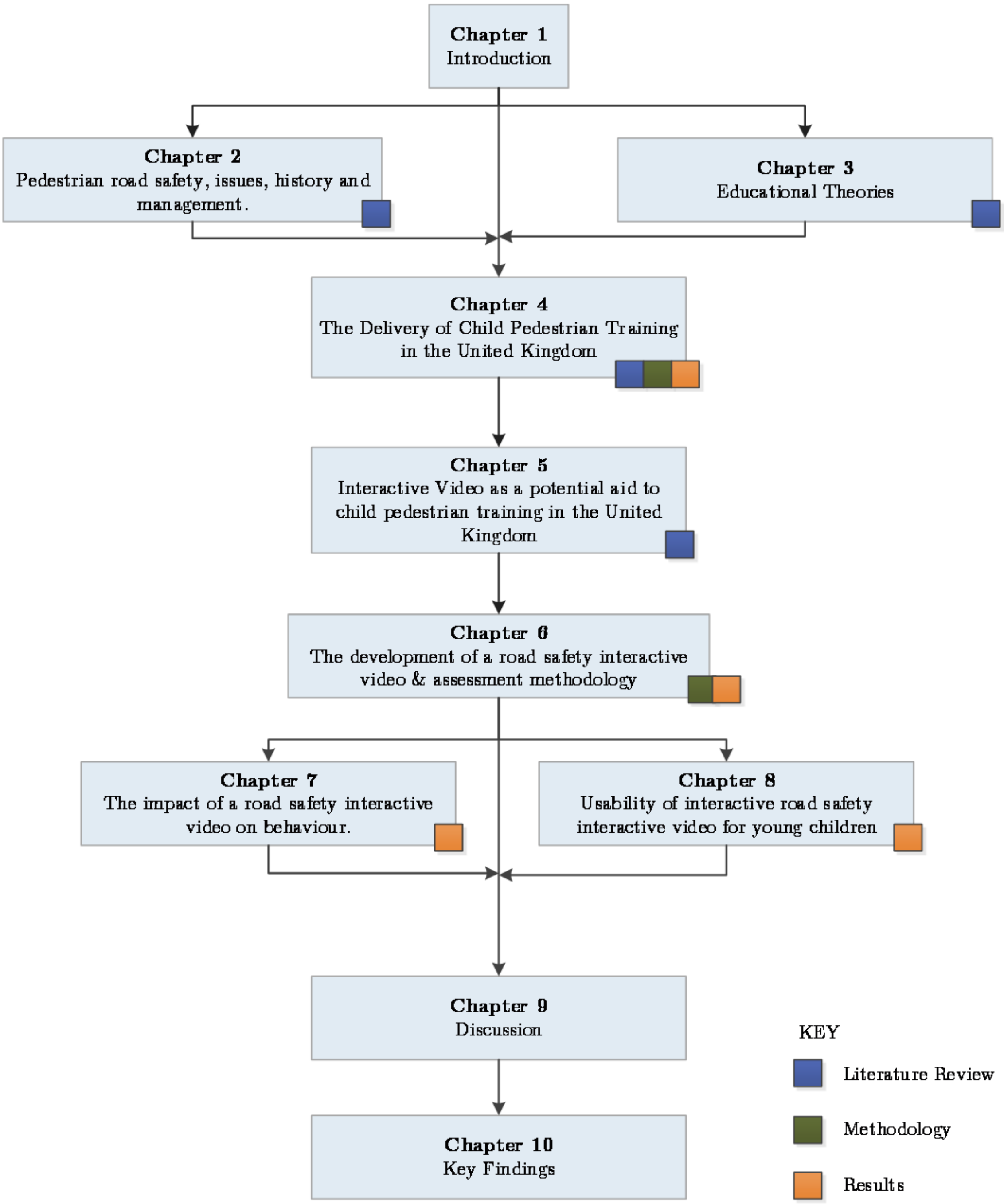



**Figure 1.5.1: An outline the key content in this report: A research process flowchart.**

Chapter 2

# Pedestrian road safety; issues, history and management

Road safety is a broad issue that relies on interventions working as part of a multi-method system to ensure that traffic injuries are controlled and reduced. Key elements of a road safety system include engineering, enforcement, education, management and publicity. This chapter puts this research in context by exploring key road safety concepts and principles and some of the underpinning knowledge that makes up the various facets of the topic. The chapter briefly outlines the variations in incidents related to road safety on a global scale before looking in more detail at issues with a focus on Great Britain and child pedestrian road safety. It also explores development of the approaches to improve road safety.

## 2.1 The global variation in road safety

While road safety is indeed a global issue, considering it at the macro level is not necessarily valuable when trying to understand what interventions should be implemented at the local level to reduce the impacts of collisions. Indeed, it is evident that the impact of road safety issues vary considerably across the World, with European countries having the lowest road traffic death rate per 100,000 population

(10.3) and African Countries having the highest (24.1)(Figure 2.1.1) (World Health Organization (WHO), 2013).

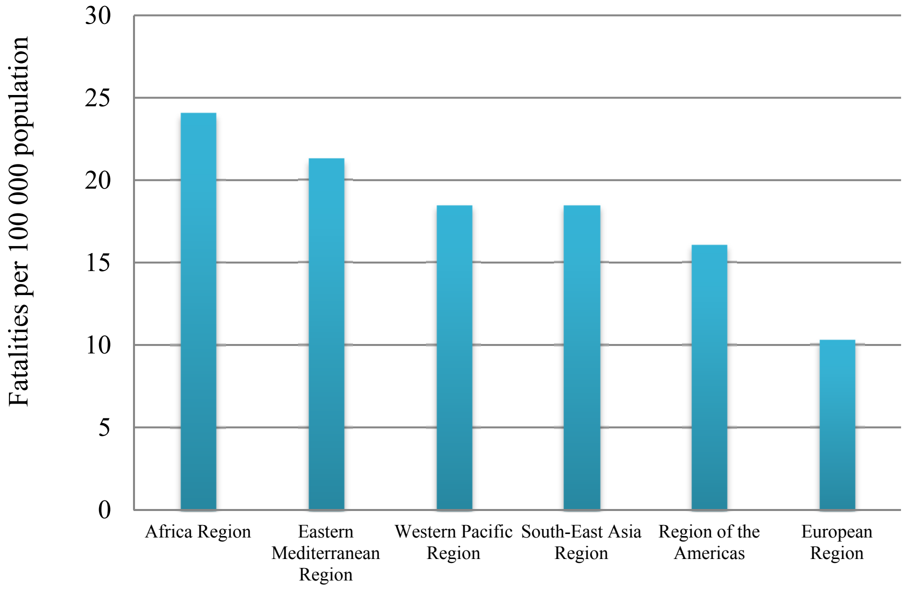



**Figure 2.1.1: Road traffic fatalities per 100 000 population, by World Health Organization Region (World Health Organization (WHO), 2013).**

Slightly different approaches to improving the situation are therefore required depending on the local context, generally aimed at addressing high-risk areas as a priority. The World Health Organization states that addressing five key risk factors with comprehensive national road safety policy that is effectively implemented can have an significant impact on reducing casualties; speed, drink-driving, helmets, seat-belts and child restraints (World Health Organization (WHO), 2013). Importantly there is also increasing recognition that walking and cycling must be made safe as current policy is focused on addressing motorized traffic (World Health Organization (WHO), 2013). In the context of global motorization, walking and cycling may be neglected as there is often less political importance placed on walking and cycling issues when compared to issues presented by rapid motorization.

Other political factors may reduce the comparative importance of road safety on the political agenda in many countries with conflict between departments, ineffective civil service and corruption (Bishai, Hyder, Ghaffar, Morrow and Kobusingye, 2003) as well as pressure on public spending all increasing the chance of a reduced road safety response at government level. Add to this other issues such as crime, terrorism and war, that are often a lower magnitude threat but have increased importance due to public perception (Bishai, Hyder, Ghaffar, Morrow and Kobusingye, 2003) and the opportunity for a well-funded road safety response is likely to be reduced (Bishai, Hyder, Ghaffar, Morrow and Kobusingye, 2003).

While the ‘big picture’ is important, it is critical to look at the country and local district or county level over a period of time in order to highlight risk groups and to assess the impact of interventions on road safety. The WHO names Australia, Canada, France, the Netherlands, Sweden and the United Kingdom as countries with a track record of achieving steady reductions in road traffic death rates, *through coordinated, multisectoral responses to the problem* (World Health Organization (WHO), 2013) (Figure 2.1.2a). Despite fluctuations, these countries have all experienced a negative trend in road traffic death rates. Compare this trend with a selection of countries that have not or are unable to implement such comprehensive coordinated responses (Figure 2.1.2b) and the impact of an organised road safety intervention response is clear.

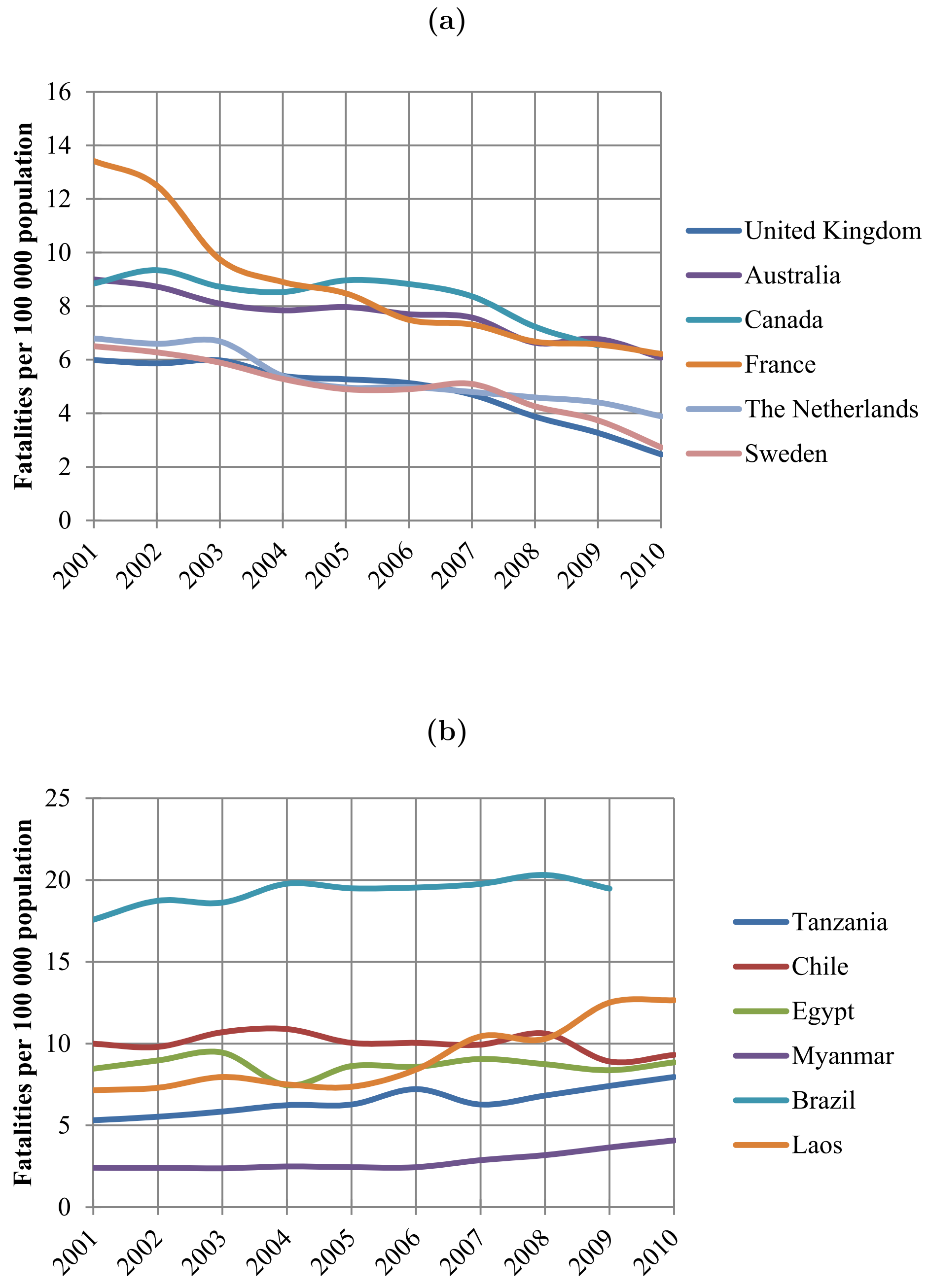



**Figure 2.1.2: Road traffic fatalities per 100 000 population by country**

## 2.2 Road safety in the United Kingdom

The United Kingdom has developed one of the safest road networks in the world, based on the number of fatalities per 100 000 population (at approximately 3), as a result of its long-standing coordinated response aiming to reduce death and injury on the roads (World Health Organization (WHO), 2013). Despite successes, with over 1900 road traffic fatalities in 2011 (Department for Transport, 2012b) costing the economy an estimated 1.2% of GDP (World Health Organization (WHO), 2013), there is still a pressing need to address the problem and continue to reduce death and injury.

### 2.2.1 Road Traffic Collision Data: All casualties

In 2011 1,901 people were reported to have been killed in road collisions on roads in Great Britain (GB), an increase of 3% from 2010 (1,850 reported deaths, Figure 2.2.1). A further increase was seen in the number of people reported to have been killed or seriously injured (KSI) (25,023), an increase of 2% from 2010 (24,510 KSIs). Total casualties fell over the same period with 203,950 people reported to have been involved in slight/serious/fatal road collisions (a fall of 2% from 208,648 in 2010). This equates to a casualty rate of 666 per billion vehicle miles and a KSI rate of 82 per billion vehicle miles (Department for Transport, 2012a).

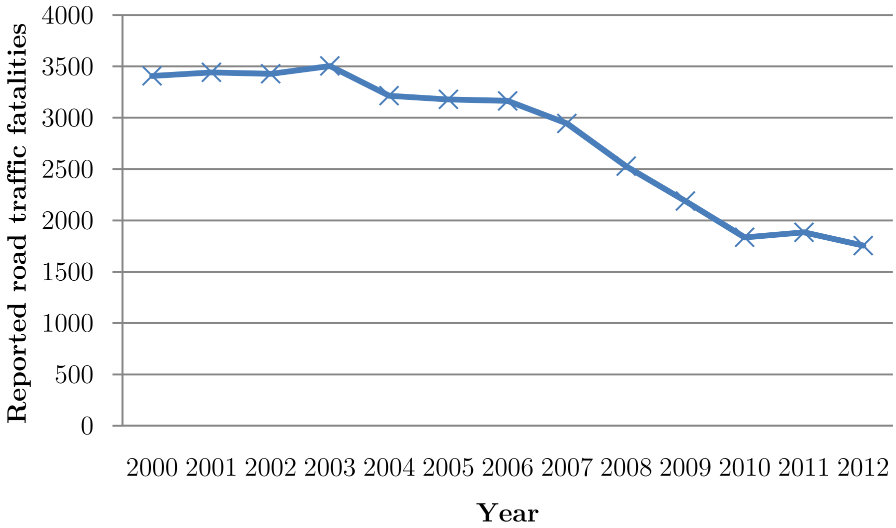



**Figure 2.2.1: Reported road traffic collision fatalities 2000-2012: Great Britain Source: (DfT, 2013b)**

While improvements were made in many areas, the number of children killed on roads in Great Britain (Table 2.2.1) increased by 9% between 2010-11 and a further 2% between 2011-12 (DfT, 2013b).

**Table 2.2.1: Reported road collision casualties by severity: GB 2011 Source: (DfT, 2013b)**

| | Number | | | | 2011 Percentage change over: | |
|---|---|---|---|---|---|---|
| | 2005-9 average | 2010 | 2011 | 2012 | 2011 | 2005-09 Average |
| **Killed** | 2,816 | 1850 | 1901 | 1,754 | -8 | -38 |
| **of which children** | 127 | 55 | 60 | 61 | 2 | -52 |
| **Seriously injured** | 27,225 | 22,660 | 23,122 | 23,039 | 0 | -15 |
| **Killed or seriously injured** | 30,041 | 24,51 | 25,023 | 24,793 | -1 | -17 |
| **of which children** | 3,067 | 2,502 | 2,412 | 2,272 | -6 | -26 |
| **Slightly injured** | 216,010 | 184,138 | 178,927 | 170,930 | -4 | -21 |
| **All severities** | 246,050 | 208,648 | 203,95 | 195,723 | -4 | -20 |
| **Traffic[1]** | 313 | 306 | 307 | 206 | 0 | -2 |
| **KSI rate[1]** | 96 | 80 | 82 | 81 | -1 | -15 |
| **Slight casualty rate[1]** | 690 | 601 | 583 | 559 | -4 | -19 |

1: Traffic in billion vehicle miles; rates per billion vehicle miles

Northern Ireland reports road safety statistics separately from the rest of Great Britain and does not form a part of the scope of this study. For information, reported RTA fatalities in 2008 were 107 (DOE, 2012), although per million vehicle miles this equates to more injury collisions per mile than in Great Britain (Crown, 2010).

### 2.2.2 Road Traffic Collision Data: Children

Children aged 0-15 (n=2412) made up approximately ten per cent of the people killed or seriously injured on roads in Great Britain in 2011 (Department for Transport, 2012b). Pedestrians made up 66% of these casualties (2011, Figure and Table 2.2.2) and there is a need to address this issue if walking is to be encouraged as a sustainable active mode of transport in schools and as part of the UK government long term sustainable transport strategy (DfT, 2011).

**Table 2.2.2: Reported children killed or seriously injured by age and road user type: GB 2011 Source: (DfT, 2013b)**

| | Number | | | | 2011 Percentage change over: | |
|---|---|---|---|---|---|---|
| | **2005-09 Average** | **2010** | **2011** | **2012** | **2010** | **2005-09 average** |
| Pedestrians | 1.9 | 1646 | 1,602 | 1,545 | -4 | -19 |
| Pedal cyclists | 485 | 398 | 398 | 324 | -19 | -33 |
| Car users | 534 | 360 | 336 | 346 | +3 | -35 |
| Other road users | 147 | 98 | 76 | 57 | -25 | -61 |
| Males | 1,984 | 1,628 | 1,519 | 1,483 | -2 | -25 |
| Females | 1,082 | 874 | 893 | 789 | -12 | -27 |
| Age 0-4 | 359 | 324 | 328 | 308 | -6 | -14 |
| Age 5-8 | 576 | 504 | 514 | 460 | -11 | -20 |
| Age 9-11 | 664 | 595 | 561 | 515 | -8 | -22 |
| Age 12-15 | 1,469 | 1079 | 1,009 | 989 | -2 | -33 |
| All children | 3,067 | 2502 | 2412 | 2,272 | -6 | -26 |

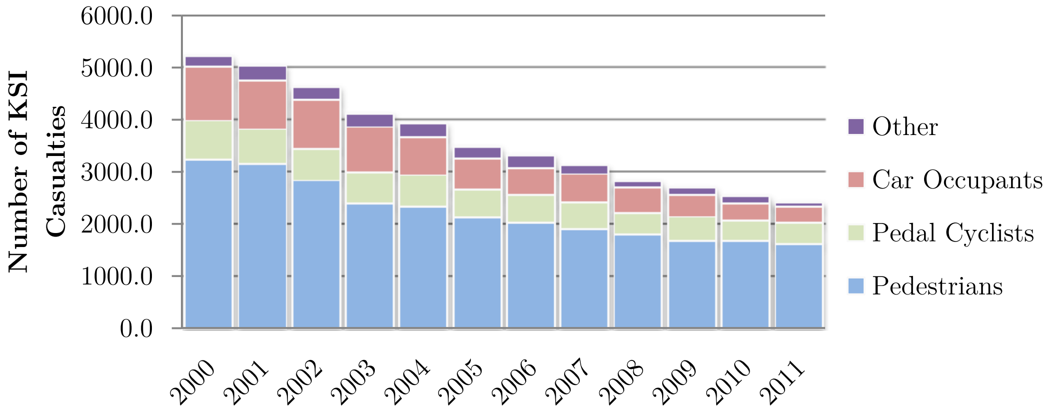



**Figure 2.2.2: Reported children killed or seriously injured by road user type. Source: (DfT, 2013b)**

Importantly, where a pedestrian was injured or killed in an RTC, *failing to look properly* was a factor in 59% of reported incidents, *being careless, reckless or in a hurry* a factor in 25% and being *masked by a stationary or parked vehicle* a factor in 16% (Table 2.2.3) (Department for Transport, 2012b). These are all behaviours that are importantly attributed to the pedestrians and while this by no means indicates that they were at fault, it does highlight behaviour that increases the risk of a collision occurring. With this in mind there is potential to develop procedures in order to mitigate the impact of these risky behaviours.

Comparing internationally, the United Kingdom and Great Britain do not provide young pedestrians with the safest road network in the world (Figure 2.2.3) and while we compare favourably, more work to improve road safety is required to ensure that we do not fall behind (DfT, 2010). The United Kingdom has a child pedestrian death rate of 5.0 per million population compared, for example, to Sweden (0.6), Germany (2.2) and Australia (1.9) who all share lower death rates (Figure 2.2.3)(DfT, 2010).

The lowest rate, achieved in Sweden, may be in part due to their Vision Zero policy that has influenced planning regulations to ensure that safety has priority over the speed and convenience. There is a shared responsibility between the system and designers to ensure that roads are safer (Vagverket, 2006) with the overarching principal being that users obeying the rules of the system will never sustain a fatal or serious injury (Elvik, 1998) when involved in a crash.

**Table 2.2.3: Reported injury incidents involving pedestrians with contributory factors: GB 2011 (Department for Transport, 2012b)**

| | Collisions involving injured or killed pedestrian | |
|---|---|---|
| **Contributory factor attributed to pedestrian** | **Number** | **Per cent*** |
| Pedestrian failed to look properly | 11,168 | 59 |
| Pedestrian careless, reckless or in a hurry | 4,772 | 25 |
| Pedestrian failed to judge vehicle's path or speed | 3,608 | 19 |
| Pedestrian crossing road masked by stationary or parked vehicle | 3,020 | 16 |
| Pedestrian impaired by alcohol | 2,139 | 11 |
| Dangerous action in carriageway (e.g. playing) | 1,385 | 7 |
| Pedestrian wrong use of pedestrian crossing facility | 1,156 | 6 |
| Pedestrian wearing dark clothing at night | 824 | 4 |
| Pedestrian disability or illness, mental or physical | 478 | 3 |
| Pedestrian impaired by drugs (illicit or medicinal) | 221 | 1 |
| Slippery road (due to weather) | 12 | 0 |
| Poor or defective road surface | 5 | 0 |
| Animal or object in carriageway | 2 | 0 |
| **Number of collisions** | **18,978** | |

*More than one contributory factor can occur per collision, resulting in a sum greater than 100%

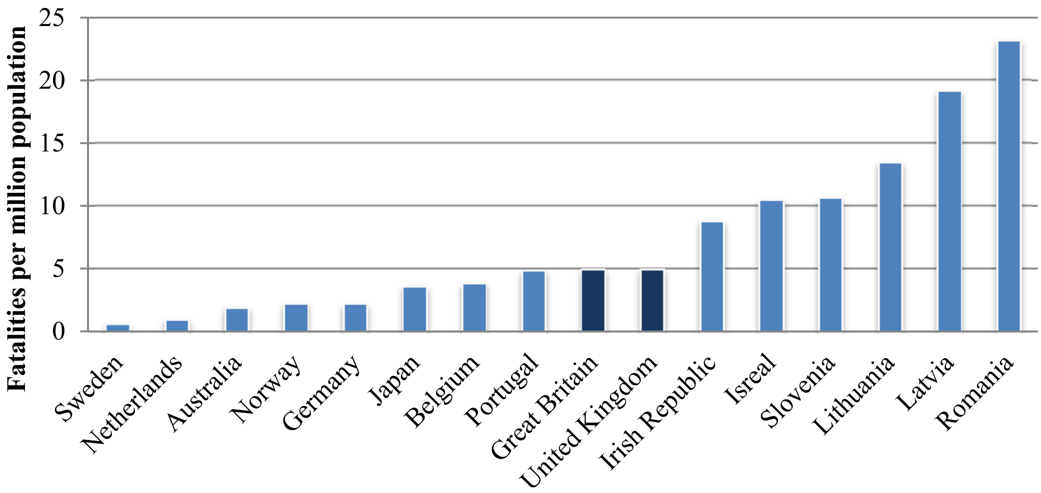



**Figure 2.2.3**: **Child (0-14) pedestrian deaths per 1, 000,000 population: 2008 (DfT, 2010)**

It is challenging to deduce why one population group is more or less likely to be involved in a child pedestrian collision due to the large number of, often immeasurable or unmeasured factors at work. Wazana, Krueger, Raina and Chamber (1997) carried out a review of academic papers published over a ten year period that examined risk factors involved in child pedestrian injuries. Risk factors were categorised into the following groups; Child characteristics, Social and cultural, Physical environment, Driver.

Child characteristics include; Age (See Table 2.2.2), Sex (See Table 2.2.2), Ethnicity and Other factors. Age and sex are relatively straightforward risk factors to quantify from collision statistics and explain in part as a result of increased exposure. While ethnicity can be quantified, it is more problematic to explain as trends could be an artefact as a result of bias in data due to underreporting an inaccuracies in population forecasts (Steinbach, Edwards, Green and Grundy, 2007). Other factors identified by Wazana, Krueger, Raina and Chamber (1997) in their review included personality traits of children, with those that were 'impulsive…daring and defiant…and not cautious' being more likely to be involved in a collision.

Social and cultural factors identified in the Wazana, Krueger, Raina and Chamber (1997) reivew included; Socioeconomic Status and the Family Environment. Socioecomoic status is a relatively widely reported risk factor in child pedestrian injuries (Hippisley-cox, Groom, Kendrick, Coupland and Webber, 2002, Whelen, Towner, Errington and Powell, 2008); lower income areas generally exhibit a higher proportion of child pedestrian injuries compared to affluent areas. The family environment was highlighted as a risk factor relating to the practice of parents practicing 'preventative behaviours' with their children and the level of parental supervision. The review highlights that injured children were less likely to have received 'preventative behaviour' practice and were less likely to be well supervised.

Physical environment factors identifed in the Wazana, Krueger, Raina and Chamber (1997) reivew included; time of day, weather and lighting, the road, number of lanes and location on the road, speed limit and volume, play areas.

### 2.2.3 Road safety in Hampshire, UK

Hampshire is a large county in the South of England in the United Kingdom. It is administered primarily by Hampshire County Council; however Southampton and Portsmouth (two of the major cities in the county) are administered by their own City Councils. Hampshire, including Portsmouth and Southampton has a population of 1.76 million people (2011 census), making it the third most populous county in England (Hampshire County Council, 2013).

The county has approximately 5,300 miles of road and more cars than any other county according to the 2011 census, when there were reported to be 796,638 cars or vans in the area (compared to South Yorkshire for example where there were 597,538 cars or vans in the area (Statistics, 2012)). Two thirds of Hampshire commuters travel by car (Hampshire County Council, 2013). In 2012, 600 people were reported to have been killed or seriously injured on the road network in Hampshire (Hampshire County Council, 2012) (Figure 2.2.4).

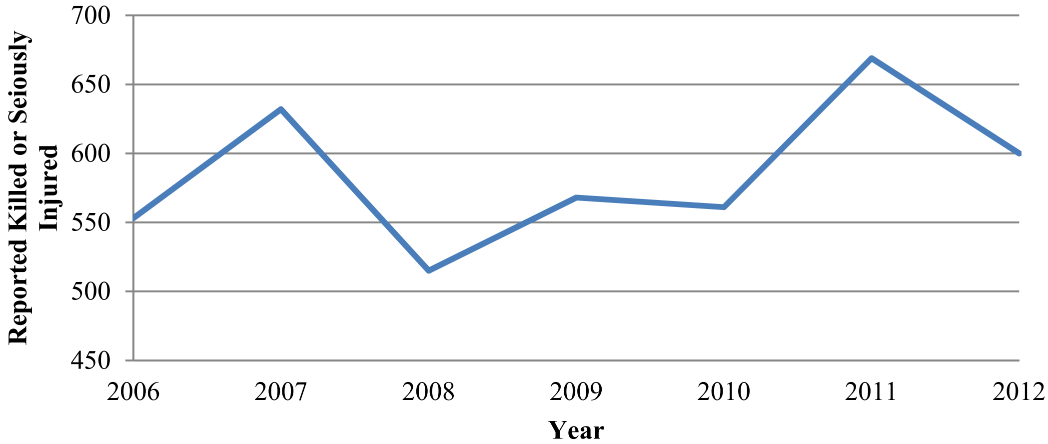



**Figure 2.2.4: Number of people reported Killed or Seriously Injured: Hampshire 2006-2012 (Hampshire County Council, 2012)**

Depending on age group child pedestrians make up between 33% and 43% of the children reported to be involved in road traffic injury incidents in Hampshire (Figure 2.2.5, Figure 2.2.6) and while the problem in real terms is greatest in the 12-15 age range when children are more likely to be independent travellers following a move to secondary school (Hampshire County Council, 2011a), there is a need to direct road user education to younger road users such that safe behaviour is commonplace before the transition from being an accompanied to an independent pedestrian takes place.

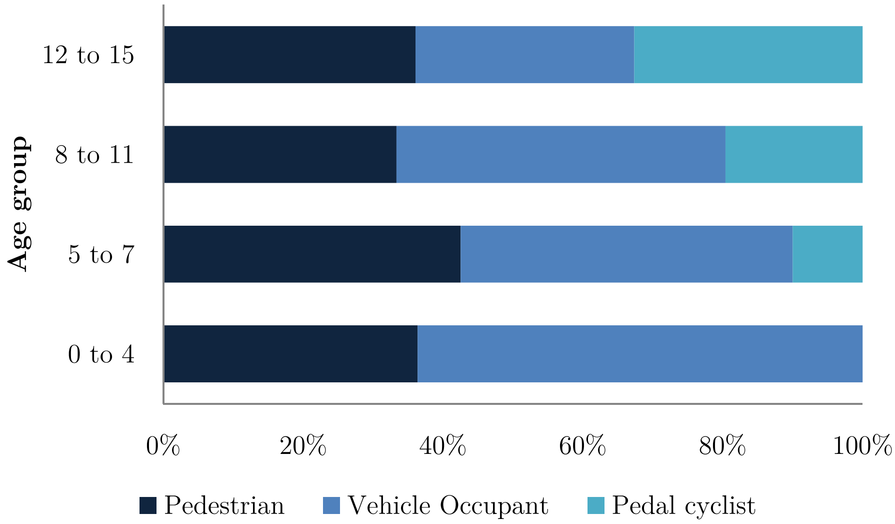



**Figure 2.2.5: Percentage of child road user injury collisions in Hampshire, by age group and mode (Hampshire County Council, 2011b).**

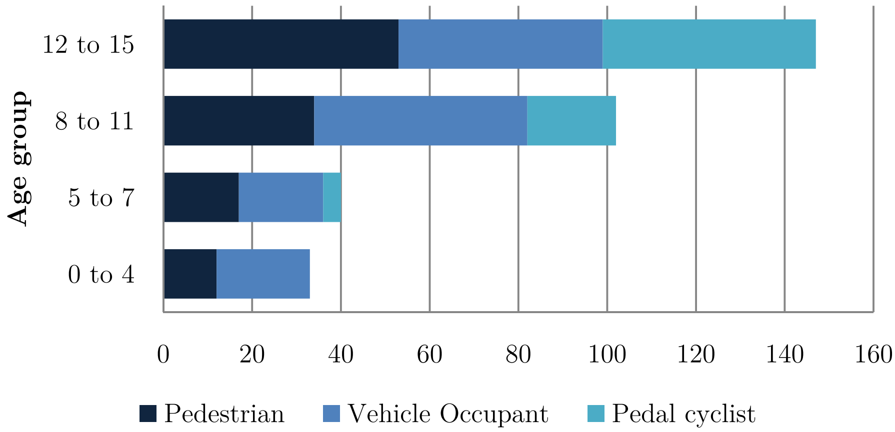



**Figure 2.2.6: Number of child road user injury collisions in Hampshire, by age group and mode (Hampshire County Council, 2011b)**

### 2.2.4 A word of caution: under reporting

Road traffic casualty data is recorded by the police either at the scene of a collision of at a police station (if a collision is self-reported by a member of the public) and recorded on a STATS19 form that details the location, time, severity and type of collision along with other contributory factors and details about the collision, site or circumstances. RTC figures are subject to a degree of uncertainty as a result of under reporting i.e. when someone is involved in a traffic collision but does not report it to the police. For 2011 the Department for Transport estimate that the number of underreported serious and slightly injured casualties may have been as high as 57,000 and 471,000 respectively (Department for Transport, 2012b). It is clear that this only goes to make the road safety issue in the United Kingdom more significant.

## 2.3 Managing road safety

The Department for Transport estimate that preventing reported collisions could benefit the economy by £15.6 billion and this figure may rise to £34.8 billion if accounting for underreporting. With the cost of a fatally injured RTC casualty estimated to be £1,686,532 in terms of damage to vehicles, property, emergency service costs, administrative costs etc. (Department for Transport, 2012b)(Table 2.3.1) there is a clear economic incentive to manage road safety with the view of reducing injury collisions. This does not even consider the social and emotional reasons for preventing road collisions which, at least from a moral standpoint, could be argued as the key incentive to RTC reduction. Inducing reductions in RTCs requires a coordinated, multi-sector management response to the problem.

**Table 2.3.1: The economic costs of RTCs in the UK by collision & casualty type**

| Collision / Casualty type | Cost per casualty **(£GBP,2011)** | Cost per collision **(£GBP,2011)** |
|---|---|---|
| **Fatal** | 1,686,532 | 1,877,583 |
| **Serious** | 189,519 | 216,203 |
| **Slight** | 14,611 | 23,136 |
| **Average** | 50,024 | 71,885 |
| **(Damage Only)** | | 2,027 |

With the incentive clear; the attitudes towards and therefore management systems of road safety have changed over time. The OECD outlined four paradigms which have developed since the introduction of the motor vehicle up to 1995 (Table 2.3.2)(OECD, n.d.).

**Paradigm I**

The first paradigm during the pre-War era related to the early misconceptions of road safety, that collisions were just random events and little could be done to improve road safety. At the time, cars were replacements for the horse drawn carriage and the safety implications would have been considered to be broadly similar. Cars would have been exciting and not necessarily the norm, probably owned by the more affluent and there was little done to improve safety. This blasé approach led to a gradual increase in traffic risk.

**Paradigm II**

The second paradigm (1925-65) further augments that of the pre-war era. It was a motoring boom and there was “blind admiration” towards vehicles. The theory at the time related to collision proneness and that you were more prone to a collision as road users had to master more complex traffic situations. The attitude was that road safety was an individual problem and there was therefore limited coordinated effort to make improvements.

**Paradigm III**

The third paradigm (1960s-80s) made a shift and introduced the concept of collision causation. It was the first time the concept of eliminating risk from the network was introduced and drivers became an active part of the road safety system. Central programmes were implemented to improve safety.

**Paradigm IV**

The forth paradigm over the 1980s to early 1990s introduced systems theory with the traffic system at the centre. The responses to road safety focussed on reducing collision exposure and improving road network regulation. For the first time the focus became road users, rather than the motorist and there was a drive to improve road safety for all.

**A paradigm shift**

From the 1990s when the OECDs work finished, another paradigm shift occurred with the introduction of more vehicles, alternative transport systems and national and international targets aimed at an increasingly complex transportation system. The management of road safety has now become more human-centric and has led to the introduction of the widely adopted 'systems approach' (World Health Organisation, 2009) to managing road safety.

**Table 2.3.2: Paradigms of road safety attitudes and management principles.**

| ASPECTS | PARADIGM I | PARADIGM II | PARADIGM III | PARADIGM IV | A NEW PARADIGM |
|---|---|---|---|---|---|
| **Time** | 1900 - 1925/35 | 1925/35 - 1965/70 | 1965/70 - 1980/85 | 1980/85 – 1990/95 | 1990/95 - Present |
| **Collision Theory** | Random events | Collision proneness | Causal collisions | Systems theory | Systems approach (WHO, 2009) and behavioural theory (Elvik et al., 2009) |
| **Description** | Control of motorized carriage | Mastering more complex traffic situations | Managing traffic system with complex interactions | Managing traffic system with complex interactions and growing traffic volume | A human-centric systems approach. |
| **Overarching ideas** | Using a car in place of a horse | Ensuring people can manage | Eliminating risk factors from the | Reducing risk exposure. | Reducing risk exposure. |

| ASPECTS | PARADIGM I | PARADIGM II | PARADIGM III | PARADIGM IV | A NEW PARADIGM |
|---|---|---|---|---|---|
| | drawn carriage | situations | road network | Network regulation. | Increasing satisfaction. |
| **vehicles / 1000 pop.** | Less than 25 | 25 - 250 | 250-500 | 500-700 | 500-800 |
| **Role of vehicle drivers** | Ownership of vehicles: "Car owner" | User of motor power: "Motorist" | Active part of the system: "Driver" | Social partnership: "Road-user" | Social partnership: "Road-user" |
| **Attitudes towards vehicles** | Fearful curiosity | Blind admiration | Prudent tolerance | Calm consideration | Part of a problem (road safety, pollution, congestion) |
| **Attitude to road safety** | Transitional problem, passing stage of maladjustment | Individual problem, inadequate moral and skills | Defective traffic system | Risk exposure | Risk exposure and compensation |
| **Organisational form of safety work** | Separate efforts on trial and error basis | Co-ordinated efforts on voluntary basis | Programmed efforts, authorised politically | Decentralisation, local management | Decentralisation, Local management, National and International goals |
| **Typical countermeasure** | Vehicle codes and inspection, school patrols | The three E's doctrine, screening of collision prone drivers | Combined samples of measures for diminishing risks | Networking and pricing | Multidimensional |
| **Effects** | Gradual increase in traffic risks and health risks | Rapid increase of health risk with decreasing traffic risk | Successive cycles of decrease of health risks and traffic risks | Continuous and rapid reduction of serious road collisions | Continuous reduction of serious road collisions |

Adapted from OECD (n.d.)

The 'systems approach' (Figure 2.3.1) identifies interactions between road users, vehicles and the road network in order that interventions are developed based on these interactions and on the underpinning understanding that human error is inevitable and that the human body is vulnerable in a road traffic collision (World Health Organisation, 2009).

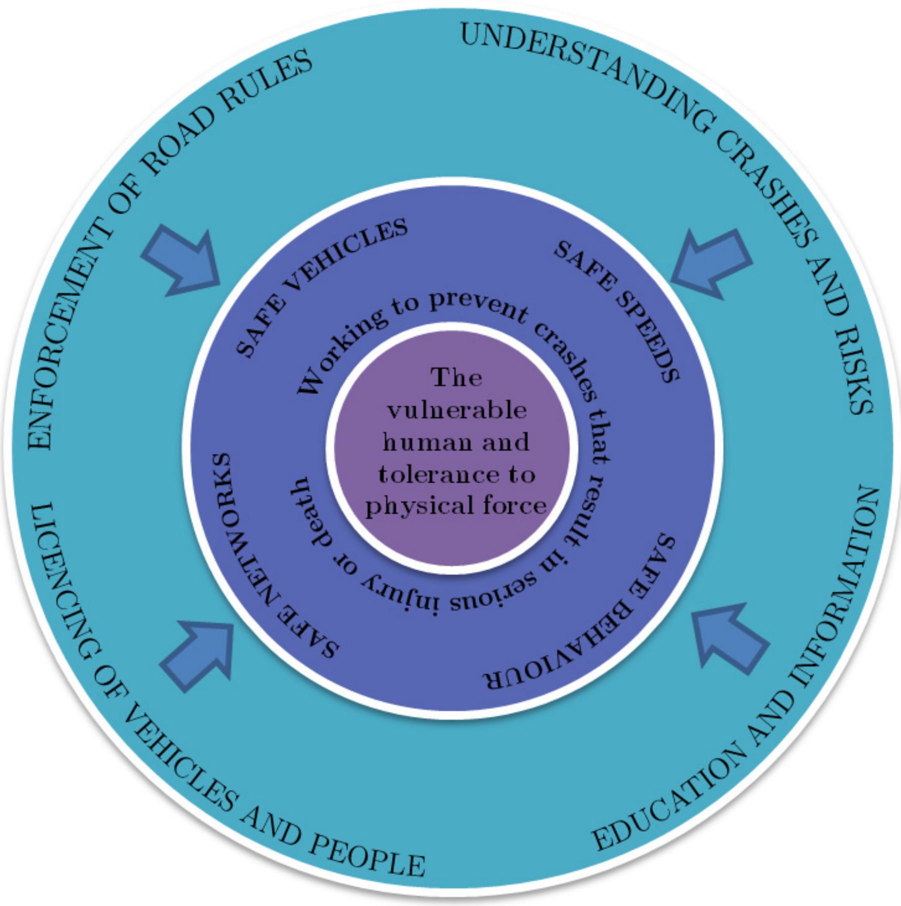



**Figure 2.3.1: The human-centric systems approach to road safety management.**

Adapted from WHO (2009)

The systems approach, as opposed to the approaches taken in the previous paradigms discussed, is suggested to be the most successful management system for road safety and has resulted in reduced collision rates in the countries that have implemented the system; hence it is advocated as the global system for road safety management (Elvik, Hoye, Vaa and Sorensen, 2009, World Health Organisation, 2009).

Elvik, Hoye, Vaa and Sorensen (2009) argue that the systems approach has not proven to be "fully satisfactory" as it rarely leads to a complete or near complete reduction in fatalities. The evidence for this incomplete reduction is unequivocal, as represented by figures presented by the WHO (World Health Organization (WHO), 2013), and it can be argued that the absence of complete reductions of casualties can be explained by our acceptance of risk within the wider context of Wilde's risk homeostasis theory, sometimes referred to as 'Behavioural theory' (As cited in Elvik *et al.*, 2009).

While the theory of risk homeostasis is by no means new, its significance in achieving successful road safety improvements has become recognized. According to this theory, Wilde proposes that humans assess and accept risk on a daily basis and as a result, society has an accepted level of risk; the 'target level'. In crude terms, we subconsciously accept that a number of people will be fatally injured on road networks (the target level) every time we drive. The theory suggests that the only way of achieving the aims of a road safety strategy is to lower this target level of risk (Elvik, Hoye, Vaa and Sorensen, 2009) which was demonstrated, for example, by the UK and Swedish Governments by the national targets laid out in the Ten Year Plan (Department for Transport) and Vision Zero (Vagverket, 2006) respectively. Vision Zero, released in 1997, set out the Swedish policy with a vision to reduce road deaths as a result of collisions to zero (Elvik, 1998). The ten year plan set specific targets to reduce the number of people killed or seriously injured in road collisions by 40%, and children by 50%, over the decade following publication (Department for Transport, 2000b). While both policies go some way to reducing the target level of risk, the Ten Year Plan is not as bold and it also explains the criticism that the UK Government received in not setting new road safety targets following the conclusion of the Ten Year Plan (Townsend, 2011).

While the systems approach provides an overarching framework on which to manage road safety, interventions implemented can still be broadly categorized as one of the "Three Es" which became commonplace from the 1960s; Engineering, Enforcement and Education (Cummins, 2003). Modern strategies expand on this to include four (Casbard *et al.*, 2003) or five (Safe Routes to School National Partnership, 2013) categories of intervention (Table 2.3.3).

**Table 2.3.3: The 'Es' of Road Safety Intervention**

| **1960s** | **1990/2000s** | **Present** |
|---|---|---|
| Engineering | Engineering | Engineering |
| Enforcement | Enforcement | Enforcement |
| Education | Education | Education (training and publicity) |
| | Encouragement | Encouragement |
| | | Evaluation |

Each of these broad approaches to intervention and road safety management can be described as:

1) *Engineering measures*: Physical changes designed to reduce the probability of a collision occurring and may include alterations to the road layout, revising speed limits, traffic calming and vehicle safety features (RoSPA, 2008, Towner and Ward, 1998). These can be very effective but are often expensive, time consuming to implement and limited in their spatial impact. Examples include; traffic calming, segregation, speed limit reduction.

2) *Enforcement (of government legislation):* Reinforces safe behaviour and practice, through the enforcement of traffic regulations by police forces and government bodies such as the Driver and Vehicle Licensing Agency (DVLA). Enforcement includes reprimands for speeding, dangerous driving, failure to wear a seatbelt and for poorly maintained vehicles (Improvement and Development Agency, Towner and Ward, 1998). In the United Kingdom the primary source of road safety regulation is contained within the Road Traffic Act 1988 (1988).

3) *Road safety education* (RSE): A measure designed to increase understanding and promote desirable behaviour with regard to road safety, commonly starting in childhood, continuing throughout the formative years, both in and out of School. The delivery of road safety training involves participants receiving practical 'guided experience' of real (on-street) or realistic (in-class) traffic situations (Local Government Improvement and Development, 2008) and can be aimed at the driver, cyclist or pedestrian. Such practical training has been shown to positively impact on the attitudes of the general public which in turn can influence central road safety policy (Towner and Ward, 1998). For example increasing the awareness of the impact of speed on fatality rate could lead to positive public perception of lower speed limits increasing the likelihood of politicians introducing more stringent legislation.

4) *Encouragement:* A relatively new addition to the three Es; encouragement concerns encouraging or positively reinforcing road users to exhibit safe behaviour without the need for negative reinforcement or reprimands (See Chapter 3).

5) *Evaluation*: A new addition that encourages continuous and end of project evaluation of road safety measures to demonstrate effectiveness and prove their worth (Sentinella, 2004). This would typically be by the body that implements the measure although in a number of cases evaluation is not carried out to a sufficing level of detail (See Chapter 4).

### 2.3.1 Road safety management in the United Kingdom

Although road safety management systems in the United Kingdom have evolved over time into what they are today, it is evident that the range of measures influencing road safety is leading to reductions in road traffic injury collisions. Numerous engineering, enforcement and education interventions have been introduced in the UK by various bodies over the last 70 years and their combined impact have led to a reduction in road fatalities. Figure 2.3.2 shows an overview of the some of the main interventions, aimed at improving child road safety, used in the United Kingdom which have in part positively impacted on reducing child road fatalities.

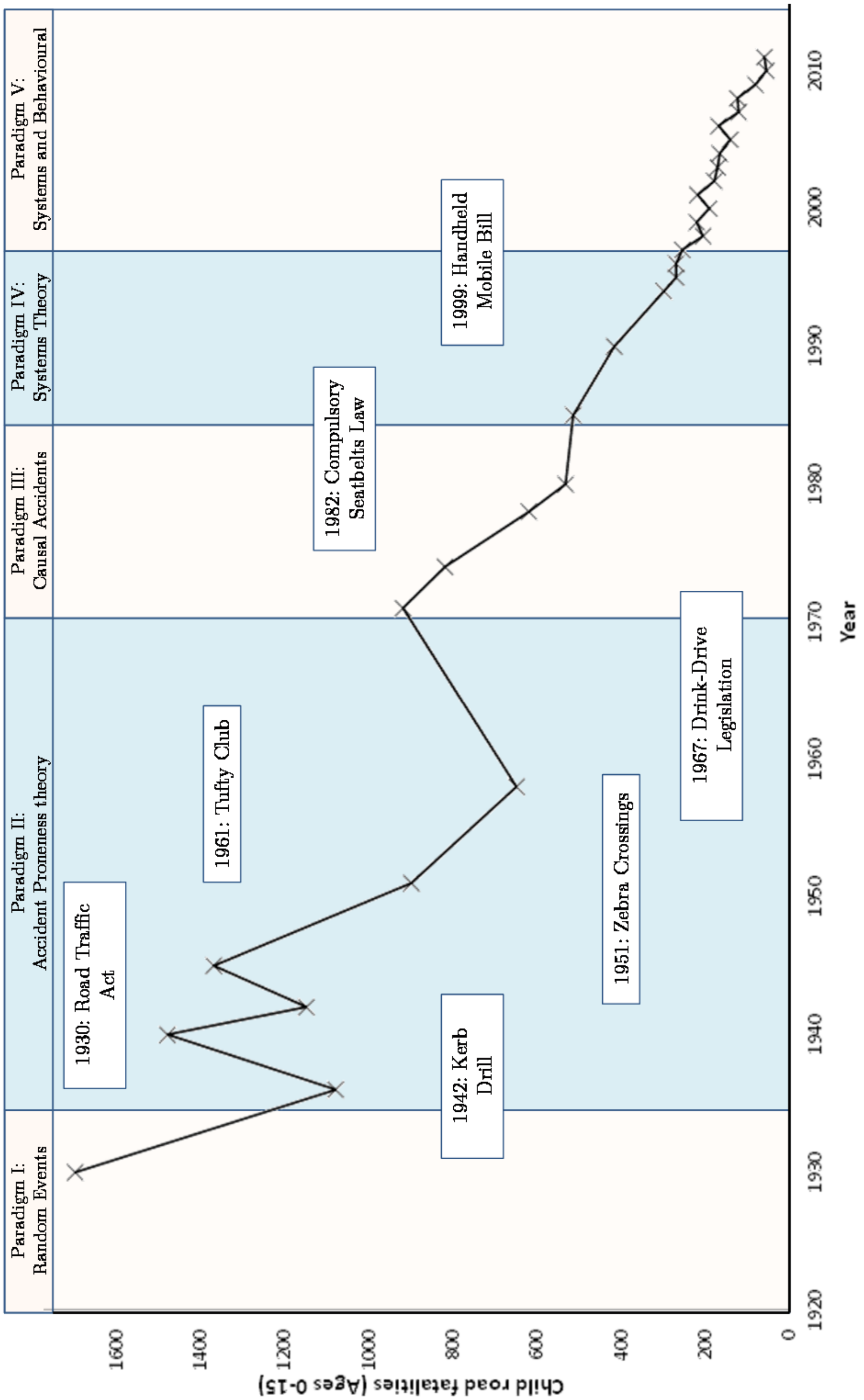



**Figure 2.3.2: Road safety initiatives and child road fatalities (0-15)**

Data sources: TRL (2009) (RoSPA, 2010)(Department for Transport, 2010c)

**1930: Road Traffic Act** (*Enforcement*) – Introduced comprehensive regulation on the use of the road network, including; the classification of vehicles, licensing and driving test regulations, the introduction of offenses such as dangerous driving and it made 3rd party insurance made compulsory (Crown, 2007).

**1942: Kerb Drill** (*Education*) – A 'drill' for safe road crossing, making use of rule recitation (Zeedyk, Wallace, Carcary, Jones and Larter, 2001). It was aimed at young children to improve crossing technique and was popular in the 1950s (Zeedyk, Wallace, Carcary, Jones and Larter, 2001).

**1951: Zebra Crossings** (*Engineering*) – consisting of black and white stripes and 'Belisha beacons' (National Archives, 2009). These crossings can be used in a variety of locations, including standalone crossings, near side roads, on approaches to roundabouts but not at signal controlled junctions where there would be a conflict in control methods (DfT, 1996).

**1961: Tufty Club** (*Education*) – A road safety club for children to join. A character 'Tufty Fluffytail,' introduced clear and simple road safety messages to children (RoSPA, 2009). Over 60,000 children joined the club in 1962 with over 10,000 affiliated clubs by 1973 and 24,500 clubs at its peak. Original stories developed *"for the Royal Society for the Prevention of Collisions featured the squirrel and his friends to introduce clear and simple safety messages for children. Tufty was joined in his adventures by Minnie Mole and the naughty Willy Weasel along with Mrs Owl the teacher and Policeman Badger, who always popped up in the nick of time to save the children." (RoSPA, 2009)* Evidence indicates that this approach to road safety is ineffective in improving road safety knowledge (Towner, Dowswell, Mackereth and Jarvis, 2001).

**1967: Drink Drive Legislation** (*Enforcement*) – In 1967 it became an offence to drive with more than 80mg of alcohol per 100ml of blood in a persons' body. Snortum (1990) notes that there was a self-reported link between the level of enforcement and compliance and this was reflected by an interruption of the "escalating pattern of alcohol related crashes". The enforcement and education campaigns that accompanied the law helped to ensure long-term compliance (Snortum, 1990). Importantly, Snortum (1990) highlights that the potential for disqualification (having a driving license revoked) was the major deterrent, even greater than the threat of prison. The legislation demonstrates the effectiveness of enforcement and publicity in targeting and reducing the impact of a specific behavioural road safety issue.

**1971: Green Cross Code** (*Education*) – Introduced a mnemonic to help children remember a safe road crossing procedure (BBC, 2006). This built upon the work of Kerb Drill and is taught in schools in the United Kingdom (DfT, 2013a).

**1982: Compulsory Seatbelts Law** (*Enforcement*) – A transport bill makes it compulsory that seatbelts must be worn (RoSPA, 2010).
1988: Road Traffic Act 1988

**1999: Handheld Mobile Bill** (*Enforcement*) – A failed bill raised the issue of the dangers of driving with a mobile phone. It became illegal to drive whilst using a mobile phone four years later in 2003 (RoSPA, 2010).

## 2.4 Road Safety Education

RTCs involving child pedestrians on UK roads do not tend to cluster together and are instead dispersed throughout the road network. Ward (1991) suggests that engineering solutions are hard to successfully target at child pedestrians, due to a lack of cluster sites which can be modified through engineering. Instead targeted education, training and publicity are key to reducing child pedestrian casualties (Ward, 1991). This pre-emptive approach offered by education (as opposed to engineering solutions, which tend to be reactive unless greenfield development in taking place where the road safety auditing process attempts to ensure that new developments are safe for all users), will foster safe and consistent behaviour from the outset of a road users development, reducing the potential for them to become involved in high risk situations.

Road safety education (RSE) is a vast subject, covering all modes of road transportation, with three key objectives (European Comission, 2005):

- **To promote knowledge** – people must understand the rules of the road and know how to deal with various situations
- **To improve skills** – people must be able to implement their knowledge effectively
- **To change or strengthen attitudes** – people must have a proactive attitude towards road safety risks.

A summary of these objectives of road safety education is shown in Figure 2.4.1. These three objectives hope to influence or change road user behaviour to avoid road traffic collisions occurring.

<table>
<tr><td>Delivery Methods</td><td colspan="3">Road Safety Education<br>Indoor and outdoor lessons, on-street training, group work and discussions, presentations, theatre education, demonstrations, creative and interactive techniques</td></tr>
<tr><td>Aims</td><td>Promote Knowledge:<br>• Rules & Laws<br>• Risks<br>• Consequences of poor behaviour</td><td>Improve Skills:<br>• Safe road crossing techniques<br>• Transform knowledge into ability</td><td>Change and strengthen Attitudes:<br>• Commitment and motivation towards road safety<br>• Sustainable travel</td></tr>
<tr><td>Goals</td><td colspan="3">• Safe movement of people in traffic<br>• Transfer of short term safe road crossing techniques which can develop into a life-long skill<br>• Promote safe and responsible behaviour of all road users</td></tr>
</table>

**Figure 2.4.1: Road safety education goals, methods and objectives.**

Adapted from (European Comission, 2005)

It is critical that road safety interventions are not designed to rely on knowledge acquisition alone as evidence suggests that this is unlikely to lead to significant behavioural change. A study of three commercially available road safety interventions showed that the increase in a child's knowledge alone did not lead to a change in behaviour on street (Zeedyk, Wallace, Carcary, Jones and Larter, 2001) and without behaviour change any intended improvements in road safety are unlikely to occur.

The interventions used were; a traffic play-mat in which toy figures are 'walked' through the road layout in order to teach safe route choice skills; a board game which requires children to carry out different actions depending on the 'crossing square' encountered e.g. a zebra crossing square allows the child to safely cross and continue, where as a pelican crossing square with a red light requires the child to wait and miss a turn; and finally a poster & flipchart based intervention in which groups of children received a road safety talk supported by materials on the flipchart (Zeedyk, Wallace, Carcary, Jones and Larter, 2001). While each intervention led to an increase in the road safety knowledge of the children, when tested on-street there was no behavioural difference in the 'trained' and control group children (Zeedyk, Wallace, Carcary, Jones and Larter, 2001).

With this in mind, road safety interventions aimed at child pedestrians must allow deeper learning to take place in which children understand road safety concepts for themselves, rather than merely memorising the facts and procedures (Sims and Chambers, 2006), for example learning the kerb drill in class but not putting it into practice on-street, to ensure a change in behaviour results from the intervention. One successful method of achieving this deeper learning and therefore a positive behavioural change in child pedestrians is practical roadside training.

### 2.4.1 Pedestrian Training

Educating children in the use of a safe method for road crossing way to cross the road could reduce the number of injury collisions in 5-9 year olds by between 7 - 15 % (Elvik, Hoye, Vaa and Sorensen, 2009) as this type of pedestrian training has been successful in improving the traffic awareness skills and road crossing behaviour of young people (Thomson *et al.*, 2008).

Studies have demonstrated that indoor and outdoor training is effective in improving pedestrian skills in real roadside traffic conditions using pre and post-training roadside behavioural assessments in which the quality of pedestrian skills were judged, scored and compared.

Albert and Dolgin (2010) demonstrated that short-term indoor classroom based training on pre-schooler children had a positive effect on conceptual understanding and showed that gaming can improve street-crossing behaviour. Their research involved a trial of 40 children aged 4-5 who were assigned one of four conditions (game, story, song or control). The game used a table top model of a road layout and children performed safe crossings using dolls. The song involved learning a road safety song and the road safety story was read the book as a class by a researcher. All experimental group children showed improved knowledge but only those in the game condition demonstrated improved behaviour (Albert and Dolgin, 2010).

Van Schagen and Rothengatter (1997) compared the effectiveness of roadside training and classroom instruction on improving roadside behaviour and demonstrated that each method could improve knowledge and roadside behaviour. In classroom sessions, children used a work book and video to understand the required crossing behaviour when vision is obstructed by parked cars. They then used table top models to carry out crossings with model pedestrians. Roadside training consisted of five 15 minute sessions leaning how to cross the road with and without parked cars and approaching traffic. The study used 89 participants with an average age of 7 in roadside training, classroom instruction, combined training or control groups (Van Schagen and Rothengatter, 1997).

Thomson *et al.* (2008) demonstrated that roadside training was effective in improving roadside behaviour in the UK national pilot training scheme, ‘Kerbcraft’. While there is some doubt as to the true effectiveness of this type of training in reducing the risk of involvement in an RTC throughout a pedestrian’s life (Duperrex, 2002), it is seen as an integral component towards improving road safety and is incorporated into many road safety schemes.

To tackle the issue of child pedestrian casualties, the Department for Transport (DfT) and the Scottish Executive funded a national pilot of the Kerbcraft Pedestrian Training Scheme (‘Kerbcraft’) between 2002 and 2007 in England and Scotland. Local authorities in Wales also began operating Kerbcraft with funding from the Welsh Assembly Government (Department for Transport, 2010).

### 2.4.2 The administrative and policy context for child road safety education

At the time of the Kerbcraft pilot, national road safety administration was directed by UK government targets seeking to reduce RTC related casualties. The strategy for children, presented in "Tomorrow's roads: safer for everyone" (Department for Transport, 2000a) was to reduce the numbers of children killed or seriously injured in 2010 by 50% compared to the 1994-98 average. Whilst not made compulsory, child pedestrian training was highlighted as one of the key areas of RSE required to achieve this (Department for Transport, 2000a) and delivering, monitoring and evaluating Kerbcraft highlighted as an area of focus (Department for Transport, 2000a). Kerbcraft sat within this policy context, being funded and driven by government targets, but delivered and administrated by local authorities, schools and members of the general public who were willing to volunteer their time (Figure 2.4.2).

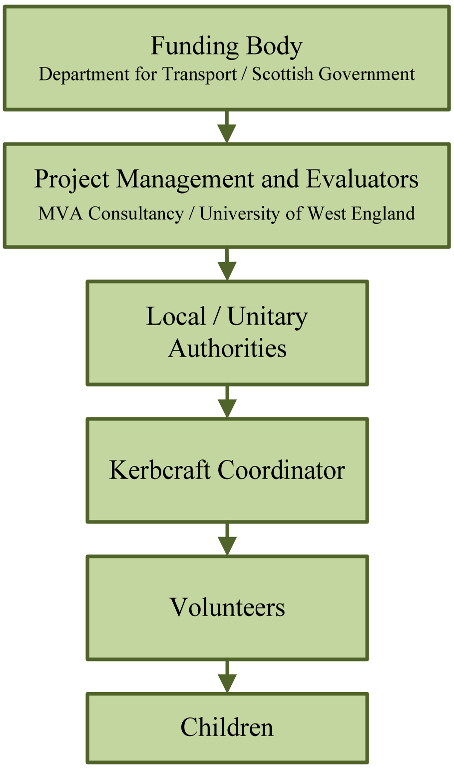



**Figure 2.4.2: Administrative structure of the Kerbcraft Pedestrian Training Pilot Scheme.** Adapted from Whelen, Towner, Errington & Powell (2008)

Alongside Kerbcraft, guidance provided to schools recommended that basic road safety education should be taught as part of 'Personal, Social and Health Education' (PSHE) and 'Citizenship' during years one and two ('key stages one and two') of a child's primary education when they are normally aged between 5 and 7(QCDA, 2007). Often these recommendations are fulfilled by Local Authorities who deliver RSE in Schools. General road safety education is also delivered by other organisations including the emergency services and charities, such as the Royal Society for the Prevention of Collisions and the Institute of Advanced Motorists (Audit Commission, 2007).

The 'Strategic Framework for Road Safety' (Department for Transport, 2011) may well alter this national government driven structure, giving fewer targets and more local control of road safety strategy. While the impact on child pedestrian training as a result of this development is currently unknown, similar local level administration has operated effectively in road safety programmes in a number of other European countries (European Commission, 2003).

There is no standardised structure for road safety education administration across the European Union, with roles being shared amongst public bodies, such as Transport and Education departments, and in some cases, private bodies such as insurance companies. As with the UK, however, most European road safety education is funded by governments and delivered by schools and police forces.

### 2.4.3 The Kerbcraft pedestrian training scheme

Aimed at 5 to 7 year olds, Kerbcraft offers children practical training in three key areas over a minimum of twelve roadside sessions, performed solely at the roadside and delivered by trained volunteers; ‘Choosing safe places and routes’, ‘Crossing safely at parked cars’ and ‘Crossing safely near junction’ (Prentice, Reilly and Dickens, 2007).

The pilot scheme in England and Scotland received funding from both the DfT and Scottish Government, who provided up to £30,000 per annum to each of the 75 participating local authorities to pay the salary of a Kerbcraft coordinator and to purchase the items and equipment required to deliver the training.

Each Kerbcraft pilot scheme took approximately one year for a child to complete, with one pedestrian skill being taught each term. The scheme was delivered under the guidance of a Local Authority based Kerbcraft coordinator who was responsible for liaising with schools, parents and volunteers to ensure that the schemes operated efficiently and were delivered to at least 300 children per year, for three years. The volunteer trainers supervised small groups of children, delivering the pedestrian training at the roadside. They ensured that the relevant roadside session content was covered each week and were encouraged to facilitate discussion amongst the children during these roadside sessions in order to promote a problem solving approach to road safety situations.

The ‘Choosing Safe Places and Routes’ session incorporated basic road safety knowledge and was taught in the first academic term as it underpinned the remainder of the training. It was carried out over four to six, thirty minute roadside training sessions (one delivered each week). The material had an emphasis on hazard identification, and children were asked to find a safe route from an origin to a destination on roads around the school, discussing hazards on the way. Lessons were delivered at a ratio of one volunteer to three children. The key outcome was to ensure children could recognise intrinsically dangerous roadside situations and construct routes to avoid them.

‘Crossing between parked cars’ was taught in the second academic term and was carried out over four 15 to 20 minute practical sessions at the roadside. Children were taught a safe procedure for crossing between parked cars when there is no other alternative. Given the increased risk of the activity due to the visual obstruction posed by the parked cars, lessons were delivered at a ratio of one volunteer to two children. Children should recognise that crossing between parked cars is intrinsically dangerous but safe routes cannot always be constructed to avoid them; this skill ensures that the procedure can be carried out safely when necessary.

‘Crossing at junctions’ was delivered in the third academic term in four to six, thirty minute roadside sessions where children were taught a safe procedure for crossing at uncontrolled junctions. Lessons were again delivered at a ratio of one volunteer to three children. Again, crossing at junctions is often unavoidable; this skill ensures a safe procedure is available.

A comprehensive evaluation of the Kerbcraft pilot scheme took place with both quantitative and qualitative analysis, including; interviews, surveys and questionnaires directed at all participants (teachers, coordinators, volunteers and children) and the behavioural observation of children at the roadside. The behavioural pedestrian skills assessment of training in all three skills, took place before, immediately after and two months after training, and included a random sample of trained and a matched sample of untrained children from fifteen of the pilot schools (Whelen, Towner, Errington & Powell, 2008). The skills assessments were carried out at the roadside and consisted of identifying specific roadside behaviours required to safely execute each of the three skills e.g. stopping at a pavement before stepping into the road. Investigations into cost effectiveness and issues such as deprivation, ethnicity and rurality also took place (see Whelen, Towner, Errington and Powell (2008)).

The pilot scheme demonstrated “strong statistical evidence of the positive impact of training in all three Kerbcraft skills” and was “proven to deliver a lasting improvement in road crossing skills” (Whelen, Towner, Errington & Powell, 2008). The assessment of safe crossing places and junction crossing found that trained children identified significantly more safe routes compared to untrained children; an increase of 27% from the baseline of 17%. Similar results were found in their ability to cross safely amongst parked cars in terms of stopping at the kerb, stopping at the line of sight and some key ‘observation’ behaviours. Following assessment of junction crossing behaviour, it was found that trained children again outperformed the untrained. Some 85,994 children received at least some Kerbcraft training but only 15 schools took part in the behavioural skills assessment. Interestingly the national pilot demonstrated less improvement in behaviour than an original small-scale pilot carried out in the Drumchapel area of Glasgow which took place before the national pilot (Whelen, Towner, Errington & Powell, 2008) and highlighted the fact that an intervention that performs well in one area, may not perform as well in another.

Following the scheme and evaluation in 2008, local authorities were asked if they intended to continue training in some form; 78% stated that they would continue offering training, 5% stated that they would offer training within 12 months (i.e. in 2009) and 17% were not planning to continue offering any training (Prentice, Reilly and Dickens, 2007). No further review of training has been undertaken since the completion of the pilot scheme so it is unclear whether these intentions were acted upon or have developed since the pilot.

## 2.5 Evaluating Practical Training

Evaluation can be defined as the "systematic investigation of the worth or merit of an object (Joint Committee on Standards for Educational Evaluation (JCSEE), 1994)." While evaluation is often misinterpreted as a process that looks to seek 'what works', Pawson and Myhill (2001) state that the aim of an evaluation is to find out "what is it about a programme which works for whom in what circumstances and what respects".

In the context of a local authority there are many barriers to carrying out an effective evaluation of a road safety intervention (King and Clinton, 2010). As well as cost, other barriers include a 'business as usual' culture and a lack of evaluation understanding (King and Clinton, 2010). This need not be the case; with a modest budget and the correct knowledge an effective evaluation, providing numerous benefits can be carried out relatively easily (Sentinella, 2004). Thompson and McClintock (2000) stress that well-financed evaluations are not diverting resources from the front-line of schemes, but that they in fact add value as a project that can demonstrate success will attract more "legislative, community, technical and financial support," thus ensuring that project continuation and future development is possible.

### 2.5.1 Behavioural Intervention Evaluation methodologies

A number of behavioural intervention evaluation methodologies were identified from the literature which would be suitable to assess the effectiveness of road safety behavioural interventions, including child pedestrian training programmes.

- A roadside behavioural assessment in which children are individually escorted to the test road and then inconspicuously filmed crossing the road alone, while the traffic is stopped. Behaviour types are coded post-test after reviewing the video footage (Albert and Dolgin, 2010). This method of evaluation can be referred as "observed behaviour in the road environment" (Sentinella, 2004).
- A roadside behavioural assessment in which children are individually escorted to the test road and asked to lead an evaluator through a number of roadside tasks with the possibility that the evaluator could prevent the child carrying out unsafe behaviour at any time. Behaviour types are coded and recorded by the evaluator during testing (Foot *et al.*, 2002, Whelen, Towner, Errington and Powell, 2008). This method of evaluation can be referred to as "practical testing in the road environment" (Sentinella, 2004).
- A virtual reality behavioural assessment carried out in indoor, controlled conditions, for example setting up a mock road scene in front of a large screen or screens showing oncoming traffic scenes (Dommes, Cavallo, Vienne and Aillerie, 2010, Schwebel, Gaines and Severson, 2008, McComas, MacKay and Pivik, 2002, Simpson, Johnston and Richardson, 2003). This method can be referred to as using "computer and video based tests".

### 2.5.2 Observed behaviour in the road environment

Behavioural change can be directly observed at the roadside, potentially using video, in order to determine whether a behavioural change has occurred (Sentinella, 2004). This method has the potential to either be done generally (i.e. looking at all pedestrians) or on a targeted basis (i.e. observing only those pedestrians that took part in the training programme. Either method has its flaws; general filming will observe natural behaviour, not necessarily that of the children that participated in the programme. Targeted filming will only observe programme participants, but their behaviour may be influenced by the fact that they are being observed less conspicuously.

Video footage would have to be reviewed and coded at a later date, a time consuming process, and Sentinella (2004) noted that it may be good practice to gain permission to film outside schools.

**Advantages**

- It is possible to observe actual behaviour in a natural environment. Participants are not trying to exhibit best practice but instead demonstrate their normal behavioural patterns. (Sentinella, 2004)

**Disadvantages**

- Observation is time consuming
- If the participant is, or becomes, aware that they are being observed, they may adapt their behaviour to demonstrate what they consider to be the ‘expected’ behaviour.
- If it is not possible to have direct interaction with the participants then it becomes problematic determining characteristics of participants (age, gender, ethnicity etc.)
- A restricted view, in the case of covert observation, can obscure important behavioural details.
- Determining which participants have and have not received road safety education can be problematic. (Sentinella, 2004)

### 2.5.3 Practical testing in the road environment

Practical testing specifically observes the performance on set pedestrian tasks by participants of the training programmes. Their performance is immediately assessed by a roadside assessor based on specific criteria. There is also the opportunity to ask participants follow-up questions to understand why certain decisions were been made.

Implementation of such evaluation schemes require thorough risk assessments and participants should be assessed on a one to one basis whilst holding the assessors hand. Participants' behaviour may be influenced by the presence of an evaluator and this should be taken into consideration in the study design.

**Advantages**

- Individual tasks or skills can be evaluated to gain an understanding into the effectiveness of a scheme in teaching individual elements.
- Can take place at the roadside with the presence of natural roadside scenarios and situations making the tasks realistic.

**Disadvantages**

- Consent and risk assessment procedures can be comprehensive and therefore time consuming.
- Practical evaluations are staff intensive and time consuming. (Sentinella, 2004)

### 2.5.4 Computer and video based testing

Computer and video based testing has previously been used to evaluate pedestrian behaviour using a virtual roadside. Depending on the level of complexity, this may involve using a standard personal computer to respond to a task or scenario on a computer screen, or in more advanced systems may include a virtual reality crossing scenario with motion detection and projected multi-angle views of the road to immerse the participant in virtual surroundings. Dommes, Cavallo, Vienne and Aillerie (2010) used a mock 4.2 metre section of road indoors adjacent to a computer generated traffic screen projection. Users were observed and their movements were tracked by a movement tracking device in order to record when they crossed the road in the mock scenario.

The clear advantage of this type of evaluation is that it is safe and allows a large amount of data to be collected for in-depth post-test analysis to take place. The drawbacks however are that the virtual reality tools may not relate to behaviour at the roadside and therefore require extensive validation before the data collected can be assumed to be fit for purpose. Virtual tools may also be expensive to develop, difficult for untrained users to set-up and as an on-going form of programme evaluation; they may be cost and time prohibitive.

| | |
|---|---|
| **Advantages** | Computer based testing is simple to administer. |
| | Data collection is rapid and automated. |
| | Scenarios can be replicated. |
| | Can measure inputs and reaction times. |
| | Motivation can be enhanced due to 'novelty value'. |
| **Disadvantages** | Expensive and time consuming development. |
| | Training may be required to use the application. |
| | Validation issues. (Sentinella, 2004) |

## Chapter Two Summary: Key Points

- Road safety is a global issue that not only causes death and injury but has a wide range of social and economic impacts.
- In the United Kingdom death and injury of child pedestrians is an issue which requires addressing.
- A variety of engineering, enforcement and education measures used within a systems approach to road safety management have the potential to reduce the number of road traffic collisions, including those affecting child pedestrians.
- Having a target level of injury collisions may drive reductions in death and injury as a result of road traffic collisions.
- Pedestrian training, in particular the Kerbcraft training scheme, is recommended by the United Kingdom government as being the most effective way of improving roadside skills in young children, in schools.
- While Kerbcraft is recommended as the basis for pedestrian training, it is unclear how prevalent the scheme is following the termination of a national pilot scheme.

Chapter 3

# Educational theory and the impact on road safety education resource design

Chapter 2 provided a background to the road safety issue of child pedestrian casualties and highlighted that education is one of the responses implemented to improve knowledge, skills and attitudes in order to reduce the likelihood of a road traffic collision taking place. This chapter explores educational theories that underpin learning from a more general perspective in order to outline their impact on learning and the relationship to road safety education and how they are being or could be applied to practical uptake of desired pedestrian road safety skills on-street as part of a computer based resource.

## 3.1 General educational theories

Three main theories of learning are generally cited as being a possible basis for describing how we learn; Behaviourism, Cognitivism and Constructivism (Ertmer and Newby, 2008, Chisholm, 2005).

### 3.1.1 Behaviourism

Behaviourism is concerned with the observable outcomes in stimulus-response methods of teaching. Its basic principles are demonstrated in almost all teaching scenarios; for example the award of 'well done' stickers for recognition of good work. Its roots are founded in early conditioned response experiments on animals where an animal could be 'trained' to demonstrate automatic responses to various stimuli. For example Pavlov's experiments (Pavlov, 1927) in training a dog, over time, to salivate in the presence of a ringing bell, rather than at the presence of food.

Skinner (1938) developed the idea of behaviourism by introducing the concepts of positive and negative reinforcement. In his experiments on rats he demonstrated that presenting a positive "reinforcer" or removing a negative "reinforcer" led to an observable increase in a specific behaviour.

Behaviourists did not concentrate on the study of cognition and how to use the brain processes in order to make learning more effective, rather they focussed on the cause – effect results of teaching to find out what was effective (Jordan, Carlile and Stack, 2008). Examples of this approach in the classroom include repetition and providing positive reinforcement through such measures as "well-done" stickers.

Important aspects of this theory in road safety training are likely to be repetition of key messages and ensuring learning is reinforced with feedback.

### 3.1.2 Cognitivism

As with all educational theories, Behaviourism does not offer a complete explanation of all learning functionalities. Most importantly it may neglect the fact that not all learning is a simple stimulus – response relationship. Other brain or cognitive processes must exist that make the relationship more flexible. It is argued that as well as stimuli or 'inputs' and responses or 'outputs;' cognitive processes take place in order to link the two. Five processes are theorised to be involved in cognition which can be targeted in order to make learning more effective; *Sensation*, *Perception, Attention, Encoding* and *Memory* (Jordan, Carlile and Stack, 2008):

- Sensation is the process by which an external stimulus is temporarily stored before continued processing elsewhere. For example, humans can generally retain a visual 'list' of up to ten items for a short period of time.

- Perception is the process by which we interpret our senses.

- Attention is the process of concentrating on the most important input or stimulus. The most important stimulus reaches our consciousness while less important stimuli (at the time) are dealt with by the unconscious.

- Encoding is the process by which we organise information into a 'mental picture' or schema. Put simply; the process of organising our thoughts.

- Memory is the process by which we retain and then recall the organised or 'encoded' information. As discussed, this includes sensory memory which retains small amounts of sensory information for a very short period of time. It also includes our Short-term and Long-term memory (Figure 3.1.1).

The Long-term memory is divided into *Episodic*, *Semantic* and *Procedural* memory stores (Tulving, 1985). *Episodic* stores contain memories of things that have taken place, *Semantic* stores retain facts, information and concepts and our *Procedural* stores retain our procedural knowledge.

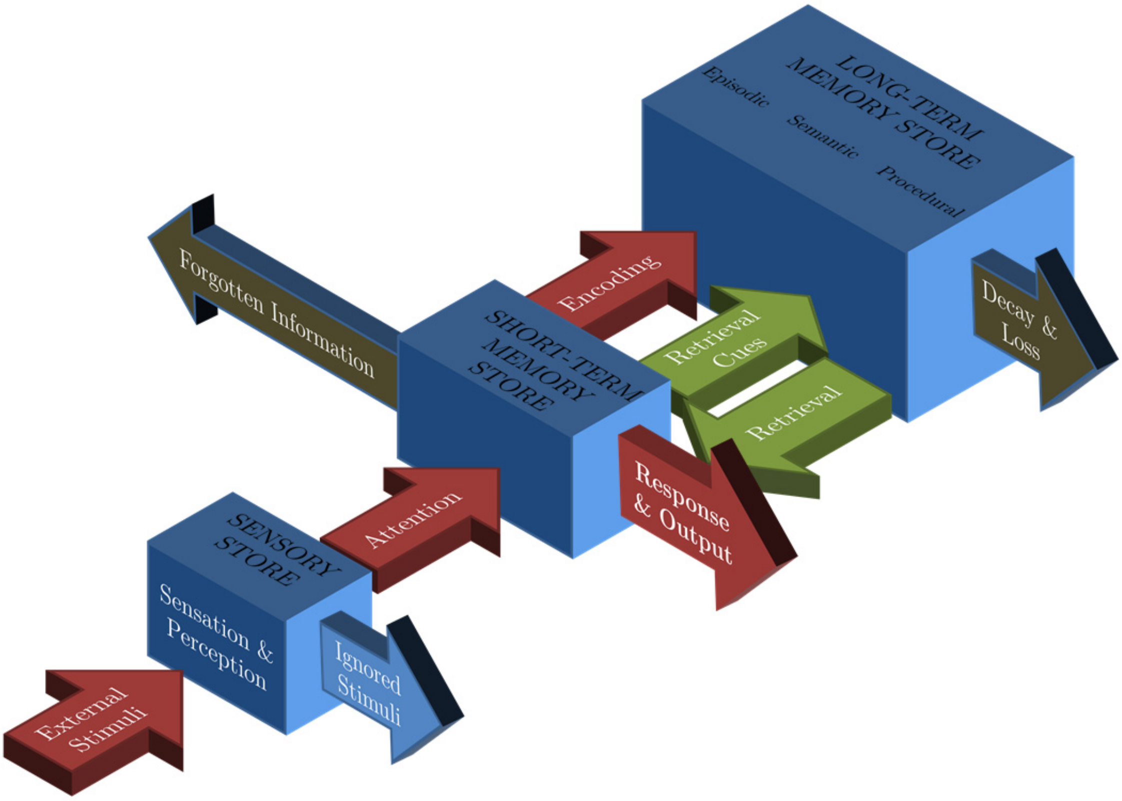



**Figure 3.1.1: A representation of memory storage in the brain. Adapted from (Jordan, Carlile and Stack, 2008).**

### 3.1.3 Constructivism

Constructivism is essentially the process by which we construct meaning (Jordan, Carlile and Stack, 2008). How do we go about getting a correct or incorrect answer and what are the constructors or learning processes we go through to get that answer? How can we ensure that the correct constructors are used to get to build the correct answer? Constructivism builds upon Cognitivism and thus still has interest in the underlying cognitive processes along with how we increase knowledge by constructing new meaning with other information (Jordan, Carlile and Stack, 2008).

Piaget (1969) theorised that constructivist learning occurs when existing knowledge is expanded by new experiences and is in part why exploratory learning is used in schools i.e. where children carry out experiments for themselves with little reliance on a teacher; thus learning from their own experience.

Table 3.1.1 outlines some of the practical implications of educational theory on in-class road safety education.

**Table 3.1.1: The implications of educational theory on in class road safety education**

| | Theoretical learning approach | Implications for in class road safety activities |
|---|---|---|
| **Behaviourism** | Stimulus & Response | Stimuli must trigger a response that highlights the importance of road safety. |
| | Positive and Negative Reinforcement | Positive reinforcement must reward good road safety knowledge and behaviour. Negative reinforcement could be used to penalise poor knowledge and behaviour. |
| **Cognitivism** | Memory storage and recall | Activities should target the episodic and procedural memory. |
| | Deep learning | Activities should ensure long-term memory storage is achieved. |
| **Constructivism** | Mental constructs | Children should be able to learn from an experience. |

### 3.1.4 Skill Acquisition

Rather than merely learning knowledge, for child pedestrian training to be successful skill acquisition must take place in order to change behaviour. A skill is a “proficiency, facility, or dexterity that is acquired or developed through training or experience” (Farlex Inc., 2010). More simply, a skill can be described as “an ability that has been acquired by training” (WordNet, 2010). With this in mind, child pedestrian skills must be acquired through some form of experience and training, rather than knowledge acquisition alone.

Fitts and Posner (1967) suggest that skill acquisition takes place in a three stage process:

- **Cognitive stage** – individual elements of a skill are identified and developed until the whole process can be formed in the mind. This stage often involves some sort of instruction.
- **Associative stage** – this stage involves practicing the skill until it is perfected.
- **Autonomous stage** – the skill is developed until it becomes automatic i.e. little or no conscious thought is needed to carry out the skill (Fitts and Posner, 1967).

Relating this process to a child pedestrian training intervention, for skill acquisition to take place, a child first needs to be taught the skill process, they then need to practice the skill until it can be completed without mistake and they then need to use the skill on an on-going basis until it becomes automatic.

It is important to note however that road safety skills do not offer immediate reward and therefore the incentive to learn safe skills is not always apparent (Percer, 2009). This factor could be a barrier in any form of child pedestrian training. Taking swimming as an example, a swimmer must use the correct technique in order to stay afloat and prevent drowning (Percer, 2009). There is therefore an immediate incentive provided to children in a swimming lesson which reinforces the need for learning i.e. if they don't learn the required techniques drowning may be the consequence. Crossing the road on the other hand is different as it is possible for a child to cross the road using unsafe techniques and still make a 'successful' crossing; only in some instances, when all factors required for a collision to occur were simultaneously present, would a collision occur. There is therefore no immediate incentive for a child to learn road safety skills and as such an incentive to learn should be provided which can often be provided in the form of positive reinforcement (Percer, 2009). Percer (2009), in an advisory report for the United States Department of Transportation and the National Highway Traffic Safety Administration, states that positive enforcement elicits behaviour and that programs incorporating positive reinforcement can have positive impacts on behaviour. This is the simple and common process by which desired behaviour is rewarded and may be as simple as a verbal congratulation (Dunn, 2000).

An important factor to account for in the development of an intervention aimed at child pedestrians is Piaget's theory of cognitive development which states the way a child's cognitive abilities develop from birth. The development is separated into four stages, Table 3.1.2 (Huitt and Hummel, 2003, Child Development Institute, 2000, Piaget, 1983).

**Table 3.1.2: The cognitive development stages of a child.**

Adapted from (Huitt and Hummel, 2003, Child Development Institute, 2000)

| Stage of Cognitive Development | |
|---|---|
| Sensorimotor stage (0-2 years) | Development begins with simple reflexes such as grasping objects. These are then repeated until "interesting consequences occur" such as kicking feet to become more mobile. These reflexes become more coordinated over time until intentional movements can occur. Intellectual abilities and language abilities begin to develop. |
| Pre-operational stage (2-7 years) | Intelligence can be demonstrated, language use matures and memory and imagination develop. Thinking is generally from the child's perspective. |
| Concrete operational stage (7-12 years) | Organised, logical thought occurs which allows problem solving to take place. Thinking is tied to "concrete" reality but can take on multiple perspectives. |
| Formal operational stage (12 years +) | Thinking develops away from concrete reality allowing hypothesis to be made and abstract concepts to be understood. |

With these stages in mind, and the fact that road safety interventions to child pedestrians occur in the pre-operational and concrete operational stages, a number of deductions can be made which will have influence on how the interventions are designed. One of the most critical factors is that young children think from their own perspective and often fail to see things from another person's perspective (Percer, 2009). In a road environment, this is obviously a problem as children will find it hard to see road safety problems from a driver's perspective so will fail to deduce, for example, that crossing the road where there is poor driver visibility could be dangerous (Percer, 2009).

These cognitive, along with metacognitive, processes underpin our ability to learn effectively. Cognition is simply our mental ability to think, perceive, analyse and reason (Children's Hospital Boston, 2003). Metacognition is therefore our conscious or cognitive ability "in which learners plan, monitor, evaluate and revise their progress in the course of the learning process (Department of Education and Early Childhood Development, 2009)." Relating this to a road safety context, cognitive and metacognitive processes are the system by which people analyse road safety situations and then plan how to deal with them, monitor what happens when the plan is put into action, evaluate the success of the plan and finally revise the plan on the basis of this evaluation (DfT, 1999).

With these processes in mind, it can be seen that cognitive and metacognitive ability of a child will have an impact on how they learn and respond to road safety situations. A study into cognitive and metacognitive processes needed for pedestrian skills carried out for the Department for Transport in the UK suggested that a child's ability to develop pedestrian skills depends on a number of factors (DfT, 1999):

- Road traffic exposure – A child needs to be exposed to traffic to learn about it, whether this is through controlled road safety education projects or just everyday exposure.
- Cognitive abilities – A range of cognitive abilities such as academic attainment, metacognition and visual search skills are required in order to analyse situations.
- Cognitive style – Whether a person is impulsive or reflective.
- Development of decision making strategies (DfT, 1999).

Using 180 primary school children from a range of ages (4-11), along with adults for comparison; pedestrian skills were assessed using slides and videos to gauge the ability of participants to identify danger, coordinate information and identify safe places to cross the roads. As would be expected, the study found that overall, pedestrian skills did develop with age but that within the sample, there was overlap in the performance of the age groups (i.e. some younger children outperformed older children) (DfT, 1999).

As a result of the study, there were a number of recommendations made about road safety education (DfT, 1999):

- RSE should start young; children aged 5 and younger were displaying the development of pedestrian skills.
- Knowledge-based approaches aren't as successful as problem-solving approaches where children are able to reflect.
- Children cannot be taught to adopt adult strategies immediately. They must slowly be encouraged to speed up their judgement time; starting with waiting to cross the road when there is no traffic and slowly moving on to predicting when a safe gap will occur.
- Real life simulations may be "fruitful" in giving children effective road safety education experiences (DfT, 1999).

## 3.2 The implications of learning theory on the design of in class road safety activities

A basic understanding of the three theories allows us to deduce effective game design principals based on an understanding of how children theoretically learn.

**Table** 3.1.1 outlines some of the practical implications of educational theory on in-class road safety education.

Table 3.1.1 highlights some of the differences between each of these educational theories and attempts to show how they may be used to make road safety education more effective.

The negative and positive reinforcement principals alongside repetition suggested by Behaviourism indicate that road safety games should;

- Repeat key safety messages, similar to the principals of the green cross code and kerb drill. While this may only improve knowledge, underlying knowledge retention will be important when learning the steps required for safer on-street behaviour.
- Reward positive behaviour; in a gaming situation a scoreboard would be one way of implementing this as it provides instant feedback as well as creating a sense of achievement.

The memory storage and recall procedure suggested in the cognitivist approach to learning will also be important to consider in game design. It is possible to use this model of memory recall (Figure 3.1.1) to target users of educational material more effectively:

- Engagment is critical from the outset; the external stimuli (in this case an edcuational resource), must engage the user's attention.
- Once attention is captured, it is important to highlight the key information as information can be lost at this stage.
- Encoding into the correct long-term memory store(s) must take place through further engagement and scenarios. Because decay, leading to loss, of long term information can take place it is important to repeat important information to users.

The constructivist approach to learning would finally suggest that a road safety game must allow children to learn from experience of situations. Rather than simply providing paper based work, this may indicate that video, animated or virtual reality environments may be useful in allowing users to experience the road environment, providing a framework of experiences from a classroom environment that may be transferable to the street.

## 3.3 Chapter Three Summary: Key Points

- A number of educational theories exist which underpin and influence the effectiveness of learning.
- These same educational theories will therefore underpin road safety education programmes and should be taken into account to increase the effectiveness of new and existing schemes.
- In the arena of road safety, skill acquisition should be focussed upon.
- Road safety training should begin from a young age. The UK guidance is from 5 years and upwards as children exhibit road safety skill development from at least this age onwards.
- RSE should start young; children aged 5 and younger were displaying the development of pedestrian skills.
- Knowledge-based approaches aren't as successful as problem-solving approaches where children are able to reflect.
- Children cannot be taught to adopt adult strategies immediately. They must slowly be encouraged to speed up their judgement time; starting with waiting to cross the road when there is no traffic and slowly moving on to predicting when a safe gap will occur.
- Real life simulations may be "fruitful" in giving children effective road safety education experiences.

# Chapter 4

# Understanding how child pedestrian road safety training is currently delivered in the United Kingdom

Chapter 2 highlighted a key gap in the current understanding of road safety training; the extent to which pedestrian training is currently being delivered in the United Kingdom and the delivery methods employed. Importantly since the Kerbcraft pilot ended it is relatively unknown on a national level how pedestrian training is implemented. This is a key gap in the current knowledge related to pedestrian training in the UK and this chapter outlines the development, and presents the findings, of a new survey directed at a sample of local authorities that did and did not take part in the Kerbcraft pilot scheme in order to increase our understanding of the magnitude and type of training currently being undertaken.

Following the completion of the Kerbcraft pilot scheme in 2007 and the associated withdrawal of centralised funding and administration, the survey aimed to assess the longevity and sustainability of such a scheme without guaranteed funding.

Following reduced government control of training combined alongside the global financial downturn, it can be hypothesised that the nature of pedestrian training is likely to have deviated from the design of the original Kerbcraft scheme with potential impacts on the quality of training provision alongside spatial differences in the content and type of training on offer.

## 4.1 Investigating the delivery of child pedestrian training in the United Kingdom following the Kerbcraft pilot

The survey conducted was designed to assess the extent to which child pedestrian training was being conducted at the local authorities that took part in the Kerbcraft national pilot scheme.

For comparison, local authorities that did not take part in the Kerbcraft trial were also contacted in order to make comparisons between the type of training on offer. Fewer authorities that were not involved in Kerbcraft were willing to take part.

### 4.1.1 Kerbcraft

Kerbcraft is described in detail in section 2.4.3. Table 4.1.1 summarises the key features of the Kerbcraft model.

**Table 4.1.1: Key features of the Kerbcraft Pedestrian Training Scheme**

| Skill | Content, Format and Outcome |
|---|---|
| **Choosing Safe Places and Routes**<br>(Term 1) | **Content:** Basic road safety knowledge underpinning the remainder of training, including; hazard identification and finding safe routes and places.<br>**Format:** Four to six, thirty minute training sessions with a 1:3 staff-student ratio.<br>**Outcome:** Ensure children can recognise intrinsically dangerous roadside situations and construct routes to avoid them. |

| Skill | Content, Format and Outcome |
|---|---|
| **Crossing between parked cars** (Term 2) | **Content:** A safe procedure for crossing between parked cars when there is no other alternative. **Format:** Four 15 to 20 minute practical sessions at the roadside in a 1:2 staff-student ratio. **Outcome:** Children must recognise that crossing between parked cars is intrinsically dangerous but safe routes cannot always be constructed to avoid them; this skill ensures that the procedure can be carried out safely when necessary. |
| **Crossing at junctions** (Term 3) | **Content:** A safe procedure for crossing at junctions. **Format:** Four to six, thirty minute roadside sessions in a 1:3 staff-student ratio. **Outcome:** Crossing at junctions is often unavoidable; this skill ensures a safe procedure is available. |

### 4.1.2 Survey design and development

The survey was devised to ascertain information regarding the design, delivery and administration of schemes and as such questions were designed to seek the extent to which key delivery and content criterion that are part of the Kerbcraft "curriculum", as presented in the *Kerbcraft Training Manual: A handbook for road safety professionals* (Thomson *et al.*, 2008), were being adhered to. These content and delivery criterion are discussed in Chapter 2, in particular in Section 2.4.3.

The introduction to the survey consisted of a preamble to introduce the survey aims to potential participants. Participant details were also collected to allow any necessary follow-up calls to be made, on the condition that measures were taken to ensure results were presented to protect the anonymity of participants.

The survey (see appendices) was then designed as follows:

- The first section of the survey sought to ascertain the Kerbcraft training scheme background experienced by local authorities; when did they take part in the pilot, whether they still offer any form of pedestrian training and the nature of the training on offer.

- The second section requested more detail on the delivery of pedestrian training schemes; the content, the delivery methods, the time allocated to training, the extent of training and the nature of the participants involved with delivering a scheme.

- Section three asked participants to outline the type and nature of evaluation undertaken during or after the delivery of their pedestrian training schemes.

- Section four allowed participants to provide some more general feedback on their feelings and opinions surrounding pedestrian training.

- Section five asked participants to outline the administration of training in their local authority.

- There was an opportunity at the end of the survey for any further comments.

Because the survey was delivered for both local authorities that did, and did not take part in the original Kerbcraft pilot, background questions were adapted to ensure they were relevant for either case.

### 4.1.3 Survey administration and procedure

Local authorities that took part in Kerbcraft were identified (Table 4.1.2). Surveys to the relevant local authority employees were carried out in late 2010, with results therefore reflecting the 2010/11 school academic year, in the format of semi-structured telephone interviews covering the required material whilst allowing respondents to expand on points of interest. Ison (2000) highlighted that successful local authority surveys relied on identifying and contacting a relevant point of contact prior to surveying. The relevant point of contact was found either through local authority websites detailing contact information or through the main local authority switchboard. Where a specific contact point could not be found, a general local authority road safety email address or telephone number was used.

Upon contacting the relevant member of staff in the local authority, the survey was either conducted at the time, or a convenient time in the future was arranged.

For local authorities that were not or no longer delivering pedestrian training, surveys typically took 5-10 minutes to complete. For local authorities that were delivering pedestrian training, more in depth discussion took place resulting in typical survey times of 20-30 minutes. An online version of the survey was also created to suit the needs of certain respondents who preferred to give written responses. Data were stored, and therefore reported here, anonymised.

Not all respondents were either willing or able to provide data or answers to all survey questions, thus incomplete sample sizes are reported where appropriate.

While participants did not take part anonymously, all did on good faith that they would be represented fairly. As a result all results are reported generally, providing approximate geographic locations where appropriate.

**Table 4.1.2: Original Kerbcraft pilot scheme authorities from which the survey sample was taken.**

| Local Authorities from Kerbcraft Pilot | Total No of Schemes in Pilot |
|---|---|
| Barnsley Metropolitan Borough Council | 3 |
| Birmingham City Council | 2 |
| Blackburn with Darwin Borough Council | 3 |
| Blackpool Borough Council | 1 |
| Bolton Metropolitan Borough Council | 2 |
| Bournemouth Borough Council | 2 |
| Bradford (City of) Metropolitan District Council | 4 |
| Brighton and Hove City Council | 1 |
| Bristol City Council | 2 |
| Bury Metropolitan Borough Council | 1 |
| Calderdale Metropolitan Borough Council | 2 |
| Coventry City Council | 1 |
| Derby City Council | 1 |
| Doncaster Metropolitan Borough Council | 2 |
| Dudley Metropolitan Borough Council | 1 |
| East Sussex County Council | 1 |
| Gateshead Council | 1 |
| Gloucestershire County Council | 1 |
| Halton Borough Council | 1 |
| Hampshire County Council | 1 |
| Isle of Wight | 1 |
| Kent County Council | 3 |
| Kirklees Metropolitan District Council | 1 |
| Knowsley Metropolitan Borough Council | 2 |
| Leicester City Council | 1 |
| Liverpool City Council | 6 |
| London Borough of Camden | 1 |
| London Borough of Croydon | 1 |
| London Borough of Enfield | 1 |
| London Borough of Greenwich | 2 |
| London Borough of Haringay | 1 |
| London Borough of Islington | 1 |
| London Borough of Lambeth | 2 |
| London Borough of Lewisham | 2 |
| London Borough of Southwark | 1 |
| London Borough of Tower Hamlets | 2 |
| London Borough of Waltham Forest | 2 |
| London Borough of Westminster | 1 |
| Manchester City Council | 1 |
| Middlesbrough Borough Council | 3 |

| Local Authorities from Kerbcraft Pilot | Total No of Schemes in Pilot |
|---|---|
| Newcastle City | 1 |
| Norfolk (and Suffolk) | 2 |
| North Somerset Council | 1 |
| Northumberland County Council | 1 |
| Portsmouth City Council | 1 |
| Redcar and Cleveland Borough Council | 2 |
| Rotherham Metropolitan Borough Council | 2 |
| Saint Helens Metropolitan Borough Council | 2 |
| Salford (City of) Metropolitan Borough Council | 1 |
| Sandwell Metropolitan Borough Council | 3 |
| Sefton Council | 1 |
| Sheffield City Council | 1 |
| Shropshire County Council | 1 |
| Solihull Council | 1 |
| South Tyneside Council | 1 |
| Staffordshire County Council | 1 |
| Stockport Metropolitan Borough Council | 1 |
| Stoke on Trent (City of) | 2 |
| Tameside Metropolitan Borough Council | 2 |
| Thurrock Council | 1 |
| Walsall Metropolitan Borough Council | 3 |
| Wirral (Metropolitan Borough) | 3 |
| Wolverhampton City Council | 1 |
| Aberdeen City Council | 1 |
| East Ayrshire Council | 1 |
| East Lothian Council | 1 |
| Edinburgh Council | 1 |
| Fife Council | 1 |
| Glasgow City Council | 1 |
| Inverclyde Council | 1 |
| Midlothian Council | 1 |
| North Lanarkshire Council | 1 |
| South Ayrshire Council | 1 |
| South Lanarkshire Council | 1 |
| West Dunbartonshire Council | 1 |
| TOTAL | 115 |

## 4.2 Survey Results

Following data collection, answers were stored electronically and, where necessary, responses to open questions were categorised before analysis.

### 4.2.1 Local Authorities Involved in the Kerbcraft Pilot Scheme

Following an intensive surveying period with initial phone calls, follow-up phone calls and online surveys; 57 (76%) of the original 75 Kerbcraft pilot scheme local authorities responded to the survey.

### 4.2.2 Availability of Training

Forty eight (84%) of the 57 local authority respondents that were involved in the original Kerbcraft pilot still offered some form of child pedestrian training. Of these, five were operating the original Kerbcraft training scheme in its entirety (see 2.4.3 - The Kerbcraft pedestrian training scheme). Many authorities however, stated that the original scheme was too long, time consuming (for both volunteers and children) and expensive and so the remaining 90% (n=43) delivered a different pedestrian training scheme often similar to, or adapted from, Kerbcraft.

The remaining 9 local authorities no longer offered child pedestrian training with 8 citing funding or a resource related issue as being the primary reason for stopping the service. There was a clear indication that if there was sufficient funding provision, that most of these authorities not offering training would revert their decision. It was indicated in the post-pilot survey following the conclusion of the Kerbcraft pilot that it was the intention of a number of authorities to discontinue training (Prentice, Reilly and Dickens, 2007), and this is reflected in these findings.

One point of interest that was indicated during conversations with some respondents is that a number were not aware what other local authorities were delivering with regards to training schemes. One respondent went so far as indicating that they thought only *one or two* local authorities would still be operating pedestrian training following the conclusion of the trial and this is demonstrated to not be the case.

### 4.2.3 Training scheme targeting criteria and coverage

Areas of low socioeconomic status and high collision rate were targeting criterion used for targeting training to specific groups or areas by 16% and 14% of the local authorities respectively. Over half of authorities (58%) offered training to all children without a targeting criterion. In 9% of local authorities, training was only provided upon the request of a school. A small number of authorities also increased the target age group, delivering training to older children in year groups 3 (age 7-8), 4 (age 8-9) or 5 (age 9-10). It was not possible to deduce whether this change in age group was a result of a research led decision, based on anecdotal evidence or carried out for administrative reasons.

Local authorities were asked to estimate the proportion of the total target population that received pedestrian training. Twenty were able to provide this information and maximum coverage was 100%, with a minimum estimated coverage of 9% (i.e. 5 out of 57 schools) in which the city authority only offered training at the request of schools and only to those with high car-use, free school meals or killed/seriously injured rates. Average estimated coverage from this group of authorities was 63%. Coverage is dependent on the targeting criteria used by Local Authorities along with the size and numbers of schools. It appears that local authorities that made deviated from the Kerbcraft model were more likely to deliver training to more children. More needs to be done to explore the benefits of delivering training to all children, perhaps at the expense of course length, as opposed to delivering more comprehensive training to targeted, high-risk groups of children.

### 4.2.4 Training scheme content and delivery

Eighty six per cent of the authorities that continued to deliver training target the same Kerbcraft skills of; choosing a safe place to cross, crossing safely at parked cars and crossing safely at junctions. Just 9% stated that they deviated from the content of Kerbcraft to deliver training in other skills, which included the use of designated crossings, understanding traffic calming and the use of 'problem crossings' in specific locations; all of which were scenarios not explicitly covered in the Kerbcraft model but are still critical road safety skills.

A variety of alterations were made from the original Kerbcraft model. Shortening training schemes –in 34 of the 43 authorities (79.1%) where the length of, or number of individual sessions was reduced. One local authority reduced their training scheme from the minimum of 12 sessions suggested in Kerbcraft to three sessions of one hour. Another offered just a single 20 minute introductory roadside session; however in this instance, the child's weaknesses were assessed by road safety staff, suggesting parents, who were identified by the authorities as playing a key role in training, continue further training to address these issues. It would not however be compulsory for parents to act upon this advice. One authority, who delivered their training scheme to 2700 children, reduced their scheme to two training sessions.

Of the respondents that offered child pedestrian training, the minimum length of total practical on-street training delivered was 20 minutes with an average length of 3.1 hours. A statistically significant reduction in the amount of training given was observed compared to the minimum 5 hours recommended by Kerbcraft ($T_{(41)} = -4.42$, $p < 0.05$. There was no significant correlation between the number of hours of roadside training delivered and the scheme coverage, i.e. it is possible to deliver more extensive schemes to a large number of users (this is very likely to be dependent on funding availability).

Removing the volunteer element of delivery occurred in 53.5% (23/43) of local authorities, although their use is still a key part of many training schemes. Volunteers were replaced by local authority staff, casual paid trainers or in some instances, members of the police force due to increased reliability and availability. Although a key element in the Kerbcraft model, Local Authorities responding to the survey had a tendency to find them hard to recruit and retain, therefore reducing the reliability and sustainability of schemes. One respondent in the Midlands stated that they were able to retain a core team of volunteer helpers for each scheme, but that retention of volunteers outside of this core group was more difficult. Another respondent in Scotland stated that volunteer parents tended to withdraw when their children moved between year groups.

Around half of the authorities delivered an element of their training schemes in class. Similar in-class delivery methodologies were utilised in both samples; including simple adult-led introductions and conclusions to the training course, in-class road safety role play (such as the use of mini zebra crossings), providing teaching materials to school teachers (e.g. road safety crossword worksheets) and showing introductory road safety videos.

Very few alternative in-class training materials were used, and 93% of participants indicated an interest in hearing about or in some cases trailing more innovative in-class materials such as interactive videos. The majority of local authorities with an interest in learning about more innovative materials also stated or indicated that they didn't want to replace practical training, but that additional materials may be useful in supplementing training. One local authority stated that "interactive tools could definitely help…they would be realistic and use real cars rather than animations…video would be better than animation." They also stated that rather than replacing training, the new materials, "could be used as a refresher or top-up session." Another respondent stated that new interactive video materials would provide an, "interesting aspect to the [current] training". A number of local authorities stated the need for any non-road side activities to be complementary rather than a replacement for training and this is positive as it not only demonstrates support for practical training but also the knowledge that practical roadside training is currently seen as best-practice. The remaining 7% of respondents were not interested in learning about innovative materials with a number stating their support for practical-only training schemes. One respondent stated "roadside is the best solution".

### 4.2.5 Training scheme economic costs

Each Kerbcraft pilot scheme in the original pilot had a budget of £30,000 allocated to fund a coordinator that would ensure training of 300 children took place over the academic year. A number of surveyed local authorities were unable to report on, or estimate the cost of their scheme as the data were not available at the time of surveying. Where available, costs were stated as covering expenses (travel and refreshments), course resources (e.g. printing costs) and staff salaries. Some local authorities were only able to estimate staff salaries or resource costs, rather than the total intervention costs. Reported estimated costs ranged from £8000 to £100,000 with an average annual spend of £37,290 (n=21).

The cheapest scheme, costing approximately £8000 consisted of information resource packs that were provided to schools in order that training could be coordinated, paid for and delivered at school level. The local authority stated that only half of schools requested the information packs and that those schools had no obligation to subsequently implement the scheme and the level of uptake was unknown at the time of surveying. This figure would increase if salary costs were also included.

The most expensive scheme, costing £100,000 consisted of a brief introductory classroom lesson to introduce the scheme and discuss health and safety issues. The training then consisted of eight, 40 minute roadside sessions that were conducted in all weather conditions. Rather than volunteers, the scheme made use of employed local authority staff; a training coordinator and assistant, three trainer team leaders and 20 trainers. Staff salaries amounted to 95% of the scheme budget, with the remainder spent on travel and other costs. While expensive, the scheme was delivered to 100% of the children in the target group (3940), including those with special needs, leading to a cost per head of £25.36.

In terms of training costs per head (n=12), the range was from £7.58 to £85.71 per child. This decreased overall as the coverage of schemes increased. The local authority in Greater Manchester delivering training at £7.58 targeted approximately 4290 children (1710 in year 3 and 2580 in year 5). The scheme consisted of a 1 hour practical training session in year 3 which taught the basic green cross code, how to use junctions and how to cross at parked cars. Training was carried out in a ratio of one adult to eight children. Optional worksheets were also distributed to school teachers. A refresher course was also provided in year 5 which identified hazards on the road and included the use of a 'speed gun' to see how fast vehicles were going. Training was delivered by two road safety officers. The most expensive scheme per head (£85.71) was delivered by a local authority in Scotland that continued to adopt the Kerbcraft model, opting to deliver the minimum number of recommended sessions. The scheme still used a Kerbcraft coordinator and still had a target of training 300 children per year.

### 4.2.6 Training scheme evaluation

The types of evaluations undertaken by the participating local authorities were categorised as process based, outcomes based, or summative (Sentinella, 2004). Process evaluation concerns the operation of the scheme and how this is perceived by the people involved. It allows best practice to be developed from the opinions of those involved and often takes the form of interviews. Outcomes evaluation measures the changes caused by the implemented scheme with measurement often being undertaken through questionnaires or observation. A summative evaluation takes outcomes evaluation further and seeks to determine the extent to which a scheme meets its stated objectives. As a result, the evaluation will find out how effective a scheme is against its goals and is often used to determine whether follow-on funding should be allocated to a project (Sentinella, 2004). Sentinella (2004) suggests that summative evaluation should attempt to involve an external evaluator, however this is often unrealistic as a result of resource and staffing constraint and as such internal evaluation is acceptable (Westat, Frierson, Hood, Hughes and Katzenmeyer, 2002).

Process evaluations took place in 45.5% of authorities and generally involved observation, questionnaires or recorded feedback designed to assess thoughts and feelings about the scheme. Outcomes evaluations (12.1%) generally took the form of knowledge based tests carried out in the classroom or basic roadside observations. In some cases (9.1%) both process and outcomes evaluation was implemented together. Summative evaluation took place in 24.2% of authorities and consisted of implementing the Kerbcraft pilot evaluation process, a roadside skills assessment of a similar design or other methods which allow behavioural changes over the scheme duration to be identified.

### 4.2.7 Local Authorities Not Involved in the Kerbcraft Pilot Scheme

For comparison, 17 local authorities that did not take part in the pilot scheme were approached and also provided responses. While approximately 30 authorities from across the UK were contacted the response rate was lower and this was most likely due to the lack of connection to the original scheme. The data from these authorities along with those that took part in the Kerbcraft pilot are summarised in Table 4.2.1 and Table 4.2.2. Responses received were from comparable geographic locations when compared to the sample that did take part in Kerbcraft, with authorities from London, the North, Scotland, the South and South-west all taking part in the survey. While

Local Authorities that did not respond may have done so as a result of them being less connected to the Kerbcraft trial, there was no reason indicated or subsequently identified that would preclude them from taking part other than a lack of time.

The respondents that did not offer child pedestrian training at the time of the survey stated funding or resource issues (e.g. staffing) as the main reason. No local authorities implemented Kerbcraft in its entirety; however one did adopt a similar format with the only, but noteworthy, adaptation being shorter training sessions. Irrespective of whether or not schemes were based on Kerbcraft, they all took a similar format to schemes operated in authorities that did participate in the Kerbcraft trial.

The minimum length of total practical on-street training delivered was again 20 minutes with an average practical training length of 1.33 hours. This is a statistically significant difference from the minimum number of hours recommended by Kerbcraft (one-tailed $t(9) = -16$, $p=<0.05$). No local authorities in this sample were able to report on economic costing at the time of the survey.

**Table 4.2.1: Comparing features of training schemes provided by local authorities in the UK.**

| | Local Authorities in sample indicating a positive response (%) | |
|---|---|---|
| | Involved in the original Kerbcraft pilot | Not involved in the original Kerbcraft pilot |
| Training Availability | | |
| Child Pedestrian Training delivered by authority | 84% | 65% |
| Scheme Design | | |
| No Kerbcraft influence | | 30% |
| Partially influenced by Kerbcraft | | 60% |
| Targeting Criterion | | |
| Training targeted at low SES areas | 16% | 18% |
| Training targeted at high collision areas | 14% | 27% |
| Training available to all children (no targeting) | 58% | 55% |
| Scheme content | | |
| Training covers the original Kerbcraft skills | 86% | 91% |
| Training includes other pedestrian skills | 9% | 27% |
| In class training used as part of the scheme | ~50% | ~90% |
| Scheme evaluation | | |
| Process | 46% | 71% |
| Outcomes | 12% | 14% |
| Summative | 24% | 14% |

**Table 4.2.2: Comparing features of training schemes provided by local authorities in the UK.**

| Feature | Local Authorities involved in the Kerbcraft pilot | Local Authorities not involved in the Kerbcraft pilot |
|---|---|---|
| Average amount of roadside training delivered for each child in a scheme | 3.1 hours | 1.33 hours |
| Average estimated coverage | 63% (n=20) | 64% (n=7) |
| Maximum estimated coverage | 100% (n=20) | 100% (n=7) |
| Minimum estimated coverage | 9% (n=20) | 6% (n=7) |

## 4.3 Types of training schemes identified

The results of the survey indicated that three key categories of child pedestrian training scheme were delivered to children: the original Kerbcraft system, a three session system based on Kerbcraft and a single session system.

Broadly speaking the Kerbcraft model, operated in five local authorities, is the most comprehensive scheme of the three, but as a result takes more time and resources and therefore generally achieves lower coverage than the other schemes. The scheme is based on sound educational design with frequent repetition of content and immediate feedback being core features of the scheme.

### 4.3.1 Three session scheme based on Kerbcraft

Three session schemes generally consist of three roadside sessions covering each of the aforementioned Kerbcraft training skills. They may also include other skills not explicitly mentioned in the Kerbcraft training manual.

Typically these schemes cover three lessons covering the following material:

- **Lesson 1:** The green cross code, how to cross the road and what to wear.
- **Lesson 2:** Where to cross, how to use crossings and choosing safe places to cross.
- **Lesson 3:** Keeping safe on pavements, playing safely and crossing between parked cars.

Not all schemes cover parked cars crossing, depending on the nature of the roads around the schools. For example rural schools may tent to not have a suitable site for practicing this skill. Many schemes would also include a classroom based element where, for example, a workbook could be completed with road safety puzzles and crosswords.

While this type of scheme does cover the core Kerbcraft content it is much less comprehensive, reducing contact time and therefore repetition of content. This could indicate that the educational effectiveness of a reduced scheme is likely to result in less deep learning with content being stored in the long-term memory. Such schemes should be evaluated for effectiveness and may require other supporting material to ensure the long-term uptake of key messages.

### 4.3.2 A single session scheme

Broadly speaking a single session scheme would offer one short scheme of approximately thirty minutes to an hour that attempted to cover the aforementioned road safety skills. There were exceptions to this where a morning or afternoon of curriculum time would be devoted to road safety training so children still received a single, but this time longer, training session. In contrast to the Kerbcraft curriculum a single session scheme, while incorporating the content, is void of almost all of the key educational principals suggested to be required for effective learning and skills uptake to take place. There is a distinct lack of repetition of material and time to practice skills compared to the other types of scheme and this is likely to impact upon scheme effectiveness. With few evaluations of short schemes looking at the impact on behaviour, this should be explored in future research or ideally as part of scheme design with evaluations of effectiveness taking place once a scheme has been completed.

### 4.3.3 Comparing scheme categories

Some indicative characteristics and figures outlining some of the typical characteristics of the three schemes highlighted are shown in Table 4.3.1. It is clear that the schemes all deviate from the Kerbcraft model, becoming less comprehensive in terms of the time allocated to practical on-street training and with the addition of classroom based elements.

**Table 4.3.1: Illustrative characteristics of the three typical types of pedestrian training schemes**

| | **Kerbcraft** | **Three Session** | **One Session** |
|---|---|---|---|
| **Is the scheme based on Kerbcraft?** | Not applicable | Yes | Yes (to a lesser extent) |
| **Number of roadside sessions** | 12 | 3 | 1 |
| **Single roadside session length (minutes)** | 30 | 20 | 20-60 |
| **Skills targeted** | Finding safe routes and places<br>Crossing at junctions<br>Crossing between parked cars | | |
| **Classroom sessions included** | No | Generally yes | Generally yes |
| **Average single classroom session length (minutes)** | - | 20-30 | 20-30 |
| **Classroom delivery medium** | - | Workbooks<br>Videos | Workbooks<br>Videos |

### 4.3.4 Case Study: Streets Ahead

The Streets Ahead pedestrian training scheme is an example of a three session scheme based on Kerbcraft, with classroom elements. Streets Ahead is delivered by volunteers (usually parents) under the supervision of the road safety team at the local authority. It consists of three one hour lessons with half of each being practical roadside / playground training and the other half being a road safety focused workbook.

The three lessons cover the following material:

- **Lesson 1:** The green cross code, how to cross the road and what to wear.
- **Lesson 2:** Where to cross, how to use crossings and choosing safe places to cross.
- **Lesson 3:** Keeping safe on pavements, playing safely and finding the safest route.

#### *4.3.4.1 Administration and operation*

The scheme is essentially delivered by volunteer trainers and as a result, a large amount of administration is necessary in order to ensure the scheme runs safely and effectively. The scheme administration is carried out by one or more road safety officers at the Local Authority

#### *4.3.4.2 Scheme set up*

Prior to Streets Ahead taking place, the support of the school Headteacher and Year 2 staff is required to ensure that children leaving class for training will not cause disruption. Once achieved parental consent for children to take part must be sought. Once a school is interested in taking part, the road safety team assess the surrounding roads and approve a safe training route. Finally the course is authorised by the local authority and training materials and safety clothing is issued to the school.

#### *4.3.4.3 Trainer nomination and training*

Trainers tend to consist of parents, grandparents and in some cases teaching and learning assistants. To ensure the safety of children, all trainers are nominated by the participating schools' Headteacher and are subject to a Criminal Record Bureau check prior to being accepted.

All trainers are mandated to attend a training session delivered by the local authority road safety team at least once, while trainers who have previously taken part in previous years are encouraged to attend to reinforce the material previously learned. Taking approximately two hours, this training session introduces the programme structure and content as well as setting out the strict rules prior to training taking place. The session takes the form of a presentation, with no roadside elements.

#### *4.3.4.4 Insurance*

Taking children out onto the street carries inherent risk, and as a result all trainers are covered by Third Party and Professional Indemnity insurance whilst carrying out training for the council.

In order to be covered by this insurance, strict guidelines set out in the training session must be adhered to. Specifically, trainers (and children) must be using the approved route, wearing high visibility jackets and holding hands.

#### *4.3.4.5 Monitoring*

Each programme is monitored by the road safety team at various intervals. This process involves visiting the schools to ensure that trainers are carrying out training correctly; paying particular attention to ensure the approved route is being used and that the trainers are holding hands with the children. Where a problem occurs, the trainer in question is spoken to and reassessed at a later date. Failure to adhere to the scheme's rules can result in the trainers being removed.

#### *4.3.4.6 Scheme Coverage*

While the scheme coverage is growing year upon year, not all children in within the authority get access to training. Some schools opt not to take part in the scheme, whereas others are not included as they have not fallen within a roll-out area.

The 2009/10 (latest confirmed figure) academic year saw the greatest number of children taking part in Streets Ahead, with approximately 3100 trainees. Uptake over the last five years can be seen in figure 4.5.1.

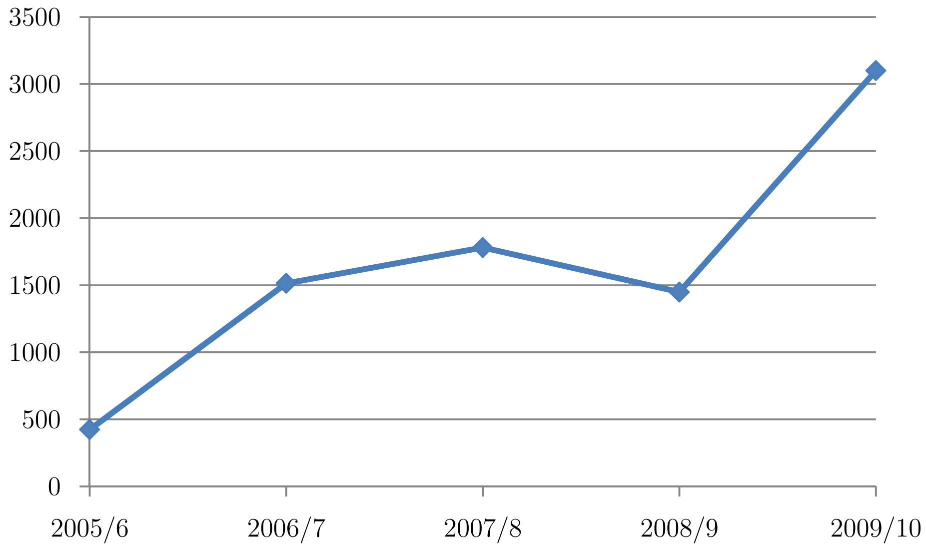



**Figure 4.5.1: The number of children taking part in Streets Ahead annually 2005-2010.**

#### *4.3.4.7 Scheme effectiveness and areas for improvement*

Streets Ahead is neither quantitatively nor qualitatively evaluated and hence the effectiveness of the scheme cannot be verified. With this, and a number of other issues raised, there are a number of possible improvement areas:

- The introduction of an on-going scheme evaluation process to ascertain the effectiveness of training
- Digitising the administration process to remove the need for a number of paper based forms
- The possibility of improving in-class elements of the scheme to target behaviour or replacing in-class with on-street training.

#### *4.3.4.8 Comparison of Training*

Table 4.3.2 compares some of the key characteristics of the Kerbcraft model and the Streets Ahead pedestrian training scheme.

**Table 4.3.2: Comparing training schemes.**

| | **Kerbcraft** | **Streets Ahead** |
|---|---|---|
| **Based on** | - | Kerbcraft |
| **Number of roadside sessions** | 12 | 3 |
| **Average single roadside session length (minutes)** | 30 | 20 |
| **Skills targeted** | Finding safe routes and places<br>Crossing at junctions<br>Crossing between parked cars | Finding safe routes and places<br>Crossing at junctions<br>Crossing between parked cars |
| **Number of classroom sessions** | 0 | 3 |
| **Average single classroom session length (minutes)** | - | 20 |
| **Classroom delivery medium** | - | Workbooks<br>1 helper : 3 children |

## 4.4 Discussion

Broadly speaking the two samples of local authorities deliver similar types of pedestrian training schemes; using similar methodologies with the practical training elements approximately similar to the *principals* of Kerbcraft. The key differences between the two samples relate to scheme content; the amount of roadside training allocated per child and the introduction of in-class elements of the training scheme. Variation in these elements is likely to have an impact on the quality of training provided at different locations across the country.

### 4.4.1 Variation in scheme content

The majority of Local Authorities surveyed perceived child pedestrian training to be an important resource and were implementing schemes within a period of resource constraint and during an uncertain time for road safety funding; a key driver for the quality and scope of child pedestrian training. Many local authorities biggest concerns were related to the availability of financial resource and a lack of funding is likely to impact on the scope and length of training local authorities can offer.

While shortening schemes, compared to the original Kerbcraft model, may well present an issue as children receive less time on-street, the bigger issue is perhaps the resulting inequality of training provided between local authorities across the country; provision in certain areas is far more comprehensive than others. If it proves that more comprehensive schemes are more effective in improving pedestrian skills, those children with less training may be at a disadvantage. It is therefore apparent that scheme evaluation is necessary in order to demonstrate the impact of individual schemes.

### 4.4.2 Scheme evaluation

Statistical evaluation of scheme effectiveness from collision statistics is complex due to the large number of confounding factors in any reported collision along with the fact that a casualty's participation in a given training scheme would be unknown. Along with weather, time of day, location, road type and road surface, other confounding factors such as engineering upgrades, level of enforcement and other road safety educational initiatives, implemented concurrently with pedestrian training, would be impracticable to control for without further data.

Unfortunately assessing the extent to which the changes to scheme methodologies presented have impacted positively or negatively on the quality of training provision is therefore problematic due to the nature of evaluation undertaken. While process and outcomes based evaluations are effective in assessing the effectiveness of delivery processes and the level of knowledge acquisition, they do not always go as far as assessing the impact on behaviour following scheme delivery and are the evaluations carried out in most of the local authorities due to their cost effectiveness.

### 4.4.3 Policy Implications

Despite Kerbcraft being advocated by the UK Government as the foundation for pedestrian training, recent financial pressures may induce local authorities to deliver less on-street training and more in-class, teacher led activities, which are potentially less resource intensive than those delivered at the roadside.

The results suggest that this trend was already materialising in surveyed authorities and yet current guidance states "*The Kerbcraft scheme remains the basis for children's practical road safety training…We encourage Local Authorities to adopt Kerbcraft of similar child pedestrian training schemes, rather than anything that is watered down or* *less effective, and target it on high risk areas and groups"* (Department for Transport, 2011).

The results indicate that despite this guidance there was a demonstrable deviation from the Kerbcraft model taking place potentially leading to schemes that, despite the guidance, could potentially be considered "watered down" versions of Kerbcraft. These watered down schemes are most likely to reduce the amount of repetition which is seen as an important learning mechanism (See Chapter 3). While the deviation in itself may not be an issue, there is a clear need to ensure new schemes are still effective in changing behaviour through evaluation and that a consistent method of evaluation should be used in order to allow easily for comparison between authorities. Alongside this the fact that the majority of survey respondents have deviated from the Kerbcraft model in some way suggests that the model may need revisiting to assess which elements of the model are the most critical for inclusion in adapted schemes.

The prevailing theme that is consistent among all adapted schemes is a shorter training programme that is based on the Kerbcraft principals and in some cases includes classroom based elements. Research should be undertaken to assess the most effective combination of teaching methods and the effectiveness of shorter schemes and this should be integrated into future policy decisions.

In the meantime it is clear that Local Authorities have a wealth of knowledge regarding pedestrian training schemes this knowledge should be shared more freely among all parties involved through existing centralised channels of communication in order to reduce the variation in delivery amongst local authorities.

### 4.4.4 The international perspective

There is limited research documenting national pedestrian training programs on an international level. One key piece of research, *Inventory and compiling of a European* *good practice guide on road safety education targeted at young people* ('ROSE 25'), invited transport departments in EU countries to document their RSE programmes as part of the research. The lack of detail in responses hinders the potential for a comprehensive comparison of training; however the report does document the reported level of pedestrian training (Table 4.4.1) in respondent countries (European Comission, 2005).

**Table 4.4.1: Levels of pedestrian training in EU countries**

| Country | Pedestrian Training | Country | Pedestrian Training |
|---|---|---|---|
| **Belgium - Dutch** | +++ | Lithuania | n.a. |
| **Belgium - French** | + | Luxembourg | +++ |
| **Czech Republic** | ++++ | Hungary | ++++ |
| **Denmark** | +++ | Malta | ++ |
| **Germany** | ++++ | Netherlands | ++ |
| **Estonia** | + | Austria | ++++ |
| **Greece** | + | Poland | +++ |
| **Spain** | +++ | Portugal | +++ |
| **France** | + | Slovenia | ++++ |
| **Ireland** | ++++ | Slovakia | ++++ |
| **Italy** | n.a. | Finland | ++++ |
| **Cyprus** | ++++ | Sweden | n.a. |
| **Latvia** | None | United Kingdom | ++ |

**Key**

| | |
|---|---|
| ++++ | 70-100% of schools |
| +++ | 40-70% of schools |
| ++ | 10-40% of schools |
| + | A few schools (10%) |
| None | No schools |
| n.a. | No assessment |

## 4.5 Conclusions

Local Authorities should be commended for their commitment to child pedestrian training given the financial climate and limited ring-fenced funding. This research has identified significant differences between current pedestrian training delivery strategies and the Kerbcraft model and while this may not necessarily be detrimental, the effectiveness of these new schemes needs documenting. It is clear that the fundamentals of Kerbcraft still persist as the basis for all pedestrian training and as such Kerbcraft still remains a comprehensive and effective model for local authorities to attempt to replicate.

## Chapter Four Summary: Key Points

- Local authorities surveyed generally offered some form of pedestrian training, however the use of the Kerbcraft model was not the status quo.
- Pedestrian training schemes were generally variations of Kerbcraft, often shorter in length and lacking the same number of sessions.
- Many training schemes include in-class elements such as paper based activities (e.g. word searches) aimed at knowledge acquisition.
- There may be scope to improve in-class activities to ensure they target behaviour.
- Kerbcraft should remain the ‘gold standard’ approach to pedestrian training unless variations are also shown to be effective through robust evaluation methods.

# Chapter 5

# Interactive Video as a potential aid to child pedestrian training in the United Kingdom

Chapter Four highlighted the fact that Local Authorities have already and are continuing to introduce paper-based in-class activities into pedestrian training schemes, often replacing a significant proportion of practical training. These paper-based activities have been shown to be less effective than practical training (Zeedyk, Wallace, Carcary, Jones and Larter, 2001)as, while they are likely to aid in improving knowledge, there is limited opportunity to improve skill acquisition. This chapter highlights some key previous attempts at using interactive media to aid the skill acquisition of vulnerable road users before presenting an argument that Interactive Video should be considered as a new in-class activity that may offer a more engaging and effective method of improving pedestrian skills from within the safety of a classroom environment.

## 5.1 Interactive computer based training for Vulnerable Road Users

Interactive computer based training as a method to improve child pedestrian roadside behaviour has been trialled on a number of occasions, with different elements showing promise in improving skill acquisition. From 1998 to 2000 a 'computer based pedestrian training resource', designed to target four key pedestrian skills was developed for the Department for Transport (Foot *et al.*, 2002). The skills the resource targeted were; finding safe places to cross, vehicle awareness, gap timing and acceptance procedures and the perception of other road users' intentions. Using an animated environment, shown in Figure 5.1.1 to Figure 5.1.3, the resource simulated realistic road traffic scenarios with the aim of teaching children, aged 5-11, pedestrian skills to a comparable level of effectiveness as practical roadside training (Foot *et al.*, 2002).

The training resource was developed using Macromedia Director 6.0 resulting in a simple animated environment that children could interact with by clicking on on-screen buttons (Figure 5.1.2) (Foot *et al.*, 2002). The software would give instant feedback to users by, for example, by allowing an avatar to cross the road if the participant selected a safe place. Initially a trainer would assist children through the use of the game, taking a proactive approach to answering questions, before retreating into the background to only offer support, once a child had understood the premise. This adult guidance, along with peer-collaboration of children, formed part of the learning process; allowing children to ask questions to begin with, but encouraging them to make independent decisions as time progressed (Foot *et al.*, 2002).

The training was assisted by parent volunteers who were trained by the researchers and children received four training sessions for each skill, each lasting approximately 20-30 minutes. Time constraints were cited as a barrier to some elements of their evaluation.


**Figure 5.1.1: Animated learning environment used in the child pedestrian training resource.** (Foot *et al.*, 2002)


**Figure 5.1.2: Finding safe places. The user can click to look left and right.**

**Figure 5.1.3: Gap timing training.**

Behavioural impact evaluation consisted of a pre and post assessment at locations adjacent to participating schools where skills were assessed. The evaluation found that the training resource developed by Foot *et al.* (2002) was partially successful in the above aims and while it was never intended to be a standalone training solution, the resource "led to substantial improvements in both roadside behaviour and children's understanding in all four of the skills dealt with, and in all three age groups," using the pre and post-test evaluations.

The exception to this success was shown in younger children, aged 6, when finding safe places to cross who showed no improvement in safe route construction post training. This is a very significant issue given that training schemes delivered by local authorities are generally aimed at the 5-7 age group in which this type of interactive tool is ineffective. Foot *et al.* (2002) suggest the reason for this is a lack of learning transfer from the simulated environment to the roadside. Any future developments in interactive learning aimed at child pedestrians will have to focus on making this learning transfer more effective.

An improvement to the simulated environment used in the resource developed by Foot *et al.* (2002) could be the use of video scenarios rather than computer generated animations to aid the transfer of learning from resource to road to take place. Indeed, the CIVITAS initiative identified a need for "new innovative tools to support and improve behaviour-based training programmes;" and one method suggested was the use of interactive video (Melson, 2009).

In 2005, CIVITAS funded the development of a video-based behavioural traffic training programme, targeted at vulnerable road users in Odense, Denmark. The video-based interactive game was designed to be an example of best practice in Europe and to provide a concept that could be transferred elsewhere (Melson, 2009). The interactive cycle training tool, "B-Game," supplemented a practical cycling test for pupils aged 11-12 years. During the game, using on-screen / keyboard controls, children are required to cycle from one point in the city to another encountering various scenarios and dangers along the way. Points are scored for safe cycling behaviour and instant feedback is given to the users. An overview of the training resource developed is shown in Figure 5.1.4 to Figure 5.1.8.

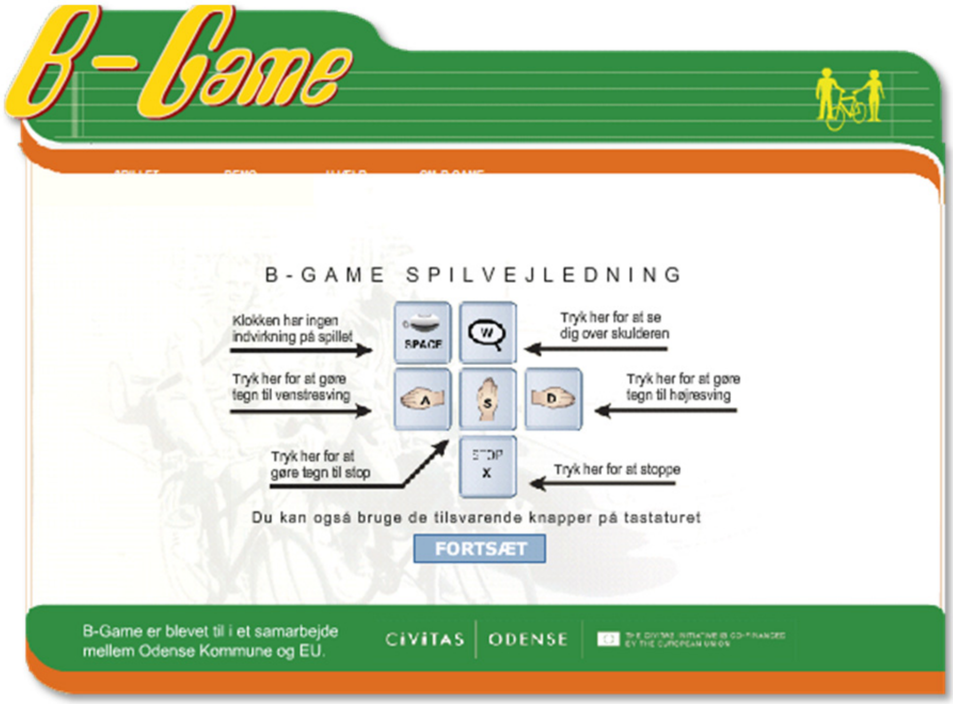



**Figure 5.1.4: B-Game introduction to controls**

The user receives a demonstration of the on-screen controls via static descriptions of the buttons using text. Importantly this assumes that the user has an appropriate reading ability and no verbal instructions are provided. An improvement to this could be to have verbal and visual instruction to improve accessibility of the tool.


**Figure 5.1.5: B-Game introduction to resource features**

An introduction to the training resource layout and features takes place. The introduction is predominantly static and a dynamic introduction to the resource could improve the understanding of the resource prior to use.


**Figure 5.1.6: B-Game: Scenario selector**

The user chooses a girl that they would like to meet at a cinema in the city. Scenarios like this may improve the relevance to "real-life" and improve the transfer of material from the screen to the road environment.


**Figure 5.1.7: B-Game Interactive Video**

Following the directions given in previous sections of the game, the user must safely navigate through the city to the destination, avoiding any hazards encountered. Control of the interactive video is via the keyboard and on-screen buttons which may not be immediately intuitive, especially for younger children with lower levels of motor skills. Simplifying the control mechanism may be necessary to apply this type of resource to younger age groups.

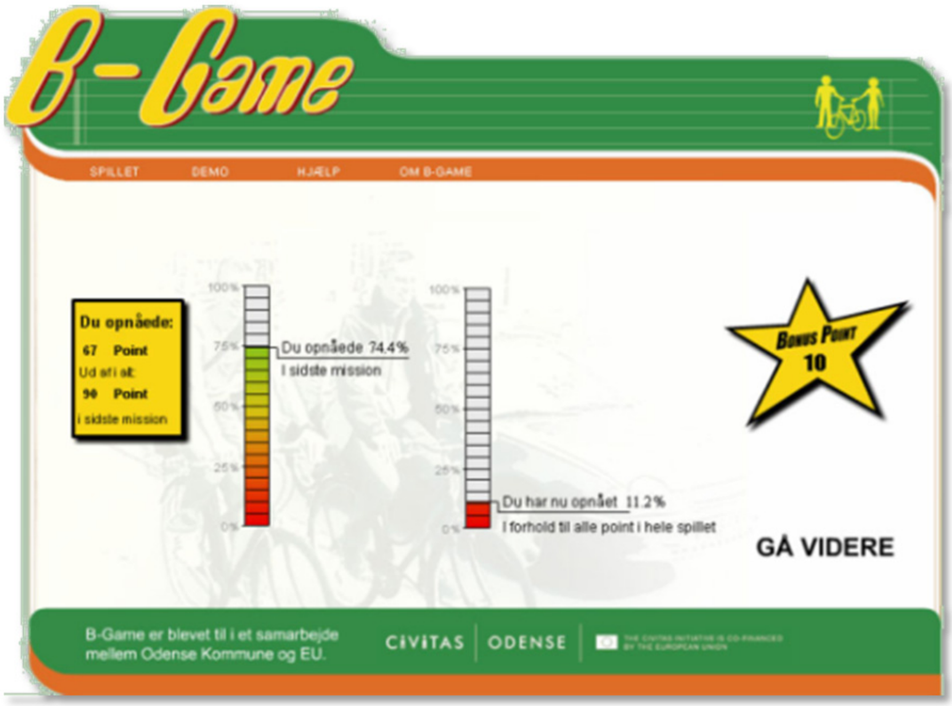



**Figure 5.1.8: B-Game scorecard**

The game scorecard ensures that instant feedback is given to the user, informing them of their 'score' based on the decisions the user made while traveling.

The main aim of the B-Game project was "to demonstrate and document that the use of behavioural training can improve traffic safety for children…targeting 4,000 school children at 40 schools in the City of Odense" (Melson, 2009). Due to numerous barriers such as a lack of teacher involvement and some technical web-hosting problems, the resource was only used 1694 times and no behavioural evaluation took place; so while a transferable concept for video training was developed, the study unfortunately provided no evidence that interactive video was effective in changing on street-behaviour (Melson, 2009). Melson (2009) highlights a number of barriers that hindered the research progress:

- Time pressure in schools from other external training and educational programmes e.g. drugs, alcohol and health. Many schools did not participate in the road safety programme as a result.

- A lack of interest from class teachers who had not had the time to "try out the programme themselves". Melson (2009) argues that if teachers were given the time to use the system they would have been more likely to want to be part of the trial.

- No national participation was secured from the National Safety Council as they were busy with their own measures. They were not part of the research contract (Mobilis) and had less interest in being involved in the project.

- The need for teacher involvement (in using an administration system to run the tool) put many teachers off taking part due to the complexity of the administration and the associated time required.

- The game was hosted by a private company and this company contractually limited distribution to local schools. Wider distribution would have incurred additional cost.

Melson (2009) concludes that "the game should have been simpler to use and made available for everybody to play for free online. That way the students could have used the game wherever and whenever they wanted! "

Part of the knowledge gap in terms of the impact of interactive video on behaviour is provided by the Interactive health and safety tool developed at the University of Southampton which showed that interactive video, of 'real life' scenarios can in fact enhance a users' learning experience and that it has the potential to teach various 'hard' and 'soft' skills (i.e. skills that are procedural or require human interaction) (Cherrett, Wills, Price, Maynard and Dror, 2009). The health and safety tool developed was based around a video aimed at engineering students highlighting the risks associated with setting up a traffic engineering experiment on a busy road. The video centres around footage captured of individuals engaging in undesired, risky behaviour, filmed in a controlled environment. Undesired behaviour demonstrated typical risks that a user may encounter when carrying out an activity and the interface allowed the users to highlight hazards as the video played. For example the film demonstrated a researcher setting up a video camera with no method of effectively stabilising the tripod. This could be clicked on by the user in order to elicit a response from the video interface. This style of training may therefore lend itself to teaching "hard" child pedestrian skills (Cherrett, Wills, Price, Maynard and Dror, 2009).

Similar studies of interactive software environments which portray real life scenarios have shown that interactive software can have a statistically significant positive impact on the users' skills post training (Surface, Dierdorff, Watson and Command, 2007) (Rockman et al., 2009).

The United States Army, Australian Defence Force and other military organisations around the world use an innovative piece of interactive software in order to teach warzone languages to troops. Known as the Tactical Language and Culture Training System, the interactive environment can teach languages including Iraqi, Pashto, French and Dari. As of 2007, over 20,000 U.S. servicemen alone had been trained using the system (LLC 2007).

Learning occurs in a "fun, 3-dimensional and immersive" videogame environment which simulates real-life theatre situations that soldiers may encounter. The system is fully interactive, allowing users to move around a virtual environment and verbally interact with virtual residents in order to learn languages. The system analyses verbal user responses and then is able to respond on the basis of what is said, how it is said and how much cultural sensitivity has been used in communication (LLC 2007). The system environment can be seen in Figure 5.1.9.


**Figure 5.1.9: Tactical Language and Culture Training System interactive learning environment** (LLC 2007)

A review of the training system carried out by Surface, Ward and Associates found that all groups of trained users showed "statistically significant increases" in language skills and cultural knowledge as a result of using the system, also indicating that 65% of speech attempts were correct (Surface et al. 2007).

Language training software is being increasingly designed around the Rosetta Stone model of learning where the learner hears words and learns to associate them with certain surroundings, things or situations (images and sounds) before being able to use them in sentence construction (Rosetta Stone 2010).

The Rosetta Stone system consists of the Rosetta Stone online language software, Rosetta Studio sessions which allow users to practice language skills with a real tutor and audio CDs (Rockman et al. 2009). An example screenshot from the interactive online language software is shown in **Figure 5.1.10**.

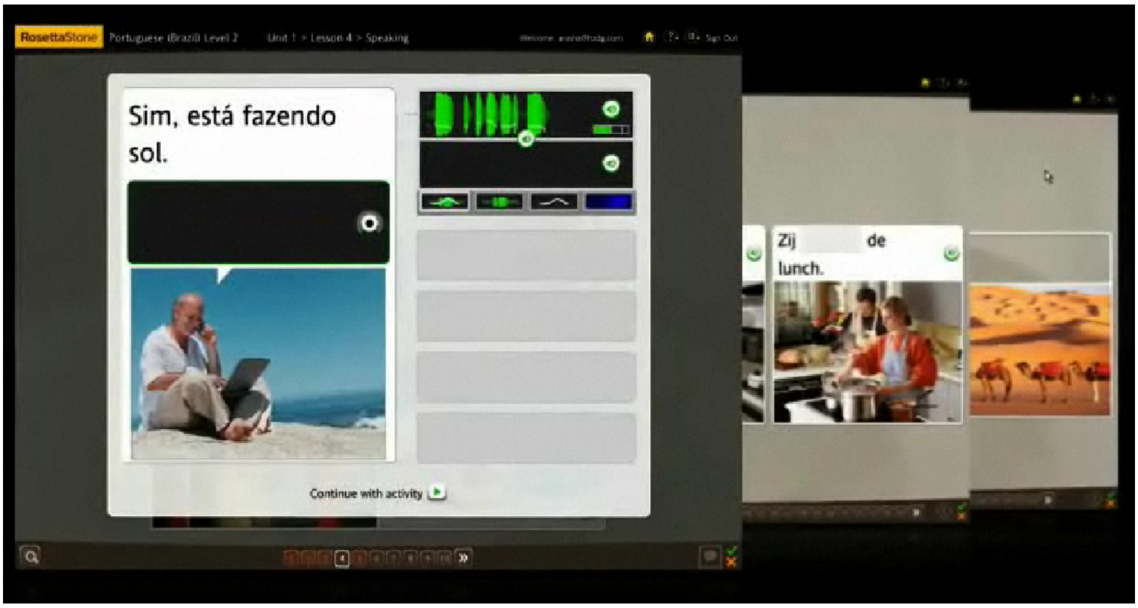



**Figure 5.1.10: The Rosetta Stone online language software interactive learning environment**

The Learn Spanish version of Rosetta Stone system was evaluated by Rockman et al in 2009. They determined that the interactive system was an effective and efficient means of learning Spanish and all participants gained significant language improvements. More importantly, because a diverse sample of people were used in the study (with differing ethnicities, educational backgrounds, ages and incomes), the study concluded that the same improvements would be seen in the larger population (Rockman et al. 2009). This suggests that this type of computer based interactive learning environment are an effective means for teaching a variety of different people; which may lend them to being effective as a teaching aid in road safety education.

## 5.2 The Scope for Interactive Video in Pedestrian Safety Training

As discussed, various forms of Interactive Media, (a combination of sounds, images, video and text in a structured interactive computer-based environment that a user interacts with in order to directly affect their experience or outcomes (Lee, 1999, England and Finney, 2002), exist in the realm of road safety education, training and publicity activities. Regarding the training of pedestrian skills, several forms of interactive media have been considered; i) *Virtual Reality* environments where a user controls an animated avatar in a simulated roadside environment, allowing them to explore roadside environments and experience risk in a safe setting (Bart, Katz, Weiss and Josman, 2006, Katz *et al.*, 2005, McComas, MacKay and Pivik, 2002) ii) *Animated Games* where a user will interact with an animated game; often focused on specific road safety learning outcomes (Dft, 2009, Foot *et al.*, 2002) ii) *Interactive Videos* where a user interacts with a video of real roadside environments to influence the outcome of the activity (Chambers, 1997).

Animated games are perhaps the most common form of interactive media available on road safety websites, covering a considerable range of scenarios and road safety material. While widespread, the majority of these games are focused on knowledge acquisition (Fokides and Tsolakidis, 2008) and not behaviour change so add little value to pedestrian training schemes where the required outcome is improved skills and awareness.

Virtual reality environments have been shown to make some improvements in road safety knowledge and behaviour of pedestrians at the roadside (Bart, Katz, Weiss and Josman, 2006, Katz *et al.*, 2005, McComas, MacKay and Pivik, 2002, Thomson *et al.*, 2005), Bart, Katz, Weiss and Josman (2006) developed a virtual reality crossing environment where the aim of the interface was for a user to guide an avatar safely across the road. The player could look left and right using keyboard shortcuts and a successful crossing resulted in progressing to the next level where the player would encounter increased difficulty. When a collision occurred, the player experienced a braking sound and the avatar was returned to the start of the level.

In a study with 86 participants aged 7-12, Bart, Katz, Weiss and Josman (2006) found that children who took part in virtual reality training (Figure 5.2.1) showed statistically significant improvements in behaviour both in the virtual reality game and on-street at a crossing assessment site. Behaviour was assessed using simple checklists to look for safe crossing behaviours which were subsequently coded and scored. A similar study was carried out with right-hemisphere stroke patients (Katz *et al.*, 2005).

**Figure 5.2.1: Virtual reality pedestrian crossing (Bart, Katz, Weiss and Josman, 2006).**

McComas, MacKay and Pivik (2002) developed a realistic virtual reality crossing environment that consisted of eight intersection crossings and was played on three computer monitors in a semi-circle. Children used the tool for 30-40 minutes in a school setting. Pre and post training assessments were carried out on street using an innovative approach; participants were tagged with reflective stickers and were observed by research assistants for one week before and one week after training. Participants gained one point for each safe behaviour that was exhibited (walking on the footpath, stopping at the kerb, looking before crossing and staying alert). No significant improvement in behaviour was demonstrated in an urban school however effects were significant in a suburban setting.

The transfer of road safety education into safe street and crossing behaviour can be problematic (Bart, Katz, Weiss and Josman, 2006, Foot *et al.*, 2002) Young children especially, may have difficulty transferring knowledge acquired in a simulation on a computer into safe behaviour at the roadside (Foot *et al.*, 2002). This lack of transfer may be because the cognitive skills in young children limit their ability to think from a different perspective (Percer, 2009), making it difficult for children to associate a simulated environment with a real roadside environment. The majority of virtual reality training demonstrations also rely on relatively expensive computer peripherals (such as multiple screens), which would contribute to and not reduce the cost of current training schemes on offer.

Interactive video creates a multi-sensory learning environment (Zhang, Zhou, Briggs and Nunamaker, 2006) and has been shown to increase an individual's ability to transfer information from the short-term to long-term memory (Cairncross and Mannion, 2007). It may offer a cheap and yet effective alternative to virtual reality environments and can be defined as 'the use of computer systems to allow proactive and random access to video content based on queries or search targets' (Zhang, Zhou, Briggs and Nunamaker, 2006). Modern technologies allow interactive video to be used alongside other multimedia such as graphics, simulations and even other videos in order to attract a users' attention to a specific issue.

The use of interactive video in road safety education was considered as early as the 1980s with the development of interactive videos by a prominent insurance company for a road safety campaign in the UK (Chambers, 1997, Cummins, 2003). These older systems relied on dedicated interactive video machines to read the videos from special discs (Chambers, 1997). Recent studies have shown interactive video to be effective in improving roadside hazard awareness skills in kindergarten to third grade students (Glang, Noell, Ary and Swartz, 2005) and has also been used in the development of a European best-practice teaching tool, "B-Game", targeting school-aged cyclists (Melson, 2009). Alongside applications in road safety, Interactive Video has also been successfully used in health and safety, and medical training (Dror, Schmidt and O'connor, 2011, Cherrett, Wills, Price, Maynard and Dror, 2009) and demonstrates the potential to train users in 'hard' procedural skills (Cherrett, Wills, Price, Maynard and Dror, 2009), making the medium applicable to road safety training in which step-by-step 'hard' procedures are taught. Critically, interactive video studies have seldom been evaluated to determine their effectiveness in changing actual behaviour on-street in live roadside situations over time, and because each video contains footage of real, rather than simulated environments, the transfer of information to behaviour will be aided by the fact that children will not have to 'translate' from a simulated to a real environment.

The interactive videos developed by both Cherrett (Cherrett, Wills, Price, Maynard and Dror, 2009) and Dror (Dror, Schmidt and O'connor, 2011), were based on the same principle; asking players to identify hazardous behaviours in the video by clicking directly on 'hot-spotted' elements as it played. A hot-spot in this instance can be defined as *an interactive element of video with defined boundaries (which change in time with the video) that can be clicked on by a user in order to trigger a pre-defined* *event*. Correct identifications would pause the video and require further input from the player before the video would continue. In both demonstrations, the interactive video was split into several key sections; one in which undesirable behaviour was shown and where correct hazard identifications would result in a hazard perception score and another a subsequent section where desirable 'best practice' behaviour was demonstrated.

"B-Game" followed a similar principle, this time in the domain of cycle safety. The users viewed footage from a cyclist's perspective, covering a variety of dangerous scenarios. They were required to complete various journeys safely, using a variety of on-screen and keyboard controls such as hand indications and stopping. If the player carried out the correct 'manoeuvres', they would progress to the next level. Players would receive a score at the end of each level and following completion of the game, a diploma would be sent to parents outlining the child's performance.

It is important to note that interactive video as a tool to aid learning will not be effective unless it is carefully designed to enable the information to be retained in long term memory. One must also be careful not to overload and distract the player from the actual learning materials, which is particularly important when dealing with children and learning through the process of experiencing failure (Schank, 1997). Schank (1997) argues that experiencing failure encourages a learner to think of reasons why they have failed, ultimately creating a strategy for reminding the learner what they should do in a similar situation.

For interactive video to be effective, as well as adopting key educational theory (see Chapter 3) it must also incorporate control, challenge, and commitment (Dror, Ashworth and Stevenage, 2008) as when the player has control over their learning, they become more involved and participate in the learning process which is critical to maximizing engagement. When players are challenged and are committed to the learning process, the cognitive system is utilized properly and learning is most effective.

While the numerous studies described have shown the possible benefit of computer based interactive learning Dror (2008) argues that for it to be effective, any technology enhanced learning (TEL) must promote the 'three C's of learning: Control, Challenge and Commitment:'

***Control*** is the extent to which learners have command over what they learn. In order to maximise learning, this control must be passed onto the learners without detriment to the learning process. This control may allow a learner to choose what they learn and how they learn it. For example a learner could have control over; whether they learn any given topic, the learning method (e.g. video, audio or text) and the pace and/or order of the learning (Dror, 2008).

***Challenge*** is required to keep learners engaged and motivated during the learning process in order to ensure that the learner feels that they have accomplished a task at the end of an activity. Using TEL, this can translate to a 'gaming' scenario, where learners are provided with a measurement of success as the learning progresses (Dror, 2008).

***Commitment*** is the final trait required for TEL to be effective. If the user is not committed to learning, they will not achieve the required goals. Control and challenge can lead to commitment so it is suggested that a gaming environment can help accomplish commitment (Dror, 2008).

By ensuring any computer based road safety intervention accounts for the way children learn, and that it is appropriate to their level of cognitive development the effectiveness of the intervention will be maximised.

## 5.3 Making Technology Enhanced Learning more effective

A number of factors will drive the success of a technology enhanced learning (TEL) platform. For example it is critical that the underlying cognitive and psychological principles underpinning effective technology enhanced learning are considered in the development of new interactive road safety training material.

### 5.3.1 The need to support the cognitive system

While it is out of the scope of this research to explore the underpinning physiological mechanisms that explain cognitive function and processing, it is important to tailor technology enhanced learning such that the mind is able to assimilate and understand the relevant information effectively. It is therefore important to support the cognitive system and as well as the Educational Theory outlined in Chapter 3, there are a number of examples that demonstrate the importance of designing TEL with the cognitive system in mind.

Take for example the ‘Stroop Task’ (see Figure 5.3.1). When a participant is given a seemingly simple task; it is difficult for the brain to name the ink colours, rather than reading the words. In this case, most humans of reading age are so familiar with reading words, that it takes extra cognitive effort to ignore the words and instead say the colours (Dror, Schmidt and O'connor, 2011, Baars and Gage, 2010). While the example is abstract, it demonstrates the need to design electronic teaching systems to enhance and make learning simple (rather than detriment it, as is apparent in the Stroop task.). “Brain friendly” TEL, that supports natural cognitive processes and makes it easy for the mind to learn is therefore required in order to create effective educational resources (Dror, Schmidt and O'connor, 2011).


**Figure 5.3.1: The Stroop test.**

*Quickly name (out loud) each of the colours (not the words) as you read along each row.*

### 5.3.2 E-learning vs. Technology enhanced learning

The literature tends to use the terms ‘e-learning’ and ‘technology enhanced learning’ synonymously; while there are similarities there are also significant differences between their respective underpinning philosophy.

Zhang, Zhao, Zhou and Nunamaker Jr (2004) define e-learning as “technology-based learning in which learning materials are delivered electronically”. As such e-learning has no emphasis on improving learning methods; rather it is merely a medium for teaching and information dissemination. The definition implies a technology driven process and therefore e-learning systems alone may not enhance learning; rather they just present classroom-based material using a new medium (Dror, Schmidt and O'connor, 2011, Singh, 2003).

Dror et al (2011) state that Technology Enhanced Learning (TEL) goes further than e-learning, in that rather than being a technology driven process, the design of TEL systems should be driven by the underpinning principals of ‘cognitive neuroscience’. Or put simply, the technology used to enhance learning must be “brain friendly”. TEL systems are therefore designed specifically for enhancing the learning process, rather than merely transcribing traditional teaching to computer-based delivery environments.

### 5.3.3 Developing "Brain Friendly" TEL: Interactive Video and mobile gaming as a TEL delivery platform

Video is one delivery medium which demonstrates the difference between e-learning and TEL. A video presented in a standard e-learning environment can only be viewed passively and therefore lack engagement at relevant moments in the video where learning outcomes are apparent. The same video in a TEL system however, could be made interactive; engaging learners directly with the video so that they actively participate in understanding the learning outcomes. Learners can have the opportunity to select objects in the video, highlight problems or hazards and answer questions and can also receive instant performance based feedback and scores. A TEL interactive video would therefore be more "brain friendly" than a non-interactive video presented in the majority of e-learning environments (Dror, Schmidt and O'connor, 2011).

Further engagement and interactivity could be introduced using mobile gaming, which can offer a "powerful and engaging learning experience" to users (Facer *et al.*, 2004). By allowing interaction between the physical and the digital world mobile gaming can enhance the conceptual understanding of activities, rather than just increasing knowledge.

Facer *et al.* (2004) developed an interactive, mobile "Savannah" game which was played on a Personal digital assistant (PDA). The game, which took place in a school playing field, allowed children, aged 11-12, to assume the role of a Lion and 'see', 'hear', and 'smell' the 'Savannah' environment simply by interacting with the PDA game interface (figure 5.3.2). As they moved around the playing field, the users would see images changing on the PDA dependent on their location determined by the global positioning system (GPS). Alongside this they would hear sounds of the savannah environment via headphones and they could 'sense smells' through images of animals and pictures of paw prints. Children were expected to act as a pride of lions as they moved around the game area, and would be expected balance their needs of finding water, food and maintaining energy. The game was considered to be over when the lions had died and were told to return to the "Den" by the mobile device.

**Figure 5.3.2: The "Savannah" game interface running on a PDA**.

Source: Facer *et al.* (2004)

Facer *et al.* (2004) found evidence to suggest that some students felt that they were 'experiencing the Savannah' and identifying with their roles as Lions during the game. The children were reported to have often spoke from the perspective of the pride of lions, for example "I'm nearly dead…where's the water…we're too hot". Using a combination of this technology and interactive video in the training of road safety skills there may be the opportunity to allow children to experience the road environment from a safe off-street, location; improving knowledge transfer of games from the school environment, to skills on the roadside.

## 5.4 Blended Learning

Richardson (2006) suggests that "the most effective e-learning programs are ones that are blended with other resources…to increase what is learned…in order to achieve an optimum learning solution". Much like TEL, blended learning should not simply rely on the delivery of old content in a new medium; it should actively strive to improve delivery and is thus seen as being more effective (Garrison and Kanuka, 2004, Singh, 2003) .

While e-learning has been shown to be effective in instructing learners and delivering procedural training, the effectiveness of practical training cannot be denied. Blending the most effective components from each delivery mechanism can therefore provide more effective training, addressing the requirements of learners who have different learning needs (Richardson, 2006, Singh, 2003).

While Richardson (2006) goes as far as suggesting the types of learning material that could be encompassed in a blended learning program, she makes no suggestion of linking material, such that it can flow seamlessly between teaching methods. For example the offline and online components of a blended learning programme could be linked through the use of QR Codes  and smart, internet-enabled devices(Tsung-Yu, Tan-Hsu and Yu-Ling, 2007, Williams and Pence, 2011) (figure 5.3.3).

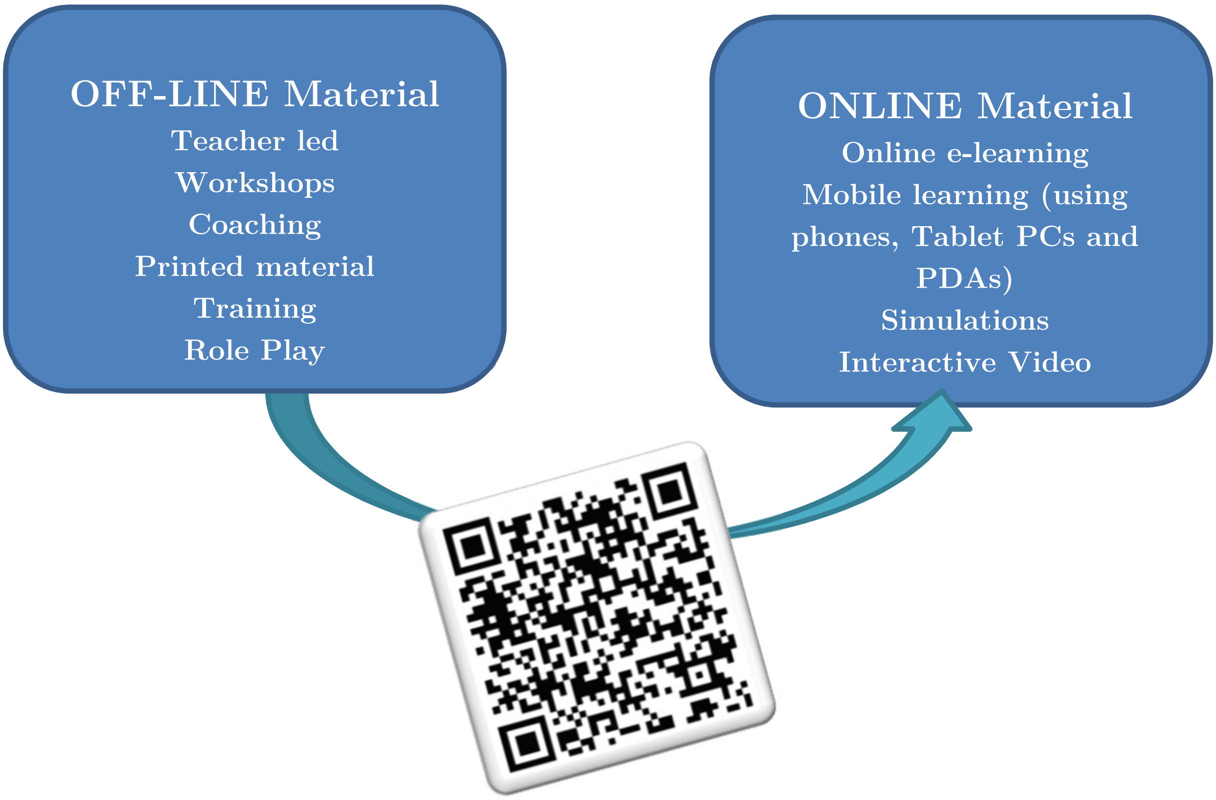



**Figure 5.3.3: Linking online and offline learning with QR Codes**

*Richardson (2006) suggests various offline and online components that could make up a blended learning programme. Many of these could be linked with QR codes.*

## Chapter Five Summary: Key Points

- Animated road safety training tools show potential to improve road safety behaviour however a lack of transfer of learning to the roadside in younger children maybe a barrier to wider take-up.
- Interactive road safety videos aimed at improving road safety skills have been developed, however their impact on behaviour is unknown.
- Interactive videos based on risk identification and experiencing failure in a safe environment show potential to train procedural skills such as those required for safe roadside behaviour.
- Interactive software environments have been used in numerous environments to create a positive learning experience.
- Designing interactive videos to allow users to maintain control of their learning experience and generate sufficient challenge and learning commitment are likely to be most effective in creating an effective learning environment.
- Mobile learning technologies could help create a positive learning experience and should be explored in more detail.

Chapter 6

# The development of a road safety interactive video & assessment methodology

The previous chapters outlined the road safety issue and highlighted the fact that interactive video may prove to be an effective classroom based road safety educational material. While interactive videos have been developed to target procedural skills, including road safety skills, they have seldom been evaluated in terms of behavioural impact. This chapter demonstrates another unique contribution by outlining the development of a road safety interactive video designed to improve skills and awareness when children have to cross between parked cars when alternative, safer crossing locations do not exist. The evaluation procedure for such a tool is developed and findings from an exploratory study are presented and their implications on video design and evaluation procedures are discussed.

## 6.1 Developing the interactive video

### 6.1.1 Filming the Video

The subject matter of the video was based around two young children, cast to appear to be in the upper quartile of the 5-7 age group, making an independent journey to a local amenity which involved crossing between parked cars where no safer crossing location was available. This skill was the focus of the research for three reasons i) UK collision statistics indicate that a number of children and pedestrians in general are masked by a parked or stationary vehicle when involved in a road traffic collision (see Chapter 2) ii) the industrial sponsor, Hampshire County Council, noted that research into the training of young pedestrians to cross near parked cars would be useful in assisting in the future development of their practical pedestrian training programme and iii) the procedural nature of the task makes it suitable for targeting long term procedural memory stores. In addition, by using footage of real, instead of simulated environments the video aims to target deep learning in order to focus on ensuring long term memory storage; both episodic (things that have taken place) and procedural (Tulving, 1985) (See Chapter 3).

Two scenarios were developed; 1) Footpath use and a road crossing demonstrating safe practice and 2) Footpath use and a road crossing demonstrating dangerous practice. The scenarios were professionally filmed on a busy residential road lined with parked cars on each side, representing a typical location where the children may be forced to cross between parked cars. In the safe practice, the children walked along the footpath and crossed safely between parked cars using UK government crossing advice (DfT):

1) Find a gap between two cars with easy access to the pavement on the other side of the road.

2) Check the cars are not going to move; check the cars are empty or look for a driver, engine noise or lights.

3) Walk between the cars and stop at their outside edge (Figure 6.1.1 and Figure 6.1.2).

4) Look and listen all around to check there is no traffic coming.

5) When there is no traffic and the road is clear, cross the road whilst remaining aware and looking and listening for traffic whilst crossing.

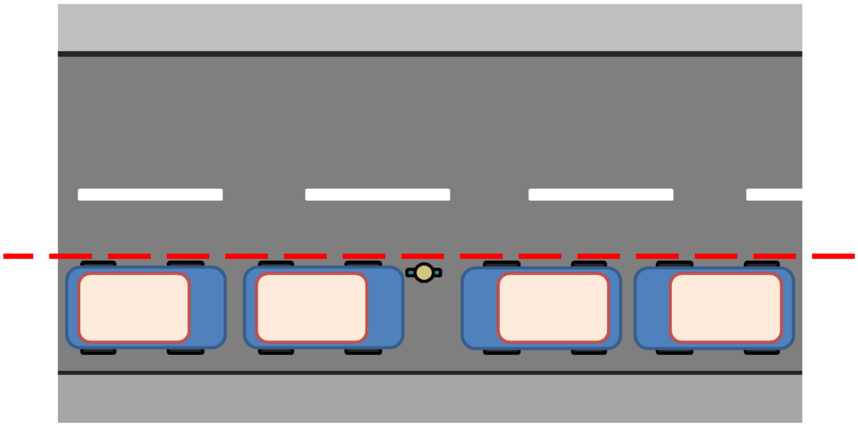


**Figure 6.1.1: Stopping at the outside edge of cars**

Children are expected to stop at the outside edge of the cars where they have an unobscured view of the road, while being offered physical protection from the parked cars.

**Figure 6.1.2: Stopping at the outside edge of parked cars**

In the unsafe practice, the children were running on the footpath bouncing a ball (Figure 6.1.3), failing to look in gateways and crossing between two parked cars without looking for on-coming vehicles, or stopping at the edge first (Figure 6.1.4).

**Figure 6.1.3: Unsafe practice: running on a footpath**

**Figure 6.1.4: Unsafe practice: running across the road**

Scenes were planned so that both the safe and unsafe procedures could be filmed without putting the subjects at any risk and the whole experiment was passed by the University of Southampton's research ethics committee. Each scene was filmed using widescreen digital video in multiple takes, generating approximately 30 minutes of raw footage which was edited into several continuous sequences. One sequence lasting 1.5 minutes demonstrated unsafe behaviour and the unsafe crossing practice while the other sequence lasting 2 minutes demonstrated safe behaviour and practice (Figure 6.1.5). A voice-over featuring an 11 year old child explaining safe roadside behaviour and the correct crossing practice was recorded and integrated into the safe behaviour video. The sequence demonstrating the safe crossing procedure was also cut into several individual clips to explain the individual procedural steps required to cross safely between parked cars.

**Figure 6.1.5: A frame from the video.**

*The children have been 'forced' to cross between parked cars on a busy residential road, in this case safely as part of Scenario 1, when no safer alternative is available.*

### 6.1.2 Making the Video Interactive

The edited video clips were imported into an animation and multimedia authoring environment which allows interactive elements to be integrated into the video using custom scripts and built-in features of the software. The model video originally developed by Cherrett (Cherrett, Wills, Price, Maynard and Dror, 2009) was used as a foundation and was then altered, following advice from road safety professionals at Hampshire County Council, Primary school teachers and IT technicians and cognitive learning experts, to ensure the user interface and functionality was suitable for young children. Key features targeting the young audience following discussions with these professionals include; i) an engaging colour scheme; ii) accompaniment of text with voice-over to aid children who have reading difficulties; iii) accompaniment of percentage scores with a star-rating system to ensure children with a range of numerical ability can understand the significance of their performance; iv) the introduction of a ‘hints’ system to aid hazard perception. The elements of the new video, which was played chronologically, were:

1) A loading screen (Figure 6.1.6) followed by an introduction which explains the background to the video and the task that the children will be given (Figure 6.1.7).

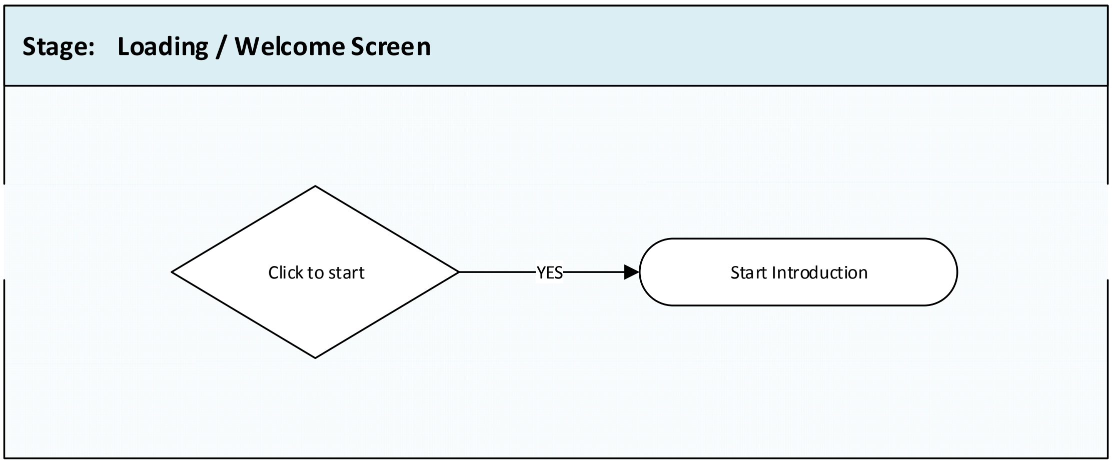




**Figure 6.1.6: The game loading screen. The user clicks the start button to initiate the interactive video training tool.**

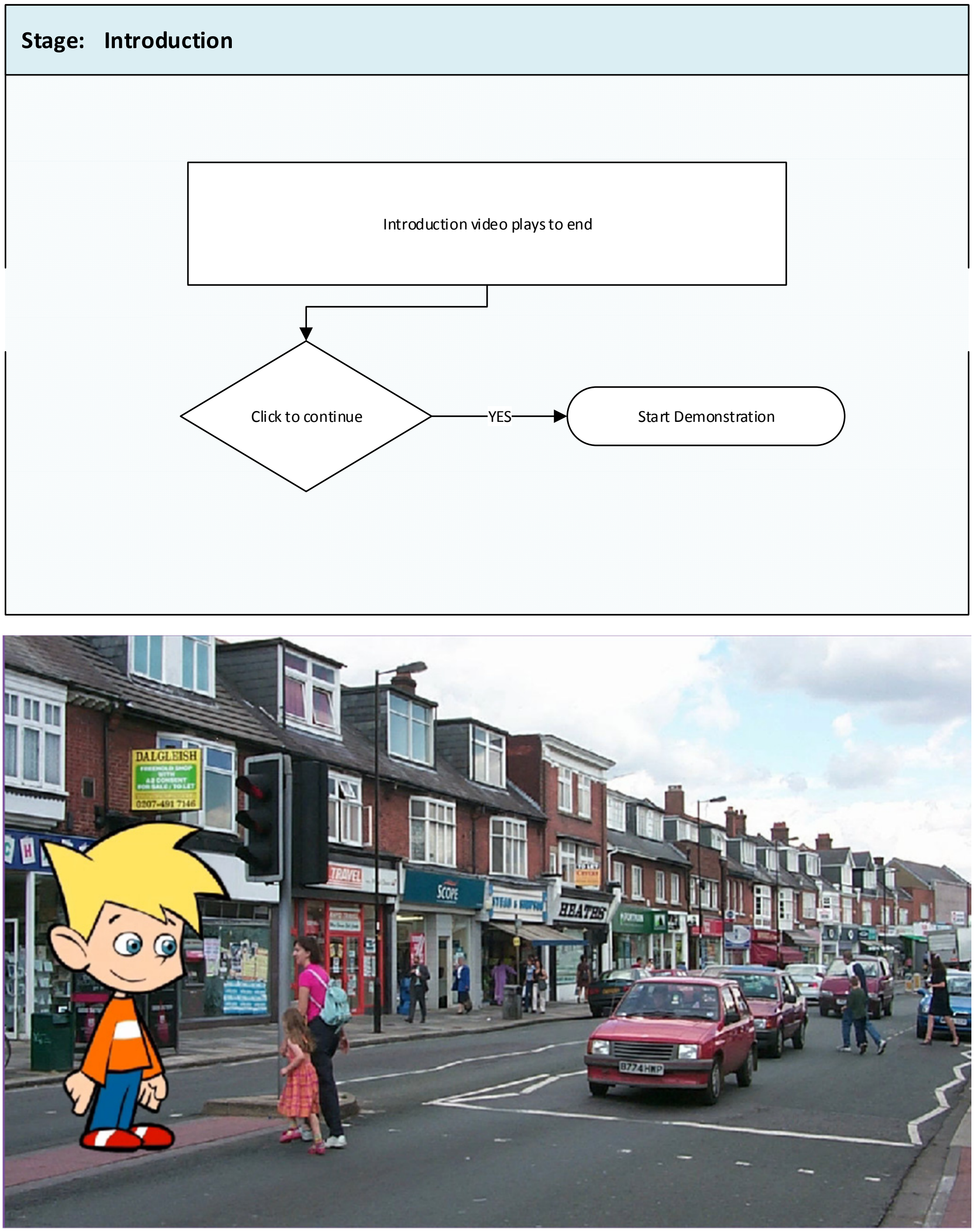
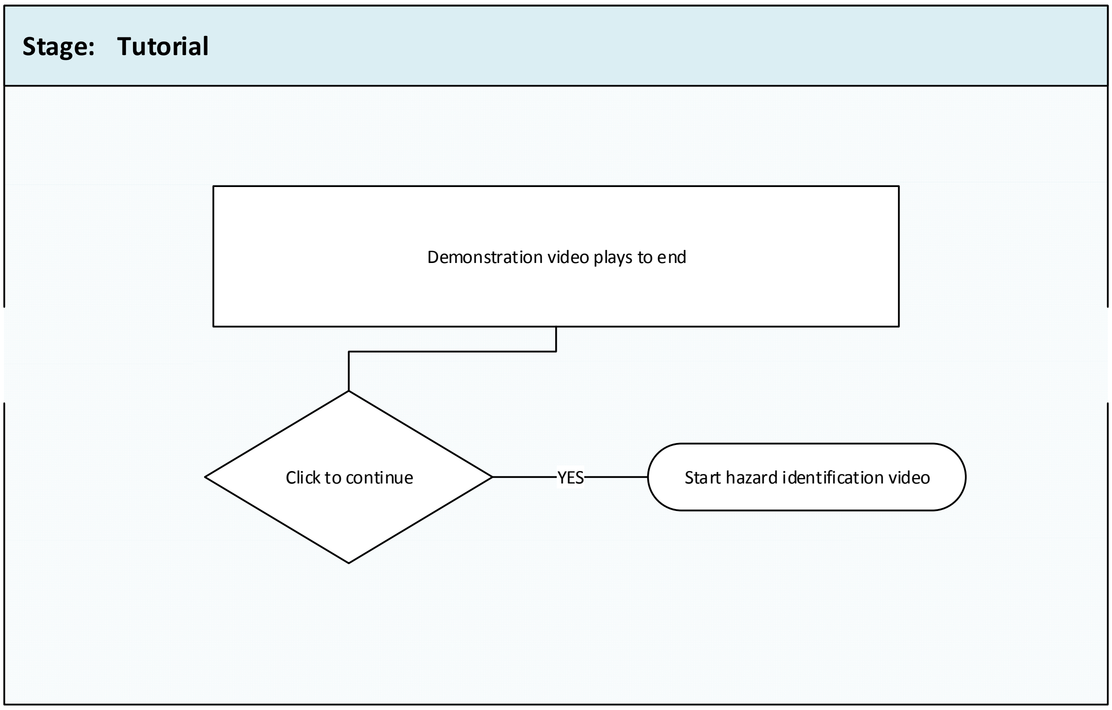



**Figure 6.1.7: The introduction sequence.** The animated character and voiceover introduce the video and in this scene can be seen telling users about safe crossing locations.

2) A tutorial which demonstrates how to interact with the video and identify and select hazards (Figure 6.1.8).



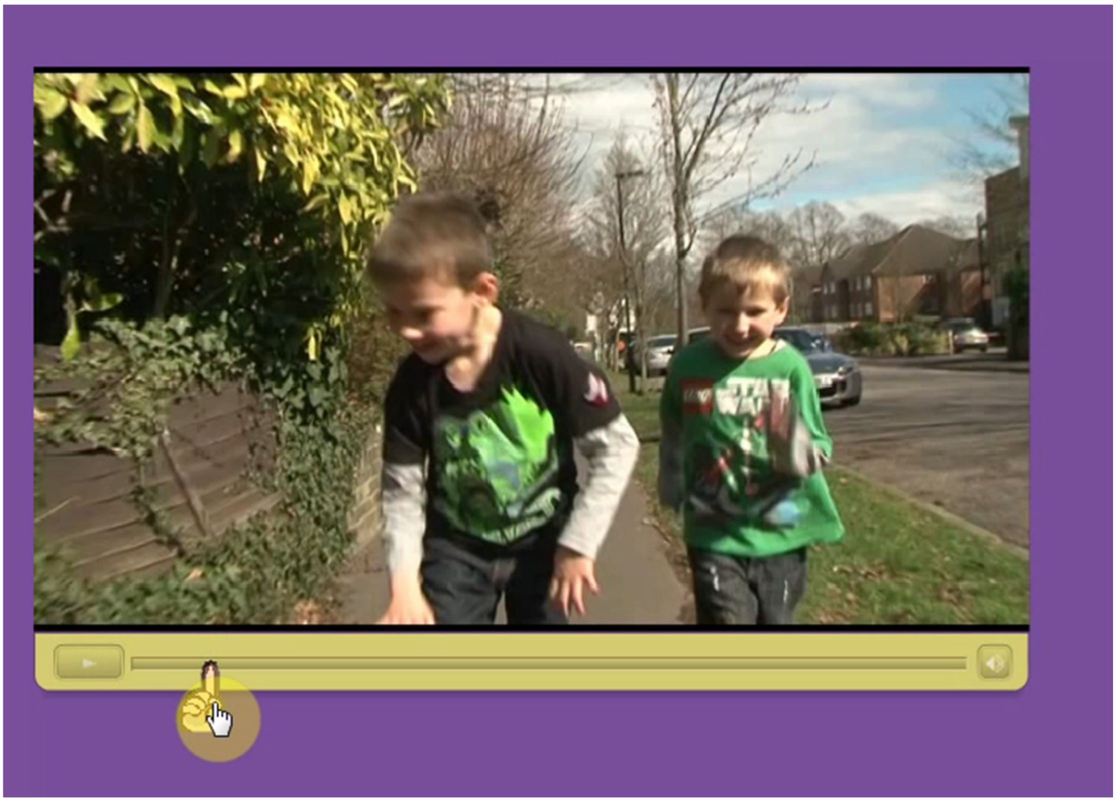
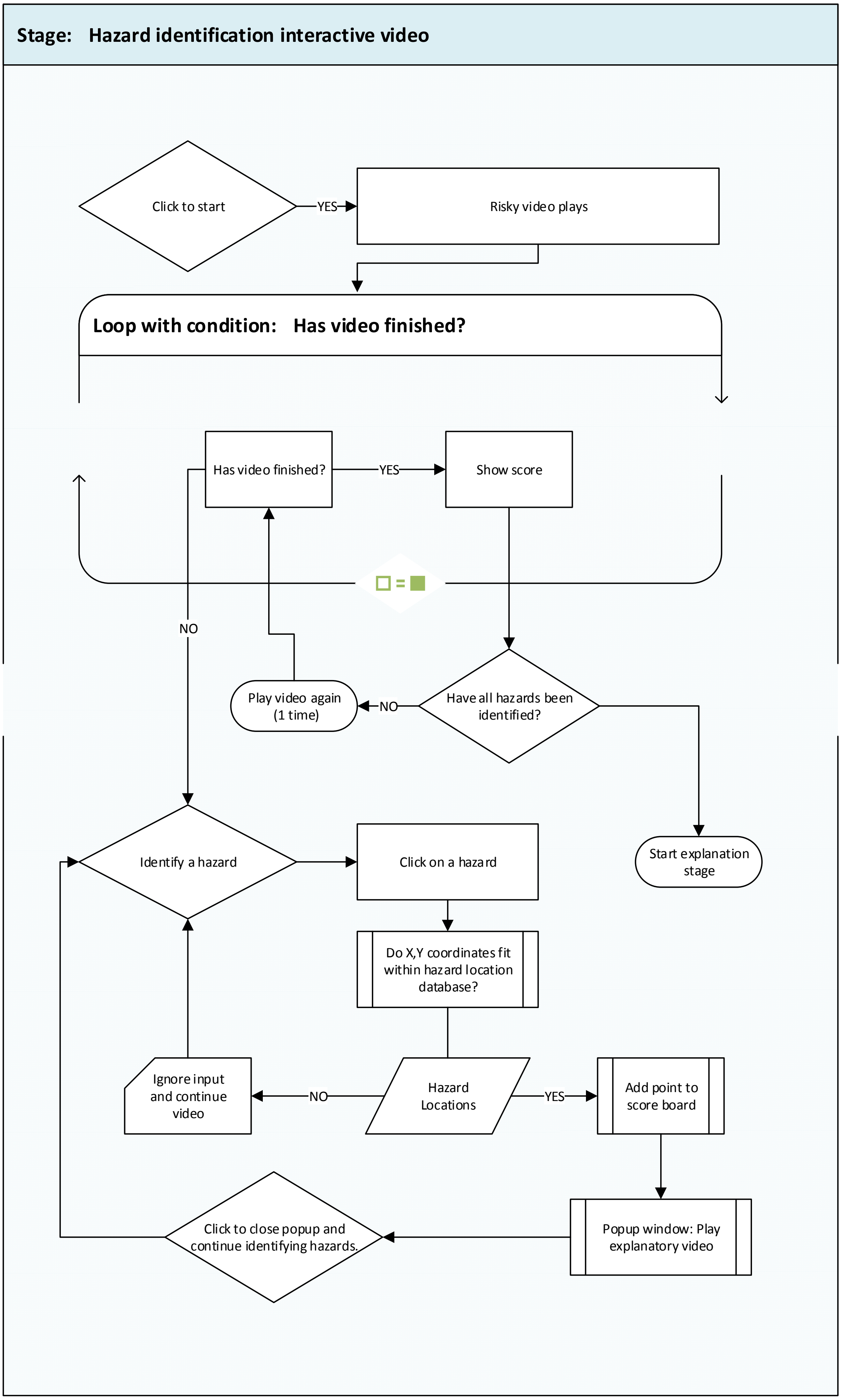



**Figure 6.1.8: The tutorial segment. A voiceover describes the interactive video features while the highlighted mouse demonstrated the procedures.**

3) The interactive video segment where the player was expected to highlight any unsafe roadside and crossing behaviour by clicking on the hot spotted activity in the video itself (Figure 6.1.9). Users receive immediate feedback outlining safe roadside behaviour (Figure 6.1.10) along with a score (Figure 6.1.11).


Stage: Hazard identification interactive video
Click to start
YES
Risky video plays
Loop with condition: Has video finished?
Has video finished?
YES
Show score
NO
Play video again (1 time)
NO
Have all hazards been identified?
Start explanation stage
Identify a hazard
Click on a hazard
Do X,Y coordinates fit within hazard location database?
Ignore input and continue video
NO
Hazard Locations
YES
Add point to score board
Click to close popup and continue identifying hazards.
Popup window: Play explanatory video


3. For each correctly identified hazard, the player scores a point.

1. When a player moves the mouse over a hazard, a hint is given; the cursor changes accompanied by an exclamation mark.

2. Upon correctly identifying a hazard, the player is presented with a short clip, noting what the hazard was and demonstrating the safe procedural step that should have been used.

**Figure 6.1.9: The hazard identification procedure used in the interactive video.**


**Figure 6.1.10: The interface explaining the importance of checking driveways.** Following a correct identification the score on the scoreboard also increases.


**Figure 6.1.11: The scoreboard.** Scores are presented to users in pictorial and numeric format.

4) An explanation segment where each hazard is displayed individually, irrespective of whether or not the user managed to highlight it, alongside an explanation of the safe behaviour expected (Figure 6.1.12).

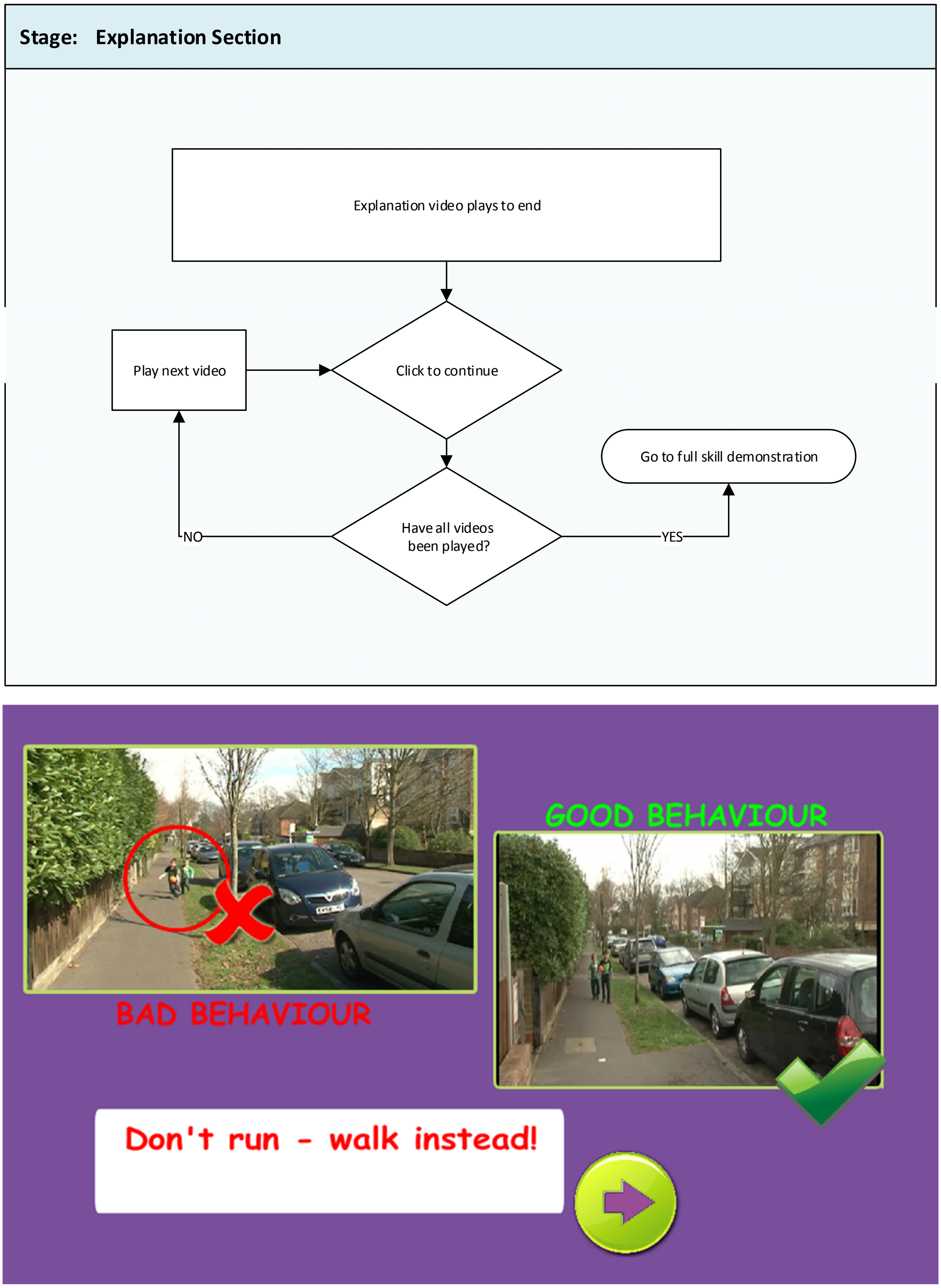



**Figure 6.1.12: An explanation segment of the video;** highlighting the dangers further, while again demonstrating correct procedures,

5) A reinforcement segment where the entire safe crossing practice sequence was played so that the player could see how the behaviours fit together into a crossing sequence.

All hazards were hot spotted manually in the multimedia authoring environment. A hot spot is a defined interactive area of a video which when clicked on allows a specific action (in this case the generation of a pop-up window) to occur. Hot spots are not static and in fact move and change size as the video develops to ensure hazardous activity can be selected with a mouse.

The player is forced to watch the introduction, tutorial and explanation sections in full before progressing. In the hot-spotted segment, the user can pause and rewind the video as many times as they choose so that they can explore hazards in their own time. Visual hints are provided to the player to help them identify hazards; 1) the mouse cursor would change from an arrow to a large hand; 2) an exclamation mark would appear next to the mouse cursor to draw the players' attention to the hazard (Figure 6.1.9). When a player clicks on a hazard, a pop-up box notifies them that they have scored a point which is displayed on a scoreboard. The player simultaneously hears a loud brake-screeching sound-effect accompanied by on-screen text saying what the children should not have been doing. The player is then shown the corresponding video clip demonstrating the correct behaviour required for the individual part of the procedure in question. When the player has viewed the video once, they are given their intermediate score and if this is less than 100% are asked to play the video again to identify more hazards (Cherrett, Wills, Price, Maynard and Dror, 2009, Dror, Schmidt and O'connor, 2011). On reaching the conclusion of the video for a second time, a final score is given before the player proceeds to the explanation and reinforcement segments (Cherrett, Wills, Price, Maynard and Dror, 2009, Dror, Schmidt and O'connor, 2011).

In formatting the video as described, the system repeats key safety messages to the users a minimum of two times following a Behaviourist approach to teaching. In addition the scoreboard system provides instant feedback to the user (See Chapter 3).

Furthermore, the cognitivist approach influences a number of features, including the engaging colour scheme, sound and multimedia features are designed to engage users in the system by requiring them to directly interact with the video. Key information is highlighted through the video to ensure key information is not lost through 'decay' and information is repeated in order to encourage long-term memory storage of information. The video also allows children to learn from experience as a result of getting two attempts at hazard identification and instant feedback; if a user does not achieve a high score in the first round, they have the opportunity to try again and be rewarded for correct hazard identifications. This is designed to give children a framework of experiences from using the video that may be transferrable to the street (See Chapter 3).

## 6.2 Developing a methodology to assess the effectiveness of the interactive video.

### 6.2.1 On-Street Skills Assessment: Initial Methodology

Two classes of 6-7 year old children, generally seen to be the target age group for pedestrian training in line with the Kerbcraft training model and Government guidance, were selected from a local primary school to take part in pilot evaluation of the interactive video to assess its impact on roadside skills acquisition and to assess any issues with the game or experimental design. One class was designated as the control group, and the other the experimental group, in a quasi-experimental study design (Figure 6.2.1) based on the practical roadside assessment used in the Kerbcraft evaluation (Whelen, Towner, Errington and Powell, 2008).

Each group took part in a pre-training skills assessment where they were taken in groups of three to a quiet residential cul-de-sac, used primarily for parking. One child at a time was asked to lead an assessor (who feigned an inability to cross roads) across the road safely. This assessor was only present to stop the child should a potentially life-threatening situation arise and was not tasked with leading or advising. During the crossing, the other assessor observed the child's behaviour and noted the presence or lack of key skills (DfT, n.d) on a three point scale (good, satisfactory, poor) using an assessment record sheet, similar to that used in the Kerbcraft evaluation (Whelen, Towner, Errington and Powell, 2008). The assessed skills were:

i) stopping at the kerb;

ii) checking the parked cars are not about to move;

iii) stopping at a safe location at the outside edge of the cars;

iv) looking all around for traffic;

v) crossing sensibly;

vi) remaining aware while crossing.

The remaining waiting children were positioned so their view of preceding children was obscured and were supervised appropriately, as per the school requirements.

Following the pre-training skills assessment, the experimental group played the interactive hazard perception video in class; generally finishing the activity in 20 to 30 minutes. The day following the interactive video training session, the experimental and control groups were re-assessed in a post-training assessment at the same roadside location and using the same methodology. Care was taken to ensure crossings only took place under the same conditions when no potentially confounding distractions to the experiment were present. Although it was not necessary, procedures were put in place to ensure that the post training assessment could be delayed if the weather conditions were not similar to that present during the pre-training assessment.

Immediately following this assessment, the children (in groups of three) were shown the correct crossing sequence, highlighting general mistakes made by the group and also told that they should always have an adult with them at the roadside until they are ready for independent school travel.

Pre and post-test assessment score records, of which a sample was cross-verified by the second assessor, were coded following the completion of the roadside study. Perfect behaviour was awarded two points, satisfactory behaviour was awarded one point and hazardous behaviour was awarded zero points.

In total 43 children aged between six and seven years were involved in the study. In order to minimize school disruption, one class (N=21, 9 females, 12 males) was randomly assigned the control condition and the other (N=22, 14 females, 8 males) was assigned the experimental condition. Groups are matched for age and participant background.

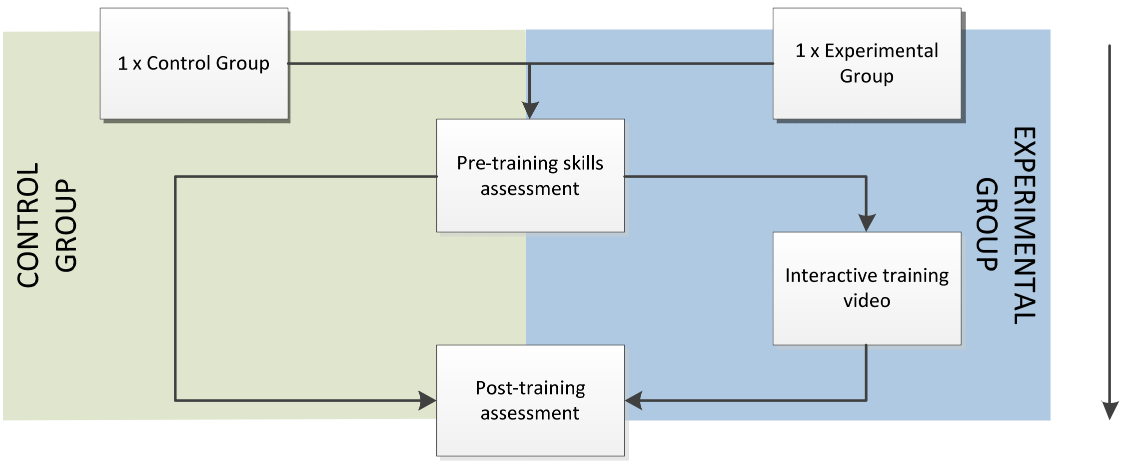



**Figure 6.2.1: A simplified overview of the study design**

## 6.3 Exploratory study: Results & Discussion

### 6.3.1 On-Street Skills Assessments Results

Crossing performance was converted to a score from 0-2 where 0 was considered to be an unsafe crossing and a score of 2 was considered to be a best-practice crossing. The crossing proficiency of the majority of participants, in *both* experimental and control groups, improved to some extent between the pre and post-training assessments (Table 6.3.1).

This was unexpected as the largest improvements were expected to be observed in the experimental group. Unfortunately as a result of the experimental setup, the results were potentially confounded by the presence of unintentional practical training whereby due to the nature of the crossing assessment site, children had to be guided across two busier roads, one of which had obscured vision as a result of the presence of parked cars, in order to get to a safe assessment location. These crossings took place before and after assessments so six safely guided crossings would take place before the post-assessment in both the experimental and control group. While children were not being actively taught during these crossings, the procedures used to cross the road were explicitly safe and in essence mimicked the training given in the interactive video.

**Table 6.3.1: Average behavioural score improvement from pre-training to post-training assessment**

| | Control Group | Experimental Group |
|---|---|---|
| Stopping at the kerb | 0.48 | 0.68 |
| Checking the parked cars for clues | 0.14 | 0.86 |
| Stops at the line of sight | 0.86 | 0.45 |
| Looks at the line of sight | 0.48 | 0.64 |
| Continues looking | 0.57 | 0.77 |
| Walks safely | 0.00 | 0.09 |

This confounding is reflected in tests for significance, where both experimental (Table 6.3.2) and control (Table 6.3.3) groups displayed significant improvements in skill demonstration following the post training assessment.

**Table 6.3.2:** Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group in the pilot school (N=23) between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -2.373 | -3.071 | -1.919 | -2.646 | -3.314 | -1.000 |
| *p* | .018* | .002* | .055 | .008* | .001* | .317 |

* indicates statistical significance where $p<0.05$

**Table 6.3.3:** Wilcoxon signed ranks test for significance in behavioural skills scores for the control group in the pilot school (N=22) between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -1.986 | -1.732 | -3.218 | -2.236 | -2.017 | .000 |
| *p* | .047* | .083 | .001* | .025* | .044* | 1.000 |

* indicates statistical significance where p<0.05

Fortunately one skill; checking parked cars are not going to move before crossing, was not unintentionally demonstrated during these guided crossings as adults are able to carry out this skill subtly on the approach to a crossing. Using a Wilcoxon signed ranks test for this skill the experimental group demonstrated a statistically significant improvement after playing the interactive video (Z = -3.071, p=<0.05), compared to the control group who did not exhibit a statistically significant improvement (Z = -1.732, p=>0.05). Post-hoc power analysis indicated a 97% chance of detecting the effect size observed in the experimental group at the 5% level (two-tailed) indicating that sample size was sufficient for this initial study. A sample size of 10 would be required to achieve 80% power. The high power observed is likely to be due to the lack of participants exhibiting this skill in the pre-training (initial) skills assessment, therefore achieving a larger effect size. While this indicates interactive videos do have the potential to impact certain skills, future research should revisit the effectiveness of interactive video on changing on-street behaviour using more thorough and robust experimental design where the possibility of unintentional training though road crossing is eliminated though better selection of assessment sites.

In order to control for either effect, future revisions of the assessment will ensure that the crossing sights do not involve crossing roads, especially when a view is obscured by parked cars, in order to get to the assessment sire.

## 6.4 Conclusions

With the introduction of more paper based activities as part of practical child pedestrian training schemes it is pertinent to explore move effective in-class materials that are designed to improve skills and awareness rather than knowledge acquisition alone. This chapter has shown that it is possible to develop an interactive video that, with further development, could be used as an additional training material, alongside practical training schemes such as Kerbcraft. Much like the paper-based materials currently used, interactive video is designed to be an addition to practical pedestrian training, which is still considered to be the most effective pedestrian skills development resource.

The results of this study show an indication that interactive hazard-identification videos could potentially have a positive impact on on-street skills and this may be applicable to other procedural skills however further research is required with more refined experimental procedures in order to assess this impact more comprehensively. As with any behavioural change system careful evaluation is required in order to ensure that that any future changes in pedestrian training activities are effective in targeting and improving desired on street behaviours and that no negative impact to current practical pedestrian training takes place.

## Chapter Six Summary: Key Points

- An interactive road safety video designed to train children in parked crossing skills as an additional resource to be used alongside practical training was developed.
- A methodology based on the Kerbcraft national pilot evaluation was developed in order to assess the effectiveness of the interactive video in a pilot trial in a Southampton school.
- Results show that there is potential for interactive video to influence behaviour but that experimental methodology needs to avoid issues with behavioural imitation for a thorough evaluation to take place.

# Chapter 7

# The impact of a road safety interactive video on behaviour

## 7.1 Methodology

The on-street skills assessment methodology developed in Chapter 6 forms the basis of the procedure used to assess the impact of interactive video on behaviour. Figure 7.1.1 shows an overview of this assessment as applied in practice, alongside administrative procedures. It is clear those administrative procedures from a significant proportion of the methodology to ensure the robustness of the experimental method but to more importantly ensure the safety of both adult and child participants (Figure 7.1.2). In all cases the trial took place over three days; the pre-training assessment was carried out on day 1, the interactive video training session was carried out on day 2 and the post-training assessment was carried out on day 3. This was appealing to schools as it minimised disruption to their teaching schedules.

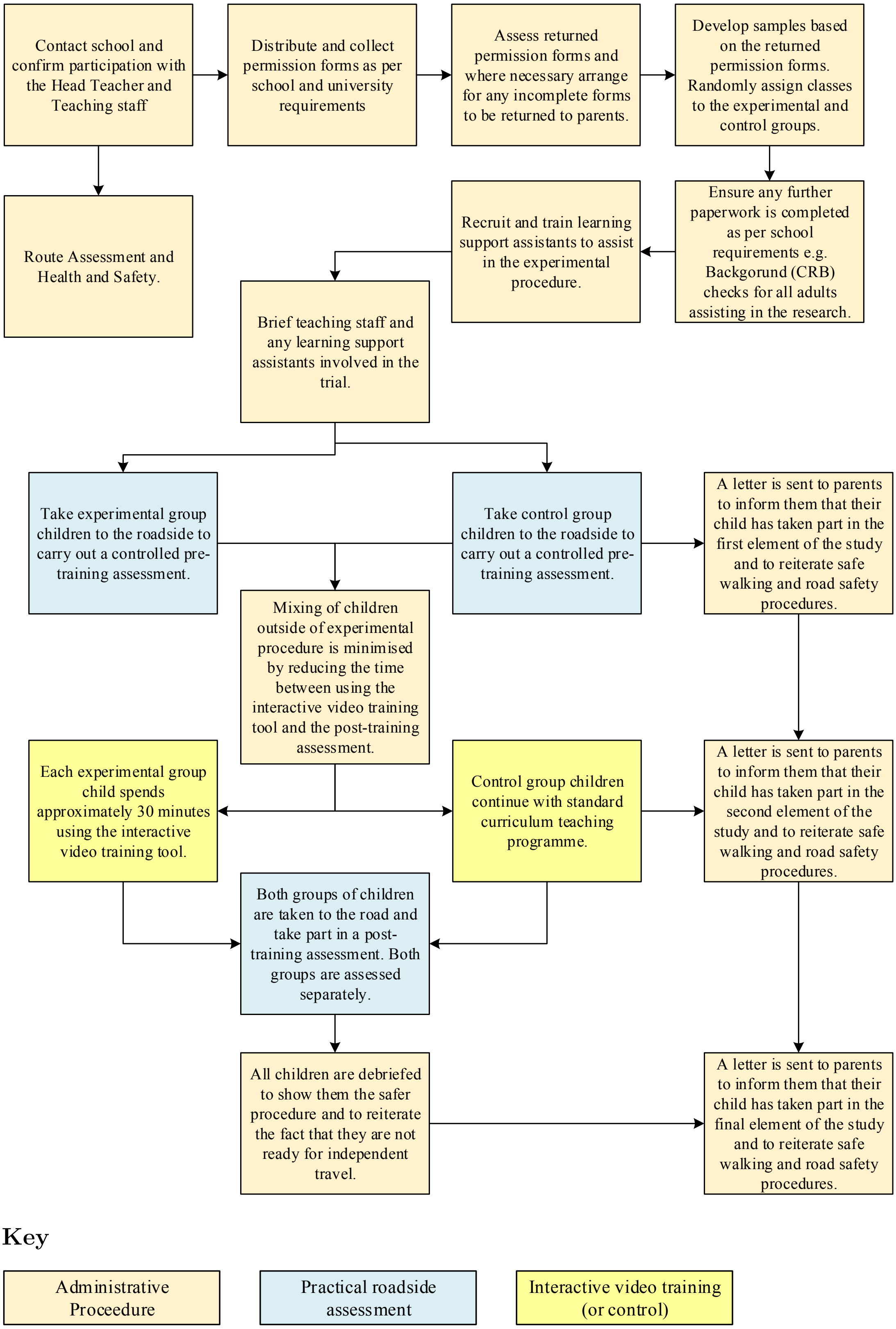



**Figure 7.1.1: Experimental procedure**

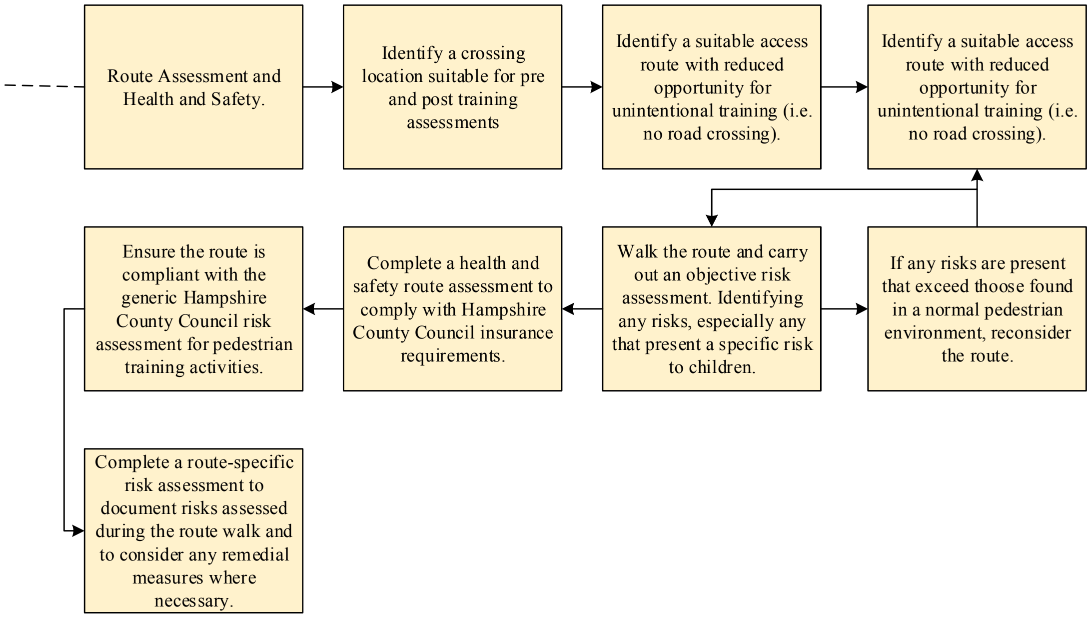



**Figure 7.1.2: Outline processes for health and safety preparation**

### 7.1.1 School selection and characteristics

Potential schools were identified by Hampshire County Council and their contact details made available for use. Each school was then contacted in order to deduce their level of interest in allowing children to potentially take part in a behavioural evaluation of the interactive road safety video. Four schools (Table 7.1.1) were eventually selected from this pool to go forward with the evaluation based on "timetable, volunteer availability, suitable testing sites and agreement in principle from the head teacher", therefore having similar requirements to the schools selected by Whelen, Towner, Errington and Powell (2008) in the Kerbcraft evaluation.

**Table 7.1.1: Characteristics of schools involved in the trial**

| | Students on roll | Comparative size | Proportion free school meals | English not a first language | Catchment social deprivation | Pupils joining after academic year start | Ofsted Rating | Child pedestrian collision (2010-2012) |
|---|---|---|---|---|---|---|---|---|
| **School A** | 200-250 | Avg. | 17% | Low | Low | - | *** | 1 |
| **School B** | <200 | Avg. | 17% | Low | Low | - | **** | 1 |
| **School C** | >250 | >Avg. | 6.3% | <<Avg. | Low | - | *** | 1 |
| **School D** | 200-250 | <Avg. | 51% | >Avg. | >Avg. | >Avg. | *** | 1 |

General school characteristics (Table 7.1.1) were derived from the Ofsted website (http://ofsted.gov.uk) using the latest available school Ofsted report. ‘Proportion free school meals’ is the percentage of students receiving free school meals as government benefit as a result of a child’s parents receiving income support or another eligible benefit or circumstance. ‘English not a first language’ relates to the proportion of students who class their first language (normally a mother tongue) to be non-english. The ‘catchment social deprivation’ is a comparative measure used by Ofsted to represent the levels of social deprivation in a catchment. The Ofsted Rating is an overall measure of school performance; outstanding (****), good (***), requires improvement (**), inadequate (*). The absolute number of pupils is not reported here to protect the anonymity of schools. Most other variables are reported in general terms in Ofsted reports and these have been replicated in tabular form here with the exception of the percentage of the school population receiving free school meals. The national average school size (for similar schools) is 257 pupils on roll and the average percentage of free school meals is 26.7.

In each school the overriding limitation was the amount of time children would spend away from the classroom, where the emphasis on teaching the curriculum was paramount. While not detrimental to the evaluation itself, this limitation restricted the number of participants each school was able to allow to take part in the evaluation.

### 7.1.2 On street skills assessment

A pre and post training skills assessment was carried out prior to training and post training in both the experimental and control groups. For all assessments, children were taken to the assessment sites in groups of three. One child at a time was asked to lead an assessor (who feigned an inability to cross roads) across the road safely. This assessor was only present to stop the child should a potentially life-threatening situation arise and was not tasked with leading or advising. In practice a life threatening situation was considered to be any vehicle driving towards the assessment area. During the crossing, the other assessor observed the child's behaviour and noted the presence or lack of key skills (DfT, n.d) on a three point scale (good, satisfactory, poor) using an assessment record sheet, similar to that used in the Kerbcraft evaluation (Whelen, Towner, Errington and Powell, 2008). The assessed skills were:

i) stopping at the kerb;

ii) checking the parked cars are not about to move;

iii) stopping at a safe location at the outside edge of the cars;

iv) looking all around for traffic;

v) crossing sensibly;

vi) remaining aware while crossing.

The remaining waiting children were positioned so their view of preceding children was obscured and were supervised appropriately, as per the school requirements.

#### *7.1.2.1 School A & B: Assessment site*

Schools A and B were a linked Infants and Junior school with some shared playground facilities and an access road to the school and adjacent residential property. Children were walked down the access street onto the public footway to a crossing from residential properties to a car park for local shops on the opposite side of road. A researcher parked a car adjacent to the crossing location to ensure that the crossing gap was wide enough to ensure a safe crossing could be commenced, but narrow enough to reduce visibility (Figure 7.1.3).


**Figure 7.1.3: School A & B: Assessment site location (Source: Google Maps)**

#### *7.1.2.2 School C: Assessment site*

The crossing location used in school C was a cul-de-sac located adjacent to a wooded area used for access to the school during drop-off and collection periods. The crossing location was from a residential property to a small grass area which could be used for recreation purposes and pick-up from the adjacent on-street parking. There was also access via a path into public space. A researcher parked a car adjacent to the crossing location to ensure that the crossing gap was wide enough to ensure a safe crossing could be commenced, but narrow enough to reduce visibility (Figure 7.1.4).


**Figure 7.1.4: School C: Assessment site location (Source: Google Maps)**

#### *7.1.2.3 School D: Assessment site*

The crossing location used for school D was a quiet residential street located adjacent to the school that was reached from a gated staff entrance / security door to the school. The crossing location facilitated onward travel across or into the local residential area. A researcher parked a car adjacent to the crossing location to ensure that the crossing gap was wide enough to ensure a safe crossing could be commenced, but narrow enough to reduce visibility (Figure 7.1.5).

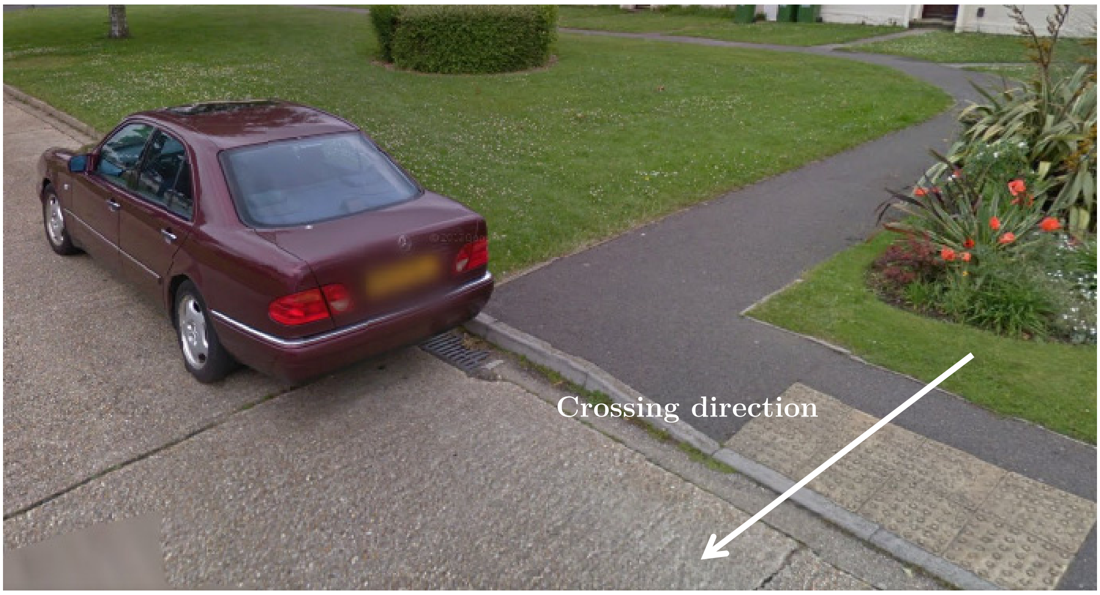



**Figure 7.1.5: School D: Assessment site location (Source: Google Maps)**

### 7.1.3 Interactive video lesson

The experimental group all used the interactive video such that they had enough time to run through the tool from start to finish. This would typically take 20-30 minutes per child.

The game could be run over the network from a central storage server (similar to streaming content over the internet) or locally installed on each computer. In all schools an IT scoping exercise was undertaken prior to commencing the trial in each school in order to test the game over the computer network and determine if local installation of the game was necessary. The installation medium technically made no difference to the user experience; however installation time over the network was faster.

During the trial, the experimental groups of children were led to the school IT suite in groups of 6-12 at a time. This was a constraint imposed by schools to minimise any impact on teaching time. Children were given a verbal introduction to the task and were asked if they were happy to go ahead with using the tool. Following this children adorned headphones and were asked to start using the tool, raising their hand with any questions or technical issues.

In all cases children had completed using the tool in approximately 30 minutes or faster. All children were debriefed in order to reiterate the need to have an adult or responsible person with them at all times when crossing the road until their parents/guardians deem that they are competent to be independent pedestrians themselves.

## 7.2 Results

In total 125 children with complete data sets took part in the evaluation (Table 7.2.1). The pilot study (Chapter 6) indicated that minimum sample sizes of 10 would be required to detect a large effect size with 80% power. This could not be achieved in School D and is discussed later in this chapter. In order to detect between-group medium effect sizes (0.5) (Cohen, 1988) with 80% power, a combined total sample size of over 106 was required.

**Table 7.2.1: Sample size broken down between the four participating schools.**

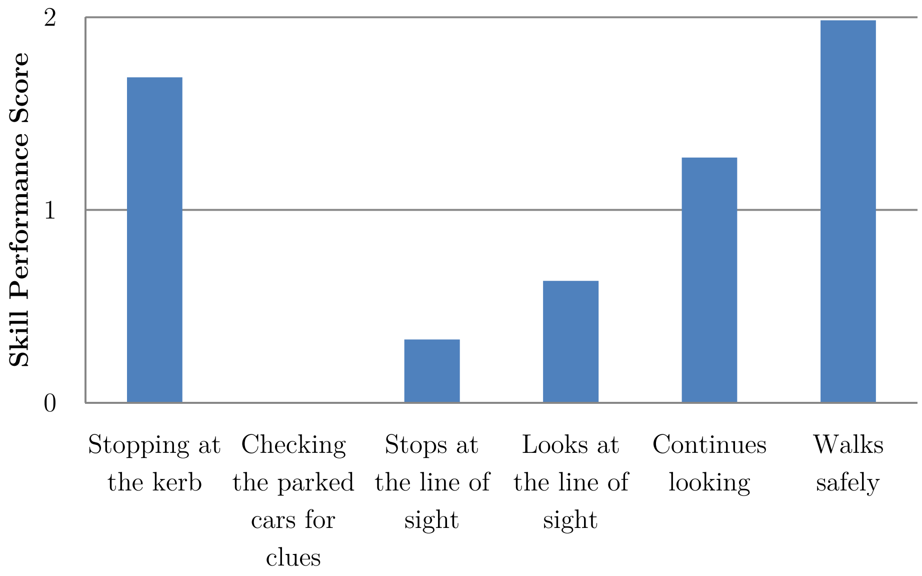
| | **Experimental Group Sample Size** | **Control Group Sample Size** | ***Total*** |
|---|---|---|---|
| **School A** | 28 | 21 | *49* |
| **School B** | 18 | 15 | *33* |
| **School C** | 14 | 17 | *31* |
| **School D** | 7 | 5 | *12* |
| ***Total*** | *67* | *58* | *125* |

Due to data protection the full names and ages of children were protected by some schools and where provided it was on the basis that the two pieces of information would not be combined in order to ensure compliance with data protection. Of the 84 children for which an age was provided, 18 were 6, 42 were 7 and 24 were 8 years of age. The distribution of sex across the whole sample was 40% male and 60% female. While in ideal circumstances this would have been 50:50 in order to remove any confounding bias in the data, it is a reflection of the class groups in the sample and a review of Ofsted data indicates that two of the four schools show a higher proportion of boys compared to girls on roll. Sex has not been considered as an independent variable in statistical tests as a result of the subsequent sample size being reduced.

### 7.2.1 Overall sample baseline performance

Data collected can indicate the extent to which the participating children already understood the procedure for crossing between parked cars (Figure 7.2.1.)

**Figure 7.2.1: Baseline skill performance (N=125)**



The baseline performance for stopping at the kerb and walking safely were very good on balance; an indication that these skills and behaviour have already been instilled into the children as part of their development into independent pedestrians to date. Almost all children came to a complete stop (n=103) at the kerb before crossing and an even greater proportion of children walked safely across the road (n=124), without running or skipping etc.

A relatively large proportion of children continued looking once they had initiated a crossing into the open road (n=60). It appeared, however, that the majority of children began to rely on the awareness of the assessor from this point forward (n=65). This is of concern as children should be encouraged to remain aware in order to increase the safety of a crossing, even if with a responsible adult.

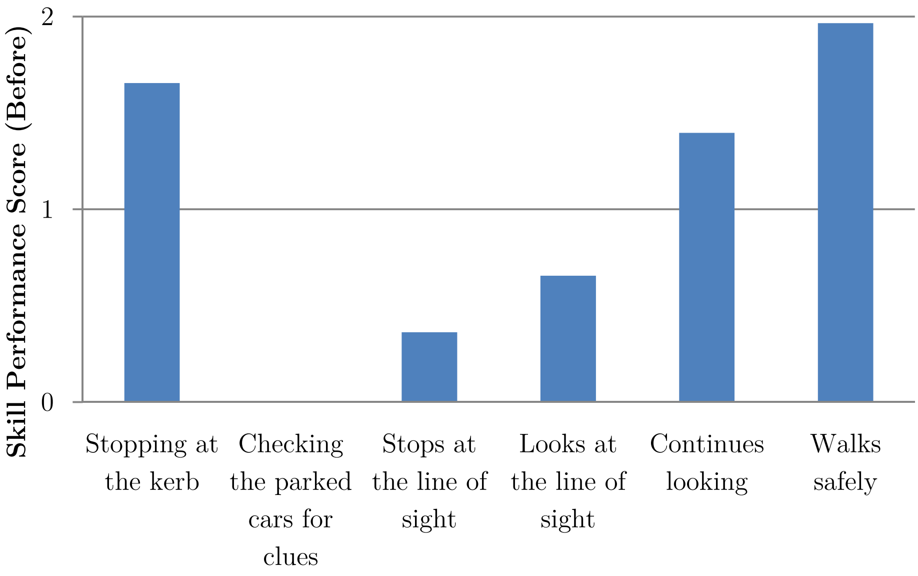
A relatively small number of children looked at the line of sight before stepping out into the road (n=46). In some instances this was a glance (n=13), in others it was a more prolonged assessment of the traffic situation (n=33). An even smaller number of children actually stopped at the line of sight (n=12) before looking and crossing into the open road. This is a critical step in the crossing procedure as it not only allows children to make a thorough assessment of the traffic, but it allows oncoming cars to see a child while they are still under the relative protection of the parked cars.

Interestingly not a single child visually checked the parked cars for “clues” indicating that they were safe to cross between. Independent pedestrians should naturally check for car engine noise, internal driver movements and vehicle lights. While a small number of children may have been able to do this subtly, avoiding recognition in the assessment in the same way as an adult would, the limited height of almost all of the participants involved would have compelled most participants to make a more overt gesture if the skill was in fact present (e.g. a concerted glance into the vehicles, or in some instances going onto their tips of toes). While it is unlikely that a child would have stepped in front of a vehicle with noise from a running engine; this visual check will become increasingly important as electric and hybrid-electric vehicles become more prevalent (Emerson and Naghshineh, 2011).

### 7.2.2 Behavioural change in the overall sample control group

As expected, there was little change in the behaviour of control group participants (Figure 7.2.2) over the duration of the study. There was a slight improvement in some children demonstrating that they were checking the parked cars. While there are a number of potential reasons for this improvement, some of the most likely causes are:

- Mixing and discussing the study with other participants in the experimental group.
- Attempting to demonstrate desired behaviour in the presence of the assessor/staff members (Sentinella, 2004).
- Receiving road safety training from another source e.g. parental demonstrations taking place during the study.



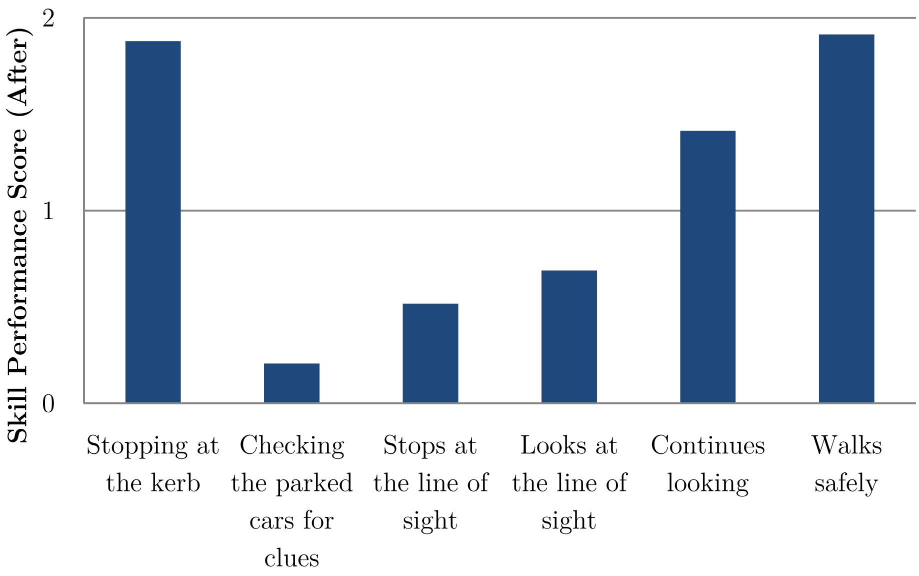




**Figure 7.2.2: Skill performance in the control group**

It is important to note that over the duration of the study, the crossing behaviour of the control group was still inherently risky overall, despite any minor improvements. Children were regularly not checking cars or regularly stopping and looking at the line of site; behaviour that would make it hard for drivers to see the young pedestrians and similarly behaviour that would make it hard for the pedestrians to see oncoming cars.

### 7.2.3 Behavioural change in the overall sample experimental Group

There was, overall, a positive change in behaviour in the experimental group over the duration of the study; indicating that the interactive video did indeed lead to a short-term improvement of behaviour for those participants that used the video (Figure 7.2.3).

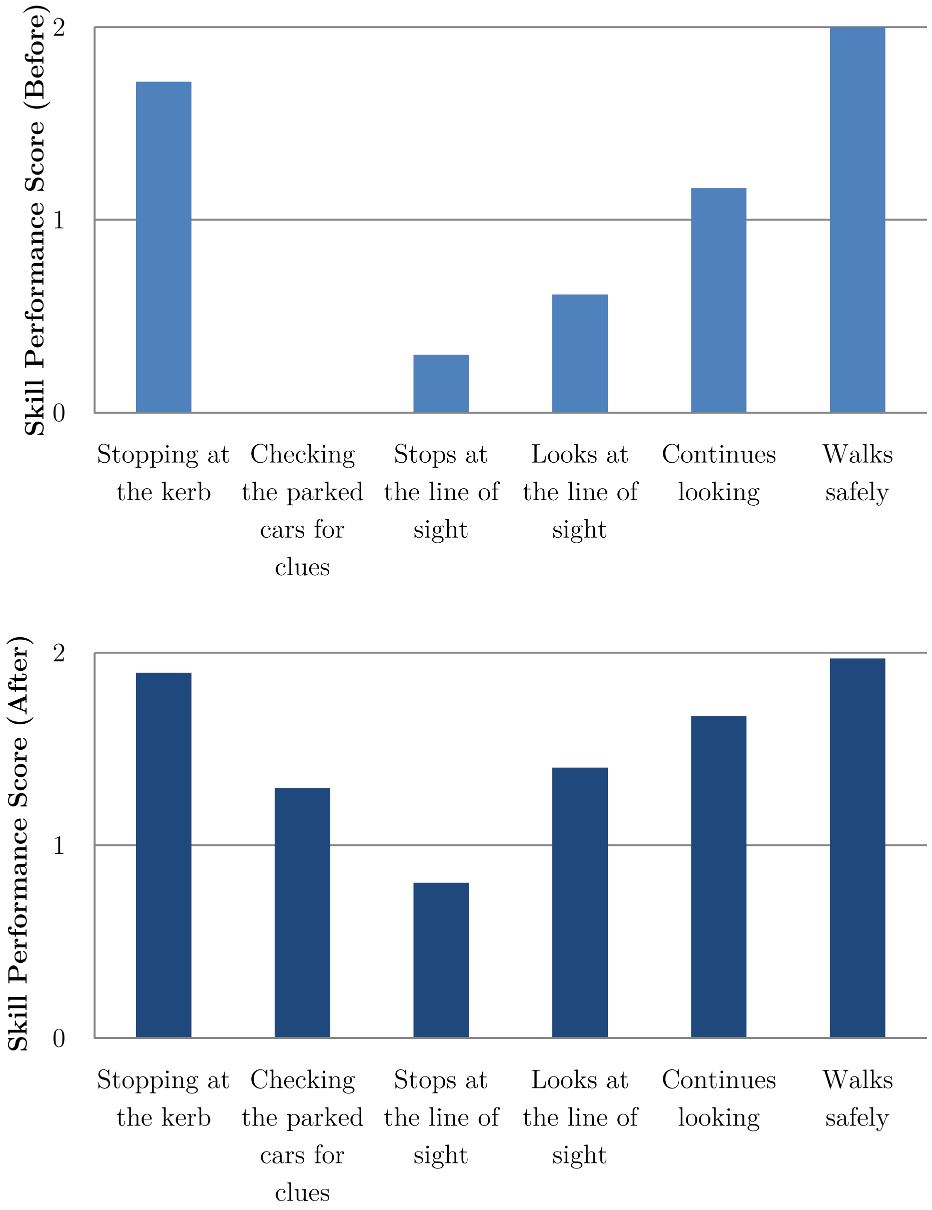



**Figure 7.2.3: Skill performance in the experimental group**

The change in skill performance scores from the pre to post training assessments were tested for statistical significance in order to assess whether the experimental sample of participants showed a statistically significant improvement compared to the control group. A Mann-Whitney test for statistical significance was used with experimental/control as the grouping variable and assessed behaviours as the test variables (Table 7.2.2). Mann-Whitney tests are applicable to ordinal data to compare the medians or distribution of two or more independent samples or treatment groups. A significant result indicates that there is a statistically significant likelihood that the samples represent populations with difference median values. The test has the added benefit of not assuming a normal distribution. (Souba and Wilmore, 2001, Gravetter and Wallnau, 2013, Sheskin, 2004). A post-hoc power analysis revealed that on the basis of the mean, between groups comparison effect size observed (0.52), a power of 88% was achieved. This is above the 80% power suggested by Cohen (1988).

**Table 7.2.2:** Mann-Whitney test for statistical significance to determine whether the experimental group improved more than the control group.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Mann-Whitney U | 1887.000 | 802.000 | 1560.000 | 1184.000 | 1449.500 | 1905.000 |
| Exact Sig. (2-tailed) | .707 | .000 | .037 | .000 | .010 | .573 |

Checking the parked cars for clues, stopping at the line of sight, looking both ways at the line of site and continuing to look while crossing improved to a statistically significant extent ($P<0.05$) in the experimental group compared to improvements seen in the control group. This indicates that interactive video does have at least a short-term impact on roadside behaviours and that it can a) train new skills and b) re-enforce or improve existing skills.

With significant improvements in skill performance from the baseline, it can be seen that safer behaviour is promoted and demonstrated as a result of using the interactive video. With key behaviours of checking the parked cars, stopping at the line of sight and looking at the line of sight showing improvements, it is clear that both pedestrians and drivers would have more chance of seeing one another, reducing the risk involved with crossing. It is important to note however that a) there is room for improvement as skills were not improved completely and b) that this longevity of this improvement is unknown and it is likely that more reinforcement of learning outcomes would be required for behaviour to be obtained.

No significant differences in improvements were seen between the experimental and control groups in the stopping at the kerb and walking safely behaviours. This is almost certainly due to the high baseline performance in these skills in both groups.

While overall improvements can be seen, it is important to note that analysing this aggregated data does not allow us to assess how the effectiveness of the video compared at the different schools it was trailed in. Importantly, while improvements can be seen overall, it must be noted that skills were not performed perfectly as a result of using the interactive video, and the video was not effective in improving behaviour in all cases.

### 7.2.4 Behavioural change in the School A sample alone

Table 7.2.3 outlines the extent to which behaviour changed in School A between the pre and post assessment for the experimental group, who used the interactive video, and the control group, who did not. It is clear that the changes in the control group are minor to the extent to which risky behaviour was still the norm when crossing between parked cars. While the experimental group shows no change for stopping at the kerb and walking safely; a result of the high baseline performance, they show much larger improvements in other skills to the extent that the overall crossing safety of the group is likely to have increased. Table 7.2.4 and Table 7.2.5 present the results from a Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group in "School A" between the pre and post training assessments.

**Table 7.2.3: Average behavioural score improvement from pre-training to post-training assessment, School A**

| | Control Group | Experimental Group |
|---|---|---|
| Stopping at the kerb | 0.05 | 0 |
| Checking the parked cars for clues | 0.19 | 1.46 |
| Stops at the line of sight | 0.05 | 0.68 |
| Looks at the line of sight | 0.05 | 1.07 |
| Continues looking | -0.24 | 0.36 |
| Walks safely | -0.10 | 0 |

**Table 7.2.4:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *experimental group in "School A" (N=28)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | .000 | -4.456 | -2.732 | -3.551 | -2.202 | .000 |
| *p* | 1.000 | .000* | .006* | .000* | .028* | 1.000 |

* indicates statistical significance where p<0.05

**Table 7.2.5:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *control group in "School A" (N=21)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -.447 | -1.414 | -.414 | -.144 | -1.311 | -1.000 |
| *p* | .655 | .157 | .679 | .885 | .190 | .317 |

* indicates statistical significance where p<0.05

It can be seen from Table 7.2.4 and Table 7.2.5 that there were no statistically significant improvements in behaviour in the control group but that there were statistically significant improvements in the following skills in the experimental group:

- Checking the parked cards for clues
- Stopping at the line of sigh
- Looking at the line of site
- Continuing to look

The results are therefore a reasonable indication that it was training with the interactive video that led to the overall skill improvement in the experimental group. Again, the impact of the video changes at the individual level, and while overall improvements are encouraging, interactive video is not a learning style that is effective for all users and it therefore should not be used alone, but alongside a range of road safety resources and learning measures, with support from an adult.

### 7.2.5 Behavioural change in School B sample alone

Table 7.2.3 highlights the extent to which behaviour changed in School B between the pre and post assessment for the experimental group and the control group. Table 7.2.7 and Table 7.2.8 present the results from a Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group in "School B" between the pre and post training assessments.

**Table 7.2.6 Average behavioural score improvement from pre-training to post-training assessment, School B**

| | Control Group | Experimental Group |
|---|---|---|
| Stopping at the kerb | 0.47 | 0.22 |
| Checking the parked cars for clues | 0.27 | 1.44 |
| Stops at the line of sight | 0.50 | 0.50 |
| Looks at the line of sight | 0.27 | 0.33 |
| Continues looking | 0.4 | 1.17 |
| Walks safely | 0.07 | 0 |

**Table 7.2.7:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *experimental group in "School B" (N=18)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -1.000 | -3.557 | -1.826 | -1.730 | -3.286 | .000 |
| *p* | .317 | .000* | .068 | .084 | .001* | 1.000 |

* indicates statistical significance where p<0.05

**Table 7.2.8:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *control group in "School B" (N=15)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -1.444 | -1.414 | -1.543 | -.954 | -1.051 | -.272 |
| *p* | .149 | .157 | .123 | .340 | .293 | .785 |

* indicates statistical significance where p<0.05

It can be seen from Table 7.2.7 and Table 7.2.8 that there were, again, no statistically significant improvements in behaviour in the control group but that there were statistically significant improvements in the following skills in the experimental group:

- Checking the parked cards for clues
- Continuing to look

The results are therefore a reasonable indication that it was training with the interactive video that led to the skill improvement in the experimental group.

### 7.2.6 Behavioural change in School C sample alone

Table 7.2.9 shows the extent to which behaviour changed in School C between the pre and post assessment for the experimental group and the control group. Table 7.2.10 and Table 7.2.11 present the results from a Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group in "School B" between the pre and post training assessments.

**Table 7.2.9: Average behavioural score improvement from pre-training to post-training assessment, School C**

| | Control Group | Experimental Group |
|---|---|---|
| Stopping at the kerb | 0.29 | 0.57 |
| Checking the parked cars for clues | 0 | 1 |
| Stops at the line of sight | 0 | 0.43 |
| Looks at the line of sight | -0.06 | 1.21 |
| Continues looking | -0.12 | -0.14 |
| Walks safely | 0 | -0.14 |

**Table 7.2.10:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *experimental group in "School C" (N=14)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -1.947 | -2.640 | -2.121 | -2.919 | -.577 | -1.000 |
| *p* | .052 | .008* | .034* | .004* | .564 | .317 |

* indicates statistical significance where p<0.05

**Table 7.2.11**: Wilcoxon signed ranks test for significance in behavioural skills scores for the control group in "School C" (N=17) between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | -1.518 | .000 | .000 | -.272 | -.263 | .000 |
| *p* | .129 | 1.000 | 1.000 | .785 | .793 | 1.000 |

* indicates statistical significance where $p<0.05$

Similarly to schools A and B, there were no significant improvements in behaviour in the control group, but there were statistically significant improvements in the experimental group in the skills of :

- Checking the parked cars for clues
- Stopping at the line of sight
- Looking at the line of sight

### 7.2.7 Behavioural change in School D sample alone

Table 7.2.12 shows the extent to which behaviour changed in School D between the pre and post assessment for the experimental group and the control group. Table 7.2.13 and Table 7.2.14 present the results from a Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group in "School D" between the pre and post training assessments.

**Table 7.2.12: Average behavioural score improvement from pre-training to post-training assessment, School D**

| | Control Group | Experimental Group |
|---|---|---|
| Stopping at the kerb | 0 | 0 |
| Checking the parked cars for clues | 0.8 | 0.86 |
| Stops at the line of sight | 0.8 | 0 |
| Looks at the line of sight | 0 | 0 |
| Continues looking | 0.4 | 0.71 |
| Walks safely | 0 | 0 |

**Table 7.2.13:** Wilcoxon signed ranks test for significance in behavioural skills scores for the *experimental group in "School D" (N=7)* between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | .000 | -1.732 | .000 | .000 | -1.518 | .000 |
| *p* | 1.000 | .083 | 1.000 | 1.000 | .129 | 1.000 |

* indicates statistical significance where p<0.05

**Table 7.2.14:** Wilcoxon signed ranks test for significance in behavioural skills scores for the experimental group (N=5) between the pre and post training assessments.

| | Stopping at the kerb | Checking the parked cars for clues | Stops at the line of sight | Looks at the line of sight | Continues looking | Walks safely |
|---|---|---|---|---|---|---|
| Z | .000 | -1.414 | .000 | .000 | -1.000 | .000 |
| *p* | 1.000 | .157 | 1.000 | 1.000 | .317 | 1.000 |

* indicates statistical significance where p<0.05

The results demonstrate that in School D there was no statistically significant effect in either group. This could be a result of a number of issues;

- The video may have been ineffective as a result of characteristics of the participants involved or the school, making them less susceptible to interactive video as a learning medium. Due to the nature of data protection, individual characteristics of children were not available for the purpose of this study.
- During the classroom based session (see section 7.1.3), There were network issues experienced during the use of the interactive video leading to video lag as the server could not cope with the demand of streaming the game to multiple computers. As a result, these children experienced disruption during their use of the video. They were asked to temporarily stop using the video and return to the classroom while the tool was installed locally on their computers. This negated any lag issues but may have introduced disruption to the activity.
- This school also had a small sample size which may have masked the effect of the video to an extent and reduced the power of statistical analysis. While this means considering this school independently must be done with care, consideration of the children in the aggregated sample is still valid as there is was no indication on the trial days that the tool was being used ineffectively.

There is not enough data to indicate why children in this school did not respond to the game so consideration of these results independently must be carried out with care if drawing any conclusions. These issues do however; present a number of considerations for this type of activity where concentration on the task at hand is critical for successful completion of the game.

### 7.2.8 Comparison of behavioural change in schools

Table 7.2.15 summarises the statistical analysis undertaken, comparing the effectiveness of interactive video in each of the four participating schools.

**Table 7.2.15:** Summary of the statistical analysis to determine behavioural improvement as a result of interactive video.

| | | **Stopping at the kerb** | **Checking the parked cars for clues** | **Stops at the line of sight** | **Looks at the line of sight** | **Continues looking** | **Walks safely** |
|---|---|---|---|---|---|---|---|
| **School A** | Control | | | | | | |
| | *Experimental* | | p=.000 | p=.006 | p=.000 | p=.028 | |
| ***School B*** | Control | | | | | | |
| | *Experimental* | | p=.000 | p=.068 | | p=.001 | |
| ***School C*** | Control | | | | | | |
| | *Experimental* | | p=.008 | p=.034 | p=.004 | | |
| ***School D*** | Control | | | | | | |
| | *Experimental* | | | | | | |

Indicates statistically significant behavioural improvement where $p<0.05$

Indicates no statistically significant improvement

None of the control groups displayed an overall statistically significant improvement in behaviour between the first and second on-street assessment. This indicates that the children in each of the schools were not exposed to an unknown entity that led to an improvement in road safety behaviour during the course of the evaluation. It also indicates that improvements in the experimental group are likely to be as a result of the interactive video intervention. It is also expected that no significant improvements in either “stopping at the kerb” or “walking safely” would be observed due to the high baseline performance of each skill.

Three schools (A, B and C) demonstrated statistically significant improvements in behaviour for three (Schools B and C) or four (School A) skills. Checking the parked cars for clues and stopping at the line of sight improved significantly in all of these schools – a real indicator that the overall safety of the crossings improved as by stopping at the line of sight, drivers would be in a better position to see the children and slow down or stop if necessary.

School D did not demonstrate any statistically significant improvements in behaviour. This could be a result of a number of factors. First and foremost, this school experienced a number of IT issues during the use of the interactive video and participating children had to return to class and restart the tool upon returning. This may well have detracted from the learning objectives of the video. This school also had the smallest sample size and this may have impacted upon the analysis. There is the potential to argue that the children taking part were less suited to learning through an interactive video medium as a result of a bias towards a preferred learning style within the group and while there was no indication of this during the use of the video, it may well have had an impact on the effectiveness if a high proportion of learners were not susceptible to interactive video.

The results do indicate that interactive video can have a positive impact on road safety behaviour for some children, however it is important to note that not all children or skills demonstrated a statistically significant improvement in roadside behaviour following the use of the video, and for those that did, it is unclear a) how long the behaviour will be retained without further practice and b) the impact of the video on the overall collision statistics.

With this in mind further development of interactive video cannot be recommended as a substitute for pedestrian training; it could be used as an additional training resource which must be reinforced through practical on-street practice of the skills learnt in the classroom environment as part of a practical training scheme. There may also be scope to introduce interactive video elements into online road safety games that are aimed towards knowledge acquisition, in order to encourage transfer of some of the road safety principles to behaviour at the roadside. Further research would be required to ascertain the effectiveness of any new training system.

Current research indicates that practical training remains the most effective method for improving roadside behaviour as part of a school based pedestrian road safety intervention and the current UK government advice remains such that;
"*The Kerbcraft scheme remains the basis for children's practical road safety training…We encourage Local Authorities to adopt Kerbcraft of similar child pedestrian training schemes, rather than anything that is watered down or less effective, and target it on high risk areas and groups"* (Department for Transport, 2011)

## Chapter Seven Summary: Key Points

- The interactive video developed to improve parked cars crossing skills was trialled in four schools in Hampshire.
- On aggregate, interactive video led to significant improvements in four road crossing skills when compared to the control group.
- The best performing school was the most affluent with the oldest children. The worst performing school was the most deprived. While these may be factors in performance, there is no proof of causality.
- Interactive video could prove to be a useful addition to the range of in-class materials available, to be used alongside practical on-street training.

Chapter 8

# Usability of and engagement with interactive video

As well as assessing the impact that interactive road safety videos can have on behaviour, this research considers the usability of interactive video as an educational resource. By understanding the usability and interaction issues that young children experience when using interactive video it will assist in assessing the suitability of such a tool for the 5-7 age group considered in this research. Due to the complexity of carrying out usability studies with young children, a number of techniques were used; questionnaire methods that have been used in other usability studies with children, event logs detailing the use of the video and general observations made during the trials undertaken.

## 8.1 Post-use questionnaire feedback

Questionaries' are a simple method for formally recording usability issues after using the interactive video and the results alongside observation provide a better understanding of how usable, fun and engaging the interactive video task is. The questionnaire methodology was based on the work of Sim, MacFarlane and Read (2006) and Read and MacFarlane (2002) who highlighted the effectiveness of 'Smileyometers' (Figure 8.1.1) in recording children's opinions. Read, MacFarlane and

Casey (2002) also note that simple observation of potential engagement issues are an effective measure and as such observation was used alongside the questionnaire.

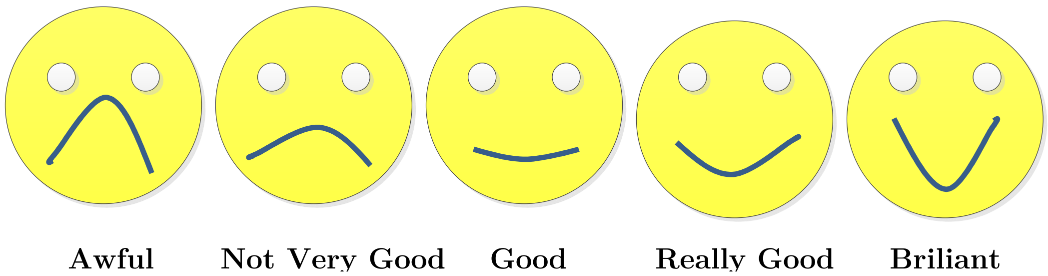



**Figure 8.1.1: A smileyometer scale**

Read, MacFarlane and Casey (2002) argue that in order to determine the level of 'fun' experienced by young children, it is necessary to measure expectations before a user uses an application. If a users' level of expectation is met or exceeded, the user will have a sense of satisfaction. If the level of expectation is not met, an event is "subsequently perceived to be dull" and a user will feel let down by the tool leading to a negative educational experience.

### 8.1.1 Participants

The study took place in a mixed-sex infants school with the following characteristics: above average overall absenteeism, over four times the national unauthorized level of absenteeism, approximately 50% white-British, approximately 50% ethnic minority heritages (of whom over 1/3 speak English as an additional language), average free-school meals and average 'special needs'. The School received a 'Good' Ofsted rating. The children (n=15) that took part in the study broadly reflected the characteristics of the school. One child was excluded from this analysis due to ambiguity on their answer sheet.

### 8.1.2 User questionnaire feedback methodology

The questionnaire survey was conducted prior to the first pilot trial of the interactive video in order to expose any key issues prior to on-street skills assessment. This allowed changes to the video interface to be made prior to the pilot study to ensure that usability issues did not impact upon user performance.

The questionnaire consisted of two phases, a single pre-play question to determine how ‘good’ the students anticipated the game would be and a set of post-play questions to determine how usable the children thought the game was; specifically, how easy or hard they found it to click on dangerous activities portrayed in the video which is the primary hazard perception task the children undertake when playing the game.

Questions (Table 8.1.1) were written in simple English and approved by the school, to ensure the questions would be understood. Questions were executed on a one-to-one basis where each question was read out aloud and described to ensure that it was clear and to assist those with reading difficulties. All answers were given on a scale using a Smileyometer where a ‘sad’ face related to a negative opinion and a smiley face related to a positive opinion depending on the question.

**Table 8.1.1: Usability and enjoyment questions**

| **Pre-play question** | **Description and rationale** |
|---|---|
| How good do you think this activity will be? | Children were asked to say how good they thought the activity would be before they started playing. This allows us to gauge the extent to which the video subsequently met the users' expectations. |
| **Post-play questions** | **Description and rationale** |
| How good do you think the activity was? | Following gameplay, children were immediately asked how good they actually found the video. Pre-play answers were hidden. |
| How easy was the activity? | Children were asked how easy they found the activity overall. If the majority of children found the video too hard or very easy to play then the difficulty level of the game would require further assessment and refinement. |
| How easy was it to see and click on the dangers? | This question specifically asked children how easy they found it to identify and select the hot-spotted hazards; the activity which forms the basis of the hazard perception element of the game. While challenge is a requirement to ensure children are engaged with the material, it is clear that too much challenge would in fact hinder the effectiveness of the game. |
| How well do you think you did at the activity? | This question aimed to gauge the child's perceived level of success. |

### 8.1.3 Questionnaire feedback

The Smileyometer scores were converted to scores ranging from 1 to 5 with low scores indicating a negative/sad response and high scores indicating a positive/happy response (Table 8.1.2: Identifying usability issues).

**Table 8.1.2: Identifying usability issues**

| Question | Mean Score |
|---|---|
| Before we start; how good do you think this activity will be? | 4.3 |
| How good do you think the activity was? | 4.5 |
| How easy was the activity? | 3.7 |
| How easy was it to see and click on the dangers? | 3.2 |
| How well do you think you did at the activity? | 4.3 |

In terms of how good the pupils found the activity, expectations were exceeded in four cases and met in 10 cases. One player stated that the video activity did not meet their expectations as they felt it was too hard; an indication of why their expectations were not met. General ease of seeing and clicking on dangers both ranged from 1 (too hard) to 5 (very easy) and this is reflected in the user's experience of how good they thought the game was. Mean scores of 3.7 and 3.2 indicated feedback was generally positive, while providing a level of challenge in order to engage users; a critical factor of successful learning.

With the majority of users thinking that they did well at the activity there is an indication that the experience was positive. These results suggest that for the majority of users, the interactive video did prove to be an engaging educational resource, but with some users having difficulty identifying and clicking on hazards, future versions of this type of activity could implement 'difficulty levels'; starting easy and progressing to harder scenarios, allowing all users to fully engage.

In addition to this it is important to note that during observation of the children using the video, they appeared to be engaged and there were no behavioural issues throughout the duration of this trial. The children also appeared to enjoy the activity, which, was consistent with their responses.

## 8.2 'Click' analytics

A system analytics log was used alongside the interactive video in order to capture user mouse inputs or 'clicks' during video use in order to assist in usability and engagement evaluation. Because logging is carried out as a background process, user behaviour is natural and not influenced by the presence of an assessor (Choros and Muskala, 2009).

Farney (2011) states that, "click analytics is a powerful technique that displays what and where users are click on a webpage" and that it allows analysts to, "easily identify areas of high and low usage on a page". Choros and Muskala (2009) state that click mapping allows researchers to identify the most popular areas of a website in order to assist with evaluation.

### 8.2.1 Methodology

A click map was developed using Microsoft Excel and has been used to highlight usability issues within the game interface. As well as a click map, Choros and Muskala (2009) state that groups of clicks can be combined into "blocks" in order to highlight areas of the screen that commonly are and are not clicked on. This aggregation of clicks can aid usability evaluation, in particular by influencing changes to layouts. Importantly, Choros and Muskala (2009) note that it is difficult to automatically define a block.

K-means clustering has been identified as a suitable method for highlighting blocks of clicks due to its application in clustering geographic coordinate based data for GIS applications. Clustering allows objects to be united into groups according to their similarity (Hamfelt, Karlsson, Thierfelder and Valkovsky, 2011). Clicks are defined by horizontal and vertical coordinate and as such are compatible with such methods. K-means is one of the most popular methods for carrying out cluster analysis (Hamfelt, Karlsson, Thierfelder and Valkovsky, 2011).

### 8.2.2 Sample

Click logs were recorded for School A, D and C. Due to computer administration settings, click logs were not available from school B. In total over 3500 user inputs were recorded over the period of the interactive video trials.

### 8.2.3 Results

Figure 8.2.1 shows the locations of clicks from the three schools while the experimental groups used the interactive video. It can be seen that the majority of clicks are heavily clustered over the hazard identification video (highlighted approximately in red). The tool control buttons used in the latter stages are highlighted in green.

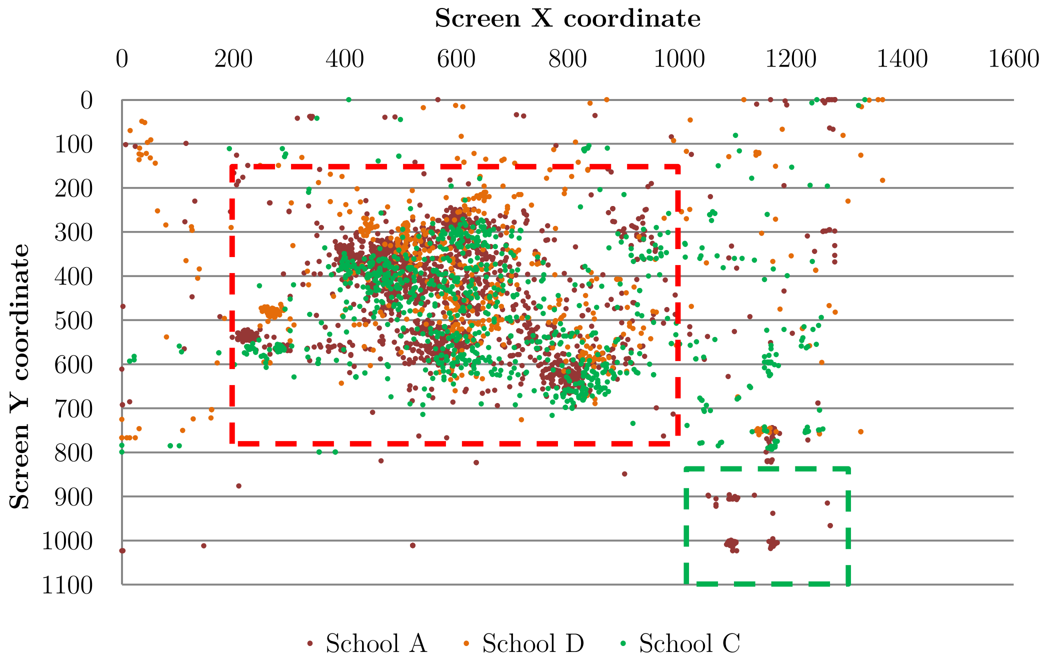



**Figure 8.2.1: User click locations during interactive video evaluations**

It is immediately apparent that the majority of clicks were concentrated within the interactive video interface area suggesting a high level of engagement with the tool.

This is encouraging as it would indicate that overall users were interested in using the tool, rather than being distracted by the surrounding computer environment.

In order to block clicks together into clusters, a K-means cluster analysis was carried out using Microsoft Excel (Neilson, 2011). Eight clusters were defined, constrained within the hazard identification area of the video in order to highlight interaction issues (Figure 8.2.2).

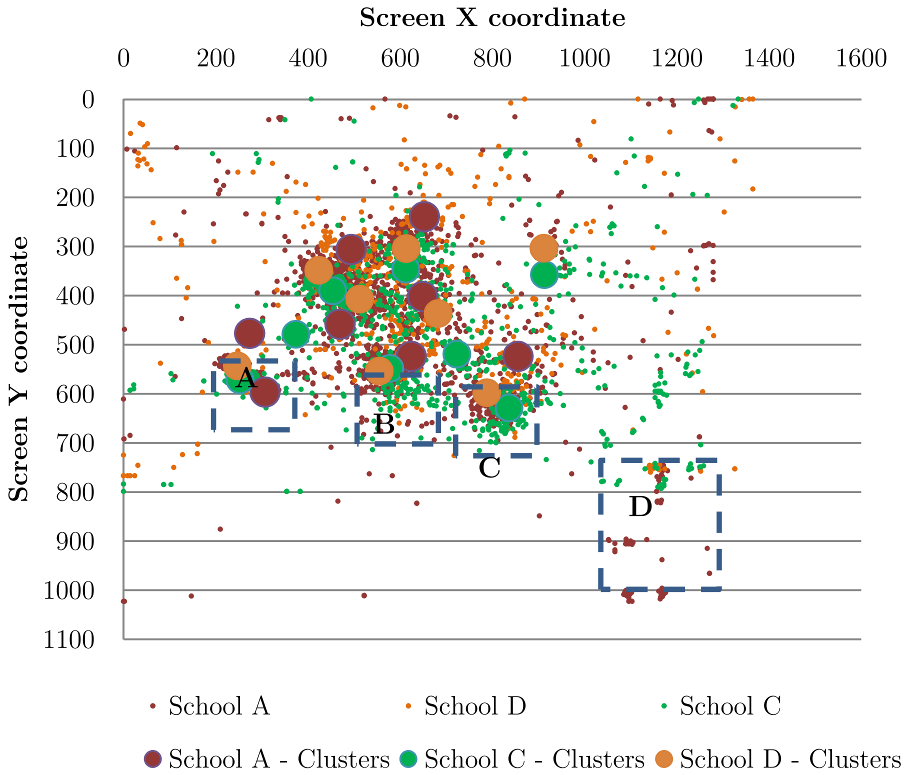



**Figure 8.2.2: Click Cluster locations within video**

The majority of clicks are within the interactive video area and the clusters are approximately congruent whereby the three schools all concentrated clicks in similar areas within the interactive video. Three clusters (A, B & C) appear towards the bottom of the video area. As well as hazard identification, the following interface items can be clicked on in these zones during the use of the tool:

A: The play button used to start the hazard identification video.

B: The OK buttons used to close information windows that pop-up giving safer behaviour advice following the correct identification of a hazard.

C: Buttons used for progression during use of the interactive video.

A further cluster appears below the interactive video area. This block (D) contains interface control buttons used towards the explanation section of the tool when users step through individual demonstrations of safe skills.

One key point of interest highlighted by the click map is those clicks that took place outside of the interactive video area. This 'click error' has been measured to count the number of non-productive clicks (time spent clicking outside the interface is not conducive to completing the task at hand). Non-productivity in School A was just 6 % compared to 14% and 26% in Schools C and D respectively (Table 8.2.1). This may indicate that children in School A were ether more interested or more able to concentrate on the interactive video. Indeed, during the use of the video, the children in School A stayed particularly on-task, listening to the introduction and remaining focussed throughout the exercise. While levels of engagement in schools C and D still appeared to be high, there were higher incidences of children talking to one another, especially at the very start of the session, before the interactive video was used.

Non-productive clicking shows very strong negative correlation with the number of statistically significant skill improvements demonstrated by the experimental groups in each school along with the average skill improvement score in the experimental groups. While this does not prove causality, it is a clear indication that engagement in the interactive video is a factor of success.

**Table 8.2.1: Correlation between non-productive clicking and on-street skill performance.**

| | % Interface click error | No. Statistically significant skill improvements | Average experimental group improvement score |
|---|---|---|---|
| **School A** | 6 | 4 | 0.60 |
| **School C** | 14 | 3 | 0.49 |
| **School D** | 26 | 0 | 0.22 |
| **Pearson correlation coefficient** | | -0.99 | -0.99 |

## 8.3 General usability observations

Children were asked to raise their hand with any technical and usability issues during the activity, which were then addressed immediately by the researcher. Technical issues were generally audio related and were addressed by increasing the volume using the system volume controls; many of the children were not yet aware of how to do this and future interactive videos aimed at younger users should also implement on-screen volume controls within the game interface. Usability issues, which occurred rarely, related to either progressing through the video e.g. the player not clicking "next" to progress through scenarios, or issues clicking on hazards e.g. the player clicking on the screen when they saw a hazard, but not on the actual hazard itself. In both cases, the researcher would encourage the child to solve the issue themselves e.g. "what do you think you should click on?", rather than telling the child what to do. It is suggested that future interactive videos make use of a training level, rather than just a demonstration video, in order to allow users to experience the activity on a trial basis before the main hazard-identification scenario.

Given that performance was different between schools it is important that interactive video is not used as a replacement for practical training, but an additional tool to be used in-class in a safe environment under the supervision of a trained adult in order to reinforce on-street training or as a precursor to practical training in order for a user to experience risk in a safe environment before experiencing it on-street.

## Chapter Eight Summary: Key Points

- The interactive video developed proves to be a fun and engaging resource that met or exceeded user expectations overall and provided a suitable level of challenge to maintain engagement.
- Clicks were concentrated in the hazard perception and interface area of the computers during the use of the interactive video.
- There is negative correlation between non-productive clicking and improvements in behaviour indicating that the best behavioural improvements were gained when children were most engaged.
- Interactive video should not replace practical training but be used as part of carefully designed practical schemes in order to reinforce training.

# Chapter 9

# Discussion and practical implications

This study aimed to understand the nature, context and extent of child pedestrian training in the United Kingdom with a view to develop and study a computer based interactive learning environment, assessing the potential of the learning environment to aid the delivery of road safety training to the young. This chapter discusses the overall findings and resultant implications of this research in more detail.

## 9.1 The delivery of child pedestrian training and deviation from Kerbcraft

Kerbcraft was designed to be a comprehensive pedestrian training scheme with behavioural improvement outcomes and is cited as an example of European best practice (European Comission, 2005). It is evident that pedestrian training schemes have, in many cases, deviated away from the original Kerbcraft model (See Chapter 4). In many cases local authorities are offering a shortened scheme to a larger number of people than authorities that have continued to implement Kerbcraft.

Authorities that implement Kerbcraft are likely to be offering children the most comprehensive training system available in the UK based on the findings of the survey undertaken, and if the small numbers of children involved are targeted correctly at high risk groups, there may be an argument that this is still the most effective method for improving children's behaviour. With only 300 children being targeted by some local authorities however, it can also be argued that the impact on reducing road safety risk would be limited unless all of the 300 children targeted were the highest risk group in the authority.

With many local authorities opting to deviate from Kerbcraft, there are some comparative inadequacies in the content and amount of training on offer as part of the implementation of such a scheme. The changes made to in the generation of these new schemes appear to be made in order to address some of the problems and reservations faced when implementing Kerbcraft; most obviously the time that the Kerbcraft model takes to run in a school compared to reduced schemes. One of the key constraints of this research was being able to secure time in schools to carry out road safety education research when the pressures on the curriculum are extensive. The time available for road safety education is therefore limited and an extensive scheme such as Kerbcraft would be difficult to market to schools with busy teaching timetables.

The added benefit of these reduced schemes appears to be;

a) Reduced impact on the teaching timetable when compared to Kerbcraft.
b) Potential to deliver training to a much larger group of schools and children, allowing more people to benefit from training.

If these shortened schemes prove to be as effective as Kerbcraft, there could be an argument for adopting these schemes as an alternative. Unfortunately a lack of evaluation means that the impact of these schemes on behaviour remains relatively unknown. More research needs to take place to establish the effectiveness of these schemes, and if it is the case that they are as effective, a new model for training could be developed and implemented nationally in order to reduce the variation in training across the country. Local authorities should also begin internally evaluating schemes for behavioural chance, rather than knowledge acquisition. Not only will this demonstrate the worth of schemes, if training proves to be effective local authorities may be able to generate income by selling training materials to other local authorities.

The difficulty marketing comprehensive training schemes such as Kerbcraft and the popularity of shortened schemes highlights another issue; comprehensive Road Safety Education is not part of the national curriculum in England and is therefore not a compulsory part of a child's education. While all schools deliver road safety education of some sort, there is variation in the time and content of training delivered in schools, as shown by this research. If RSE was compulsory, with central government guidance on the nature of education to be undertaken, it would be a powerful tool to ensure that all children receive consistent and comprehensive road safety education.

It is clear that despite government guidance suggesting that local authorities do not 'water down' the Kerbcraft curriculum, many were shortening or altering the scheme. This is not a bad reflection on authorities but an indication that the policy is inadequate given the circumstances in which local authorities operate. For wide scale implementation of Kerbcraft to be realistic both funding and statutory requirements to deliver the scheme would need to be introduced by the government. Moreover key elements of an effective road safety strategy are missing from current guidance; in particular clear and challenging targets for reductions in road traffic injury collisions.

The amount of practical pedestrian training delivered by local authorities varied across a spectrum from implementing the full Kerbcraft scheme to delivering a twenty minute session or no training whatsoever. The effectiveness of these very short twenty minute schemes needs to be established and compared to that of Kerbcraft and its' variations. If the various delivery platforms result in different levels of training effectiveness, children are effectively involved in a 'postcode lottery' depending on whether their school catchment local authority is offering training, what type of training is on offer and whether the school is willing to give up curriculum time for training to take place.

## 9.2 The delivery of knowledge based road safety education

Numerous local authorities offer in-class elements in their training. There is a clear focus on knowledge acquisition which as previously discussed should not be the only ultimate aim of road safety activities; changes in behaviour are potentially more critical in improving road safety. This work does not argue against such knowledge based teaching; underlying knowledge of road safety issues remains an important part of any child's road safety education.

This research has demonstrated that interactive video may offer an addition to these knowledge based activities with the direct aim of improving on-street behaviour following in-class 'training'. Importantly, any adoption of new in-class activities or changes to existing activities should always be combined with evaluation to ensure that the activities are having the intended impacts on behaviour.

## 9.3 The effectiveness of interactive video in improving parked cars crossing behaviour

This research has demonstrated the potential for interactive video to be used to improve roadside pedestrian behaviour in young children. The research has indicated that a short amount of interactive video training can lead to statistically significant improvements in behaviour in children in the short term. The long term benefits of the training are unknown and it is likely that repeated exposure to interactive video or exposure to other training mediums following initial training would be required to maintain and further improve behaviour. Critically it is important that interactive video is not solely relied upon to bring about a change in behaviour as part of a road safety intervention as not all children in the study responded positively to the video.

### 9.3.1 Delivery of road safety interactive video in practice

Interactive video should not be a substitute for practical training. It is simply not as effective in improving behaviour compared to practical schemes such as Kerbcraft that contain many of the fundamental principles required for skill acquisition. Most importantly, *practical pedestrian training remains the most effective delivery medium, in-line with current research findings and the current UK government guidance*. This research has found no reason to go against current evidence and so this advice remains.

If interactive video targeting improvements in pedestrian behaviour is to be considered, it should be used as part of a practical blended learning training package to ensure that all students are able to gain a practical improvement in their road safety skills. One could envisage shorter pedestrian training schemes making use of interactive videos between practical sessions in order to repeat key messages using real video footage.

The video could be used in-class under the supervision of a class teacher or training provider. This in-class training could then be followed by an on-street practical training session to reinforce the procedures demonstrated in the video. Importantly, integration of interactive video into a training scheme should be accompanied by an evaluation of the training scheme to see if the intended outcomes have been achieved.

This research has supported previous evidence that young children in the 5-7 age range can show improvements in road safety behaviour as a result of 'training' despite their young age. This research has indicated that slightly older children may be more susceptible to interactive video training although the results in all age groups were positive. A school setting continues to be an acceptable place in which to deliver training and this fits within the current administrative context of existing road safety training and has the benefit of adults being on hand to provide support when necessary. There is potential to explore the benefits of delivering road safety activities such as pedestrian training and interactive video tools in other educational arenas such as cubs and beavers, although this may limit the exposure of the resource to a small audience.

An alternative area of distribution, and an area of further research, could be the introduction of interactive video elements to existing online games that are orientated towards increasing knowledge through fun 'edutainment' activities. The inclusion of interactive videos related to the gaming content may aid transfer of knowledge from the gaming environment to skills at the roadside.

## 9.1 Barriers to research and training

Working in schools with children caused numerous delays and reflects many of the barriers presented by Local Authorities that do not run the Kerbcraft scheme and also other researchers.

Perhaps one of the biggest lessons learnt from a research methodology perspective is the barriers to researching in schools and solutions to some of the issues that can arise. These same barriers are likely to be applicable in any roll out of pedestrian training / education; be it interactive video or otherwise.

*Barrier 1 – Timetable constraints*

Perhaps the biggest barrier throughout the duration of this research was timetable constraints in schools. While most schools saw the potential benefits of the research, a number simply couldn't spare time within their teaching timetable for non-essential activities to take place. This was particularly apparent at times when exams were imminent. The time when schools were most receptive for research activities to take place were in the days leading up to school holidays, when more time seemed to become available.

*Barrier 2 – A top down approach*

All project inceptions occurred via a Head Teacher. If the head teacher was not interested in the research, it would not take place in the school even if year group teaching staff did have time available. Where a head teacher was interested in the project taking place the process of setting up a research trial was in fact relatively straightforward and was reliant on completing the correct paperwork, having an up to date Criminal Records Bureau check and obtaining written permission from participants. Interestingly there was almost always limited communication between the Head Teacher and year group teaching staff and it was common to have to explain to each class teacher the nature of the project from the beginning.

*Barrier 4: -Technical aspects.*

While not necessarily a barrier, there was a difference in the provision of IT facilities in each of the schools and this should be considered in any future research projects involving schools. While all met the requirements of being able to play a simple flash based interactive video, more intensive programmes may have come up against performance issues. Network performance was an issue when using the interactive video whilst being streamed from a central school server; it is likely that the systems in infant schools are not designed for the heavy loads that some programmes may require.

*Barrier 5: - Staff availability and reliability*

While staff availability did not directly impact on the assessment presented in this thesis, there were occasions where staff illness led to a school helper being unavailable for the research trial, after training had been given. While this is in essence unavoidable, future projects may benefit by training several members of staff prior to research in schools commencing. This was possible in some, but not all of the schools that took part in this research and the impact of illness or other commitments were vastly reduced in those schools where more trained staff were available.

## 9.2 The impact of RSE on collisions

The most robust test of effectiveness of practical training schemes (and interactive video or any other intervention) is ultimately the impact of training on long term collision risk.

This area of research has received very little attention due to the cost and time implications involved in carrying this type of epidemiological research. While behavioural evaluations provide an indication of the potential for risk reduction based on improved behaviour, further research into the impact on collision statistics should take place in the future.

The key barrier to this type of research would be controlling for confounding in the results i.e. testing the impact of practical training alone and not any external factors.

## 9.3 Potential expansion of interactive video into other risk areas

This research has found examples of interactive video in the arenas of transport research health and safety (Cherrett, Wills, Price, Maynard and Dror, 2009), medical health and safety (Dror, Schmidt and O'connor, 2011), and cycling health and safety education (Melsen, 2008). This research has gone further by a) demonstrating that interactive video can improve behaviour and b) that it also has applications in pedestrian health and safety education.

Each of these examples has two key factors:

- procedural skills required to carry out a task safely;
- potential risks that occur during the execution of a task.

For example, in a medical scenario there are procedures that must be adhered to during, for instance, an operation. During the operation risks would be present such as sharp instruments, blood and so on. In the case of a roadside pedestrian scenario a crossing procedure should be adhered to in order to cross a road safely and this must be carried out while risks, such as moving vehicles and trip hazards, are present. The implication therefore is that interactive video may have applications in other risk areas where a procedure is commonly used to address or avoid risk. Areas which could be explored in further research are presented in Table 9.3.1, although any risk areas that satisfies the two aforementioned criterions could be considered, in particular high risk areas such as agricultural and construction settings that experience high injury and fatality rates (Health and Safety Executive, 2013).

**Table 9.3.1:** Potential interactive video expansion areas

| Risk Area | Example procedures | Potential example risks |
|---|---|---|
| Construction health and safety | Setting out construction elements<br>Excavating | Construction machinery collisions<br>Excavation asphyxiation |
| Manual handling health and safety | Manually lifting computer equipment | Musculoskeletal injury |
| Office environment health and safety | Use of computer equipment | Repetitive strain injury |
| Agricultural health and safety | Use of farm machinery | Collision with farm vehicles or employees |
| Mining health and safety | Blasting | Undetonated blast cartridges |
| Manufacturing health and safety | Use of manufacturing equipment | Trapped body parts<br>Musculoskeletal injury |
| Utilities health and safety | Repairing gas leaks | Gas poisoning |
| Railway health and safety | Repairing points | Fast moving locomotives<br>Live electrical points |

Important to note is that fact that application of interactive video in any new or existing arena should be accompanied by evaluation to ensure that the video is having the intended impacts.

## 9.4 Additionality and the scope for further research

This research set out to assess whether interactive road safety training videos be designed in order to positively impact on roadside behaviour. In the course of the research it has been shown that interactive video can indeed have a positive impact on behaviour when children are crossing between parked cars when no safer alternative exists.

This research has not assessed the "additional" nature of the interactive video. That is to say that the interactive video has been assessed against a no-intervention scenario in order to highlight the potential for it to have a positive impact on behavioural uptake. In a classroom environment a blended approach to learning is likely (and recommended) to take place, where interactive video is used as a supporting teaching medium, with practical training remaining the central form of pedestrian education.

Given that additional learning is likely to take place using a blended learning approach, further research should be carried out to assess the effectiveness of the additional learning. This could take the form of a three study group trial; a control group that receives no training, a group that receives practical training and a third group that receives interactive video training and practical training. This research would highlight the benefit of additional interactive video training compared to no training and a practical training only scenario.

Chapter 10

# Contribution of the research and recommendations

## 10.1 Contribution of the research and conclusions

In carrying out this research, this Thesis has establish answers to the research questions stated at the outset (see section 1.3.2), making a number of unique contributions to the academic record.

**How effective has pedestrian training to been shown to be in past evaluations, focussing specifically on the effectiveness of Kerbcraft?**

Practical pedestrian training has been shown to be effective in improving on-street crossing and road safety behaviour. Of particular importance is the work carried out by Whelen, Towner, Errington and Powell (2008) while developing and evaluating a national pilot of the Kerbcraft pedestrian training scheme. Kerbcraft was shown to be effective in improving the on street crossing behaviour of children aged 5-7 in three skill areas; finding safe places, crossing at junctions and crossing between parked cars (Whelen, Towner, Errington and Powell, 2008). Similar studies also demonstrated improvements in behaviour as a result of practical training (Albert and Dolgin, 2010, Van Schagen and Rothengatter, 1997). Due to the complexities of evaluations it is unclear to what extent pedestrian training reduces the risk of road traffic collision involvement throughout the life of a participant (Duperrex, 2002) although Elvik, Hoye, Vaa and Sorensen (2009) argue that training children safe methods for crossing the road can reduce the number of injury collisions in 5-9 year olds by between 7 - 15 %. See Chapter 2 for more information.

**How is child pedestrian training in the United Kingdom delivered in different authorities and what changes to training methodologies have developed since a national pilot of the 'Kerbcraft' child pedestrian training scheme?**

Following the culmination of the national Kerbcraft pilot scheme, it was not known the extent to which Kerbcraft or more generally, practical pedestrian training, was delivered in schools. This research found that 48 of the 57 local authority respondents involved in the original Kerbcraft pilot scheme were offering some form of pedestrian training but that only 5 were operating the Kerbcraft training scheme in its entirety. Nine local authorities did not offer any pedestrian training, citing funding issues as the key barrier. While training methodologies were broadly similar a key deviation highlighted by this research was the reduction in contact time when compared to Kerbcraft, with some local authorities offering around 20 minutes of practical training per participant, compared to a minimum of five hours in the Kerbcraft scheme. A number of local authorities also used in-class activities, such as paper based road safety crosswords and informational videos, despite research showing that these activities are generally only successful in knowledge acquisition, rather than leading to behavioural improvements.

**In what ways could interactive learning environments aid children's road safety educational development and to what extent can this be applied to teaching road safety skills?**

Various educational theories suggest the potential for interactive learning environments to be effective in developing deep learning and promoting skill acquisition. Interactive learning environments lend themselves to support learning theories through providing direct stimulus-response activities, positive reinforcement and continual feedback and the ability to foster deeper learning and mental constructs (See Chapter 3). Real life simulations may be "fruitful" in giving children effective road safety education experiences (DfT, 1999). Animated computer environments have been developed to improve road crossing behaviour, however a lack of transfer was identified as being an issue in younger application users (Foot *et al.*, 2002). Interactive videos have been shown to have the potential to train "hard" procedural skills (Cherrett, Wills, Price, Maynard and Dror, 2009) and this could apply to road safety skills. Interactive videos have been developed previously to train road safety skills (Melson, 2009, Chambers, 1997) however they have not been evaluated in terms of impact on behaviour within a school setting. Interactive video lends itself in particular to allowing children to learn by experiencing failure from within a safe environment facilitating deeper learning by creating strategies for reminding the learner what they should do when experiencing similar situations (Schank, 1997), for example when in the road environment. Interactive video should facilitate best practice technology enhanced learning by providing control, challenge and commitment to learners such that they control their own learning, are engaged in the material and are committed to the learning outcomes (Dror, 2008). See Chapter 3 and Chapter 5.

**Can interactive road safety training videos be designed in order to positively impact on roadside behaviour?**

Based on best practice and learning theory, a road safety interactive video was developed; designed to improve skills and awareness when children have to cross between parked cars when alternative, safer crossing locations do not exist. The tool developed used footage of unsafe road crossing practice filmed in a controlled environment in order to allow users to learn by experiencing failure based on models developed by Cherrett, Wills, Price, Maynard and Dror (2009) and Melson (2009). A methodology was developed to assess the effectiveness of the tool in improving on-street behaviour and consisted of a pre and post training assessment with an experimental and control group. 125 children took part in the final evaluation of the tool which, on aggregate, significantly improved skill uptake regarding checking parked cars for clues that they are safe to cross between, stopping at the line of site, looking at the line of site and continuing to look while crossing the road. The tool was most effective in a junior school environment in an affluent area and least effective in an infant school in an area of greater than average deprivation however it is not clear if these are causal factors regarding behavioural uptake of learning outcomes. See Chapter 6 and Chapter 7.

**Is interactive video an appropriate medium to effect positive uptake of safe crossing behaviour in primary aged children?**

Alongside behavioural improvements, interactive video must be a usable, engaging and therefore appropriate teaching medium for training road crossing behaviour in order for it to be an effective resource. Expectations of how good users thought the activity would be were exceeded on average and feedback indicated that a suitable level of difficulty and reward were provided by the interactive video tool. Click analytics based on a database of over 3500 user inputs indicated that children were generally actively engaged in the video and clicking in the hazard identification zone of the tool with click clusters corresponding to hazard areas or interface controls in general. A number of non-productive clicks took place outside of the interactive video tool interface. There was negative correlation between non-productive clicks and skill improvement, indicating that those users who were not engaged in the video were less likely on aggregate to show improvements in road crossing behaviour. See Chapter 8 for more information. Given that performance was different between schools it is important that interactive video is not used as a replacement for practical training, but an additional tool to be used in-class in a safe environment under the supervision of a trained adult in order to reinforce on-street training or as a precursor to practical training in order for a user to experience risk in a safe environment before experiencing it on-street.

## 10.2. Limitations

The key limitation of this research was the availability of school time. With more availability a larger sample size could be achieved allowing data to be further disaggregated by age, gender, and ethnicity and so on. Further work could expand this sample size using more schools and other sampling sources (for example youth groups). Sample characteristic data was also limited by schools needs to comply with data protection rules and as such ages, full names and other potentially useful information such as pupil performance data and disaggregated free school meals data was unavailable. It is clear that the use of this type of data could be contentious however with a large enough sample it may be possible to identify characteristics of groups of children who are and are not susceptible to learning using interactive videos.

Further limitations were provided by the use and reliability of school computer systems and network performance. In order to mitigate these issues dedicated research could be used, however this would come with a significant cost implication.

## 10.3. Further work

A number of opportunities for further work have been identified through the course of this research:

- The sample size could be increased making use of a wider range of users from a wider range of backgrounds. The addition of data outlining the characteristics of individual users would allow a more detailed review of usability and effectiveness to be undertaken.
- A further range of road crossing scenarios could be filmed and developed into interactive videos using the model described in this thesis in order to evaluate the impact of interactive video on other road safety skills. Scenarios could also

consider other modes, such as cycling and driving, or other procedural areas, such as safe construction methods. It could also be useful to expand the videos to consider other times of day such as the hours of darkness in order to allow users to experience a wider range of risks.

- Wider evaluation of practical pedestrian training should take place using methodologies comparable to the Kerbcraft national pilot evaluation such that the effectiveness of the more common shorter schemes can be determined.

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# Appendices

**Appendix 1:** Local Authority post-Kerbcraft follow-up telephone survey (for Kerbcraft participants)

**Appendix 2:** Local Authority child pedestrian training telephone survey (for non-Kerbcraft pilot participants)

**Appendix 3:** Crossing between parked cars: Assessment Sheet

**Appendix 1:** Local Authority post-Kerbcraft follow-up telephone survey (for Kerbcraft participants)

**Introduction:**

Kerbcraft is a practical roadside pedestrian training scheme aimed at children in the 5-7 age range. Trials were funded by the DfT from 2002-2007 to test and evaluate the programme which was developed by Professor James Thomson at the University of Strathclyde. The programme offers practical training sessions in three key areas over a period of twelve roadside sessions: choosing safe places and routes, crossing safely at parked cars and crossing safely near junctions. During the trial, 115 Kerbcraft schemes were piloted in England and Scotland, as well as further trials in all Welsh local authorities. While we know that Wales has implemented widespread take-up of Kerbcraft following the scheme, it is unclear how child pedestrian training is delivered across the rest of the United Kingdom.

The original Kerbcraft follow-up survey carried out by MVA consultancy in 2007 stated that of all local authorities that took part in the trial, only 16% were willing to continue offering Kerbcraft in its original form, 17% of local authorities were not willing to offer any training whatsoever and the remaining authorities were intending to offer a different form of practical roadside training.

**Aim:**

To ascertain if (and how) local authorities are delivering and evaluating child pedestrian road safety education, following the Kerbcraft Pilot Scheme.

Interviewee Details:

**Local Authority:** **Contact Telephone Number:**

**Name of interviewee:** **Interviewee job title:**

**Length of time post held:**

**Postal Address:** **Email Address:**

Interviewer Contact Details:

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**Section 1: Kerbcraft Training Scheme Background**

**1.1. When did the training scheme run from and to?**

From ……./……./…….    To ……./……./…….    Still running ❑

**1.2. What were the costs of the scheme over the period?**

**1.3. Which department implemented the scheme and is the same department still overseeing road safety education?**

Department:    Still overseeing road safety: YES ❑ / NO ❑

Details:

**1.4. Following the Kerbcraft trial; do you still offer roadside pedestrian training for children?**

YES ❑ / NO ❑

**1.5. If roadside pedestrian training is no longer offered, why did it stop?**

Funding problem ❑ / Scheme ineffective ❑ / Other ❑

Details:

**1.6. Does the local authority still run the original Kerbcraft scheme as it was originally implemented in the trial, or have they adapted it?**

Original ❑ / Adapted ❑    Details (e.g. adapted scheme name):

**1.7. If adapted, what elements were changed, adapted or removed, why were the changes made and what were the impacts?**

Changes, adaptations, removals:

Reasons:    Training related ❑ / Cost related ❑ / Delivery related ❑ / Other ❑

Details:

Impacts of changes:

**Section 2: Pedestrian Training Scheme Delivery**

**2.1. What skills is the training scheme designed to develop?**

**2.2. What methods are used to deliver the training scheme?**

Taught (in-class) ❑ / Roadside (practical) ❑ / Other (e.g. simulation, presentations etc) ❑

**Details**

**Taught (in-class)**

Hours taught / percentage allocation:

No. staff involved:

Adult/child ratio:

Details (hands-on / chalk and talk / ICT / demo's / films):

**Roadside (practical)**

Hours taught / percentage allocation:

No. staff involved:

Adult/child ratio:

Details (morning/evening experiences, peak time traffic, dark, poor weather):

**Other**

Details:

**2.3. Who delivers the training at different stages in the scheme?**

**Taught elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

**Practical elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

**Other elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

Details:

**2.4. To what age group(s) is the training scheme delivered?**

**2.5. How extensive is the child pedestrian training scheme?** Is it offered to all children, targeted to specific areas or only delivered at the request of schools?

All children in age group ❑ / Targeted at specific group or area ❑ / On request ❑

Where training is targeted, what is the implementation policy? i.e. why are the specific groups or areas targeted?

Is training offered at independent schools?

YES ❑ / NO ❑

**2.6. How many children are reached by the scheme and what percentage of the children in the age group is trained? What is the cost of the scheme?**

**2.7. To what extent would interactive teaching tools, for example simulation, aid the delivery of the pedestrian training scheme?**

**2.8. At what stages would interactive training tools be most useful?**

**2.9. What combination of interactive training, practical training and taught elements would be most effective?**

**2.10. How could interactive training aids improve the transition from one stage to another?**

**Section 3: Training Scheme Evaluation**

**3.1. How has / is the training scheme being evaluated? Has any qualitative or quantitative assessment been carried out into the effectiveness of the scheme?)**

Details Quantitative:

Details Qualitative:

**3.2. Was there any official evaluation 'advised' by Kerbcraft and what format did this take?**

**3.3. Has there been any attempt to evaluate:**

a) **Improvements in accident rates by school/area?**

b) **Effectiveness of trainers?**

c) **What makes a good trainer?**

d) **The impact of the training programme elements to overall improvements in behaviour?**

e) **What combination of in-class and outdoor training works best?**

f) **Quantitative results on effectiveness?**

Has there been accident or near-miss reduction as a result of training?

**g) Qualitative results on effectiveness?**

Have parents observed their children adopting safer road behaviour? e.g. the use of the green cross code?

Do children feel that they have changed their behaviours? (e.g. crossing in safe places).

**Section 4: Training Scheme Feedback**

**4.1. Taking the scheme (and pedestrian training) as a whole:**

**a) Which elements work most effectively?**

**b) Which elements don't work effectively?**

**c) What would you change and how do you think pedestrian training could be made better?**

**d) What are the main constraints to the future development of the training programme (financial, administrative and / or political)?**

**e) How would you like to see the training scheme develop?**

**f) How do you feel the scheme was received by**

**a) Pupils**

**b) Teachers**

**c) Parents**

**Section 5: Other Training Schemes**

**5.1. As well as roadside pedestrian training, are any other road safety schemes, aimed at young children, provided by the local authority?** For example cycling proficiency training.

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

(*Continue on separate sheet if necessary*)

**Section 6: Local Authority Structure and Road Safety Education Administration**

**6.1. What are the roles of road safety officers within the local authority?**

**6.2. In which department do road safety officers reside and has this always been the case?**

**6.3. Are the routes to schools and sustainability initiatives linked to the road safety initiatives?**

**6.4. Are the road safety and sustainability departments joined, is there consultation between the departments or is there no linkage whatsoever?**

**6.5. Do the road safety initiatives provided by the local authority link in any way to PSHE offered in local authorities?**

**6.6. Are any of the initiatives provided as part of PSHE at school?**

**6.7. Does any consultation or liaising take place between schools and the local authority with regards to the content of the training programmes and the overlap between them and the national curriculum?**

**Section 7: Concluding Questions**

**7.1. As part of my EngD project I am developing a new interactive training tool based on video simulation to aid pedestrian road safety training. Would you be interested in taking part in any further follow-up interviews and/or possible trials of these new child road safety training products?**

Thank you for taking part in this interview. A copy of these responses can be made available online, by post or by email should you wish to review them, add to them, or keep a copy for your records.

**Section 8: Further Notes**

**Appendix 2:** Local Authority child pedestrian training telephone survey (for non-Kerbcraft pilot participants)

- **Appendix 2: Local Authority child pedestrian training telephone survey**

Introduction:

Kerbcraft is a practical roadside pedestrian training scheme aimed at children in the 5-7 age range. Trials were funded by the DfT from 2002-2007 to test and evaluate the programme which was developed by Professor James Thomson at the University of Strathclyde. The programme offers practical training sessions in three key areas over a period of twelve roadside sessions: choosing safe places and routes, crossing safely at parked cars and crossing safely near junctions. During the trial, 115 Kerbcraft schemes were piloted in England and Scotland, as well as further trials in all Welsh local authorities.

Aim:

To ascertain if (and how) local authorities, that did not participate in the Kerbcraft pilot scheme, are delivering and evaluating child pedestrian road safety education in the United Kingdom.

Interviewee Details:

**Local Authority:** **Contact Telephone Number:**

**Name of interviewee:** **Interviewee job title:**

**Length of time post held:**

**Postal Address:** **Email Address:**

Interviewer Contact Details:

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**Section 1: Background**

**1.8. Which department oversees road safety and has this always been the case?**

Department: Always been the case?: YES ❑ / NO ❑

Details:

**1.9. Do you offer roadside pedestrian training for children?**

YES ❑ / NO ❑

Details (e.g scheme name):

**1.10. If roadside pedestrian training is not offered, why is this case?**

Funding problem ❑ / Lack of effective schemes❑ / Other ❑

Details:

**Section 2: Pedestrian Training Scheme Delivery**

**2.11. What skills is the training scheme designed to develop?**

**2.12. What methods are used to deliver the training scheme?**

Taught (in-class) ❑ / Roadside (practical) ❑ / Other (e.g. simulation, presentations etc) ❑

**Details**

**Taught (in-class)**

Hours taught / percentage allocation:

No. staff involved:

Adult/child ratio:

Details (hands-on / chalk and talk / ICT / demo's / films):

**Roadside (practical)**

Hours taught / percentage allocation:

No. staff involved:

Adult/child ratio:

Details (morning/evening experiences, peak time traffic, dark, poor weather):

**Other**

Details:

**2.13. Who delivers the training at different stages in the scheme?**

**Taught elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

**Practical elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

**Other elements:** Volunteers ❑ / Full time road safety staff ❑ / School Teachers ❑ / TLAs ❑ / Other ❑

Details:

**2.14. To what age group(s) is the training scheme delivered?**

**2.15. How extensive is the child pedestrian training scheme?**
Is it offered to all children, targeted to specific areas or only delivered at the request of schools?

All children in age group ❑ / Targeted at specific group or area ❑ / On request ❑

Where training is targeted, what is the implementation policy? i.e. why are the specific groups or areas targeted?

Is training offered at independent schools?

YES ❑ / NO ❑

**2.16. How many children are reached by the scheme and what percentage of the children in the age group is trained? What is the cost of the scheme?**

**2.17. To what extent would interactive teaching tools, for example simulation, aid the delivery of the pedestrian training scheme?**

**2.18. At what stages would interactive training tools be most useful?**

**2.19. What combination of interactive training, practical training and taught elements would be most effective?**

**2.20. How could interactive training aids improve the transition from one stage to another?**

**Section 3: Training Scheme Evaluation**

**3.4. How has / is the training scheme being evaluated? Has any qualitative or quantitative assessment been carried out into the effectiveness of the scheme?)**

Details Quantitative:

Details Qualitative:

**3.5. Was there any official evaluation 'advised' by Kerbcraft and what format did this take?**

**3.6. Has there been any attempt to evaluate:**

c) **Improvements in accident rates by school/area?**

d) **Effectiveness of trainers?**

h) **What makes a good trainer?**

i) **The impact of the training programme elements to overall improvements in behaviour?**

j) **What combination of in-class and outdoor training works best?**

k) **Quantitative results on effectiveness?**

Has there been accident or near-miss reduction as a result of training?

l) **Qualitative results on effectiveness?**

Have parents observed their children adopting safer road behaviour? e.g. the use of the green cross code?

Do children feel that they have changed their behaviours? (e.g. crossing in safe places).

**Section 4: Training Scheme Feedback**

**4.1. Taking the scheme (and pedestrian training) as a whole:**

**a) Which elements work most effectively?**

**b) Which elements don't work effectively?**

**g) What would you change and how do you think pedestrian training could be made better?**

**h) What are the main constraints to the future development of the training programme (financial, administrative and / or political)?**

**i) How would you like to see the training scheme develop?**

**j) How do you feel the scheme was received by**

**d) Pupils**

**e) Teachers**

**f) Parents**

**Section 5: Other Training Schemes**

**5.2. As well as roadside pedestrian training, are any other road safety schemes, aimed at young children, provided by the local authority?** For example cycling proficiency training.

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

Scheme name:

Type:

Skills Trained:

Date from ……./……./…….

Date to ……./……./……. Present ❑

Details (e.g. delivery methods):

(*Continue on separate sheet if necessary*)

**Section 6: Local Authority Structure and Road Safety Education Administration**

**6.8. What are the roles of road safety officers within the local authority?**

**6.9. In which department do road safety officers reside and has this always been the case?**

**6.10. Are the routes to schools and sustainability initiatives linked to the road safety initiatives?**

**6.11. Are the road safety and sustainability departments joined, is there consultation between the departments or is there no linkage whatsoever?**

**6.12. Do the road safety initiatives provided by the local authority link in any way to PSHE offered in local authorities?**

**6.13. Are any of the initiatives provided as part of PSHE at school?**

**6.14. Does any consultation or liaising take place between schools and the local authority with regards to the content of the training programmes and the overlap between them and the national curriculum?**

**Section 7: Concluding Questions**

**7.1. As part of my EngD project I am developing a new interactive training tool based on video simulation to aid pedestrian road safety training. Would you be interested in taking part in any further follow-up interviews and/or possible trials of these new child road safety training products?**

Thank you for taking part in this interview. A copy of these responses can be made available online, by post or by email should you wish to review them, add to them, or keep a copy for your records.

**Section 8: Further Notes**

**Appendix 3:** Crossing between parked cars: Assessment Sheet

Hampshire County Council | Streets Ahead – Child Pedestrian Training Scheme | University of Southampton School of Civil Engineering and the Environment

## Assessment sheet 2 – Crossing between parked cars

| | | Child/Trial | | | | | |
|---|---|---|---|---|---|---|---|
| | | **C1** | **C1** | **C2** | **C2** | **C3** | **C3** |
| **1.Stops at the kerb before moving between cars** | **Yes** | | | | | | |
| | **Pauses** | | | | | | |
| | **No** | | | | | | |
| | | | | | | | |
| **2.Looks for people and clues cars might move in both cars** | **Yes** | | | | | | |
| | **Partial** | | | | | | |
| | **No** | | | | | | |
| | | | | | | | |
| **3.Moves forward to parked car on left** | **Yes (left)** | | | | | | |
| | **No (Centre)** | | | | | | |
| | **No (Right)** | | | | | | |
| | | | | | | | |
| **4.Stops at the line of sight** | **Yes** | | | | | | |
| | **Pauses** | | | | | | |
| | **No** | | | | | | |
| | | | | | | | |
| **5.Looks right, left and right again** | **Yes** | | | | | | |
| | **Wrong order** | | | | | | |
| | **No** | | | | | | |
| | | | | | | | |
| **6.Continues looking and remaining aware during crossing** | **Yes** | | | | | | |
| | **Partial** | | | | | | |
| | **No** | | | | | | |
| | | | | | | | |
| **7.Walks safely whilst crossing** | **Walks safely** | | | | | | |
| | **Walks too fast** | | | | | | |
| | **Walks too slowly** | | | | | | |
| | **Runs** | | | | | | |

***Notes:***

-END-