



# eDriving Solutions



Arility Evaluation

24 Nov 2022

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Developed on behalf of Road Safety GB

Funded by the Department of Transport



Department  
for Transport

Road Safety **GB**

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## Acknowledgement

We would like to thank the following road safety teams and individuals for their support in delivering this project:

Kent County Council – David Williams

Warwickshire County Council – Kate Castle and Alice Edwards

Wirral Council – Rhian Hughes

It would not have been possible to complete this work without them.

## Executive Summary

### Background

This report presents the findings of an evaluation of Arility, an augmented reality road safety training package developed for children (<https://www.arility.com>). The system presents the user with a variety of scenarios and then asks them to consider what they feel the character in the scenario should do to maintain their safety. In the UK version there are 3 scenarios for Key Stage 1 (KS 1) children and 3 for Key Stage 2 (KS 2) children.

### Method

Due to Covid, and difficulties in encouraging schools to participate in the evaluation process over that period, the evaluation faced a range of challenges. It was therefore only possible to allocate schools to either a control or treatment group based on their willingness to participate. At both KS 1 and 2 the Treatment Group (TG) was formed of 3 schools, with 2 schools forming the Control Group (CG). The schools were drawn from Kent, Warwickshire and Wirral. We would like to thank the Road Safety Officers from those areas for their support, it would not have been possible to complete this evaluation without them.

KS 1 children completed a specially developed knowledge assessment test at 2 time points (T1 and T2) approximately 4 weeks apart, with the treatment group receiving the intervention approximately 2 weeks after the initial assessment. KS 2 children received a more complex knowledge assessment but also completed a Virtual Reality (VR) skills assessment. The Road Safety Officers (RSO) who delivered the sessions were also asked to provide written feedback on the sessions.

### Results

#### **Key Stage 1**

The situation was less clear for KS 1 where no clear benefits could be identified. The most likely explanation for this finding is that the content for this age group is already being covered in other ways. All 3 of the road safety officers who delivered these sessions had some concerns about the usefulness of the system for this key stage relating to preventing the technology from becoming a distraction and maintaining the children's focus on the learning outcomes. These concerns could explain the lower scores for enjoying the lesson with 76% indicating they were happy, or very happy, with the lesson and 77% indicating they had enjoyed, or enjoyed it a lot, using the tablets. Both figures are lower than those given by the KS 2 children. It is therefore suggested that the system is only used with the oldest children in KS1.

#### **Key Stage 2**

There is clear evidence which demonstrates that Arility did improve KS 2 children's road safety knowledge, with the knowledge assessment finding a significant improvement ( $p < .05$ ) between groups at T2. No difference was found at T1 between groups. In particular, the new model commission by Road Safety GB relating to the use of pedestrian crossings appears to have had a positive impact with a significant improvement ( $p < .05$ ) being identified between the treatment and control group scores at T2 on the set of items specifically testing this area.

The VR skills assessment also found a significant improvement ( $p < .05$ ) in the children's ability to select a safe time to cross the road, with 100% of the treatment group selecting a safe time to cross compared to only 82% of the control group. No significant differences were found for the number of times the children looked right or left while crossing a road, or for observing driveways whilst walking along a footpath. However, it should be noted that both groups scored high on both these tasks initially allowing little room for improvement.

The feedback from the KS 2 children was very positive with 94% of the children saying they were happy, or very happy, with the session and 94% saying they enjoyed, or enjoyed it a lot, using the tablet.

The feedback from the RSOs who delivered the training was also positive and supported the findings of the evaluation for the age group. The RSO suggested that they felt that Arility would be most effective with the younger end of KS 2 age range. The RSO believed that it could be used by a non-road safety specialist, but clear guidance notes should be made available.

### **Technology**

Technology was also identified as an issue. Delivering this evaluation was challenging due to Covid but also due to difficulties in finding schools willing to install the Arility app. This difficulty is not one of Arility's making, but how schools regulate their IT systems. These systems are tightly controlled making it difficult for the class teachers to add new software.

The only way we were able to conduct the evaluation was through the purchase of 26 tablets, but even this approach had challenges, with the trainers experiencing difficulties accessing the schools' Wi-fi systems which limited access to Arility's classroom management tools. Therefore, if road safety teams want to utilise the system, they may have to purchase their own tablets, but this raises issues of cost, maintenance, and safeguarding.

### **Recommendations**

That Arility is actively promoted for use by road safety professionals and schools.

That it is used with the younger age groups within KS 2 age range ideally years 3 and 4.

That Arility is used with KS 1 but only for year 2 children.

A set of lesson plans are developed for KS 1 and KS 2 that can be downloaded by the trainers prior to the commencement of the session.

Consideration is given to promoting the benefits of the system to overcome a reluctance by schools to download the system.

That road safety teams who wish to use the system purchase their own tablets for use in schools.

## Background

In 2017, there were 1,034 children killed or seriously injured in Great Britain aged 12 years or under (<https://roadtraffic.dft.gov.uk/custom-downloads/road-accidents>). To support its membership to address this significant road safety issue Road Safety GB worked with an Australian company called Arility to develop their award-winning road safety package for the UK (<https://www.arility.com>).

Augmented reality projects a 3D image, that can be viewed through a tablet, allowing the user to explore the image (Figure 1). Arility uses this technology to help children to learn and practice making safe choices in potentially risky situations. This is achieved by the user interacting with the characters within the scenario and answering interactive questions.

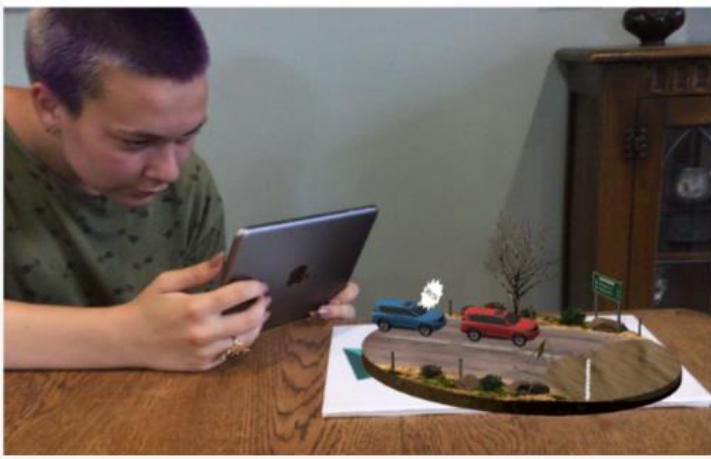


Figure 1. Promotional photograph taken from the Arility website (Copyright Arility)

The English version of Arility consists of 3 scenarios for children aged 4-6 in KS 1 and 3 for KS 2 children aged 7-11. The learning outcomes are given for each of the scenarios in table 1. Arility suggest that each scenario will take approximately 5 minutes to complete.

Whilst few changes, other than aligning the scenarios to conform with UK traffic laws, were needed for the existing scenarios, the ‘Can you see them?’ scenario was specifically developed for the UK. This module focuses on the need to maintain observation whilst crossing on a green man.

To use the system, Arility recommends the use of 1 tablet for the teacher and 1 tablet for each of the children.

Table 1. Scenarios, Key Stage, and learning outcomes

<b>Scenario</b>	<b>Key stage (age range)</b>	<b>Learning outcomes (Taken from the Arility)</b>
Cross and wait	Key stage 1 (4 – 6 years)	<ol style="list-style-type: none"> <li>1. Students practice using the pedestrian traffic lights.</li> <li>2. Students identify unsafe situations.</li> <li>3. Students make safe decisions in the traffic environment.</li> </ol>
Ball rolling	Key stage 1 (4 – 6 years)	<ol style="list-style-type: none"> <li>1. Students identify unsafe situations</li> <li>2. Students make safe decisions in the traffic environment</li> <li>3. Students develop skills to seek help in unsafe situations</li> <li>4. Students seek assistance from an adult to retrieve an object from the road</li> </ol>
Which door?	Key stage 1 (4 – 6 years)	<ol style="list-style-type: none"> <li>1. Children should always exit the car on the footpath side.</li> <li>2. The safety door is the door closest to the footpath or kerb</li> <li>3. Apply the 'stop, look, listen and think' strategy before exiting the car</li> </ol>
Bus stoppers	Key stage 2 (7 – 11 years)	<ol style="list-style-type: none"> <li>1. Where to cross the road when you exit a bus</li> <li>2. Where to stand when waiting for the bus to depart</li> <li>3. Required use of pedestrian crossings</li> </ol>
Can you see them?	Key stage 2 (7 – 11 years)	<ol style="list-style-type: none"> <li>1. Students practice using the pedestrian traffic lights.</li> <li>2. Students identify unsafe situations.</li> <li>3. Students make safe decisions in the traffic environment</li> </ol>
Bike or hike	Key stage 2 (7 – 11 years)	<ol style="list-style-type: none"> <li>1. A bicycle is a legal road vehicle. A cyclist must follow road rules.</li> <li>2. A cyclist must not ride their bike while crossing a road.</li> <li>3. A cyclist must dismount and walk their bike across a road.</li> <li>4. Some controlled crossings have special bicycle crossing lights.</li> <li>5. Where 'green bicycle' lights are displayed a cyclist can ride across the road.</li> </ol>



## Method

The evaluation faced several challenges related to Covid that had a major impact on the evaluation process. Covid meant schools found it difficult to allow road safety teams into classrooms and were reluctant to engage with a product that would require the school's tablets to be shared across classes, due to concerns about cross-contamination.

It also became apparent that schools' IT systems are tightly regulated, and this was a barrier to the schools installing the product. In many cases, if a member of staff wanted to install Arility, they needed to gain permission to do so and then required an IT technician to complete the process. Some concern was raised that the school's tablets were not always accessible or were ageing. Although this was difficult to verify.

In response to these challenges, 26 tablets were purchased and issued to the 3-road safety teams who had kindly offered to use the system for the purpose of evaluation. These teams were:

- Kent County Council
- Warwickshire County Council
- Wirral Council.

Kate Castle, Warwickshire County Castle Senior Road Safety Officer (RSO), who is also a qualified and experienced primary school teacher, developed a lesson plan which was circulated to the other two local authorities (Appendix A). In all, 140 key-stage 1 and 90 key-stage 2 children received the training. Sample sizes (N =) are reported for each statistical test completed.

### Method - Key Stage 1 (KS 1)

A quasi-experimental design was used with 3 schools receiving the intervention and 2 schools acting as a control group (Table 2). Due to Covid difficulties, it was not possible to pre-allocate schools to a treatment or control group, allocation was based on which schools were available. Priority in allocating schools was given to maximising the treatment schools sample as this would at least allow the evaluation to draw some conclusions about the effectiveness of the Arility product.

*Table 2. KS 1 School locations*

<b>Location</b>	<b>Group</b>	<b>Number of Schools</b>
Kent	Treatment	1
Kent	Control	1
Wirral	Treatment	1
Wirral	Control	1
Warwickshire	Treatment	1

## Measure

Due to the age of the children, a specially designed pictorial test was used to assess the children's road safety knowledge. The test consisted of 6 questions, with the post-assessment incorporating a further 2 feedback questions. The Time 1 (T1) test was administered just prior to the delivery of the intervention, with the Time 2 (T2) assessment being administered 2-weeks post-intervention. The RSO delivering the intervention administered the questionnaires. The control groups received the intervention over the same 2-week timescale. The questions were read aloud to the children, with the children ticking a picture that they felt showed the correct answer. The total number of correct answers provided an overall score, with one point being allocated for each correct answer giving a maximum score of 6.

## Results

### Knowledge

An independent t-test was completed on the data (Table 3). This found a significant difference in the mean scores between the control and treatment groups at both T1 and T2, with the mean scores for both groups reducing slightly at T2. This finding means there was already a significant difference between the groups prior to the Arility intervention being delivered to the treatment group, making the results unreliable.

The most likely explanation is that Arility provided the treatment group with information that the children already knew, possibly through a prior road safety intervention. This explanation is supported by the treatment group's mean score at T1 which, at 5.16, was approaching the maximum possible score of 6.

Table 3. KS 1 Knowledge assessment - results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	136	5.16 (.657)	3.430	194	.001*
	Control	60	4.77 (.908)			
2	Treatment	128	5.09 (.581)	3.498	81.38	.001*
	Control	52	4.71 (.695)			

\* Indicated significant

A paired sample t-test was also conducted on the treatment group's results which identified a reduction in the mean scores between T1 and T2, but this change was not significant. (Table 4).

Table 4. KS1 Treatment groups knowledge test – results of a paired sample t-test

Time	Mean (SD)	N	t =	DF	p =
1	5.07 (.760)	176	1.888	175	.06
2	4.93 (.760)	176			

Taken together these findings would suggest that Arility had little impact on the children’s knowledge.

**Reaction**

Two questions assessed the children’s feelings about the training using a 5-point smiley face scale (figures 2 and 4). The first question asked the children to indicate how happy they felt about the lesson. Overall, the response was positive with 76% of the children rating themselves as happy or very happy (Figure 3).

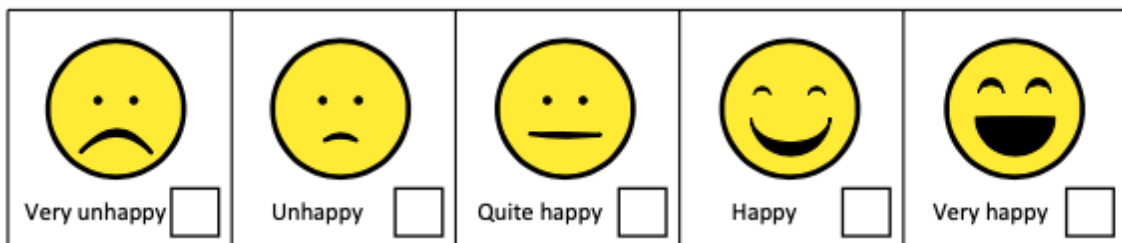


Figure 2. Smiley face scale used to indicate how happy the children felt about the lesson

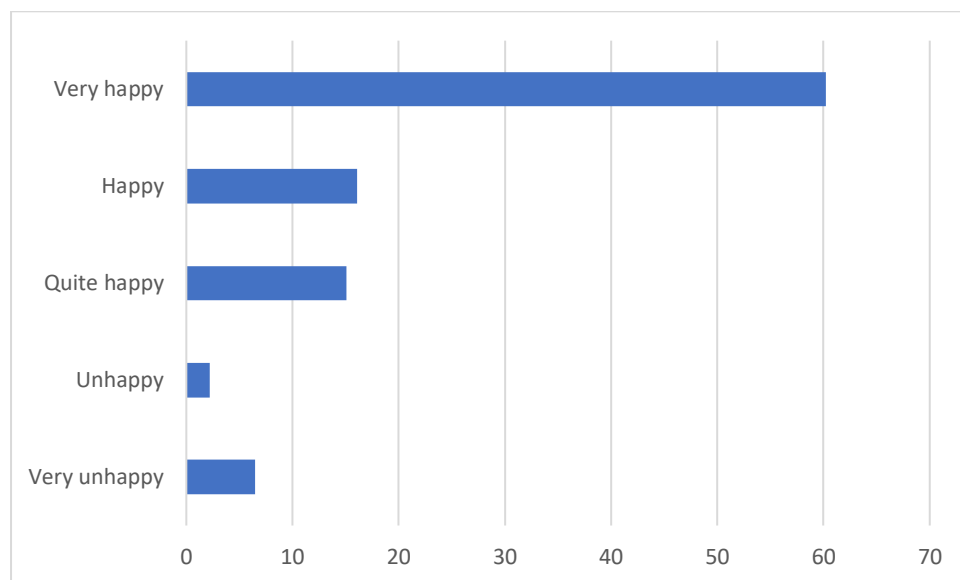


Figure 3. Percentage of responses to ‘Which face describes how you feel about the lesson?’

The second of the two reaction questions asked about using the tablets, with 77% of children indicating they enjoyed, or enjoyed it a lot, using the tablets (Figure 4).

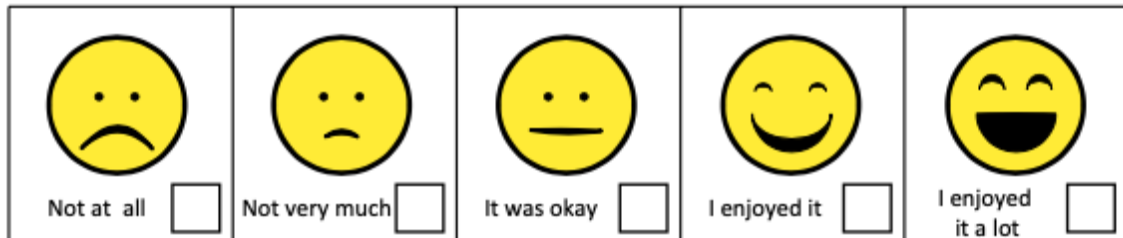


Figure 4. Smiley face scale used to indicate how much they enjoyed using the app on the tablets

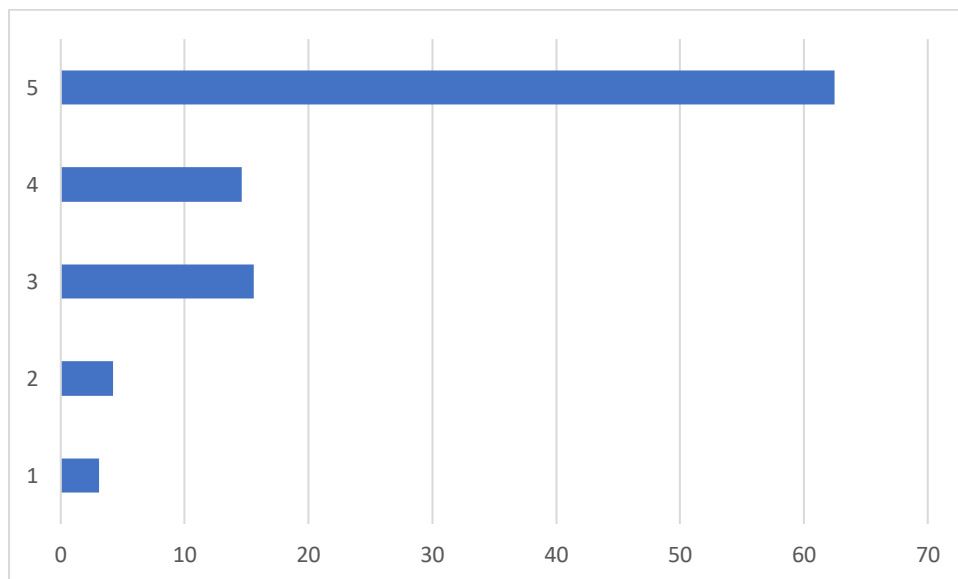


Figure 5. Percentage of responses to 'How much did you enjoy using the app on the tablets?'

Taken together these results show that the majority of the children did enjoy the session.

## Method Key Stage 2 (KS2)

This approach mirrored the approach taken for KS 1, with 3 schools receiving the intervention and 2 schools forming a control group (Table 5). As with KS1, due to the covid difficulties, it was not possible to allocate schools easily to a treatment or control group, allocation could only be based on school availability.

Table 5. KS 2 school locations

<b>Location</b>	<b>Group</b>	<b>Number of Schools</b>
Kent	Treatment	1
Wirral	Treatment	1
Wirral	Control	1
Warwickshire	Treatment	1
Warwickshire	Control	1

A specially designed pictorial road safety test was used to assess knowledge, which consisted of 14 assessment questions. The questions covered awareness at a pedestrian crossing, route planning and crossing procedure. The test was administered at two-time points, with the pre-intervention test being administered 2-weeks pre-intervention (T1) and then again 2 weeks post-intervention (T2). The control group timescale was the same but without the intervention being delivered. At the same time as the knowledge assessment test was being administered both groups completed a Virtual Reality (VR) pedestrian skills assessment. Both the assessment and VR skills assessment were administered by a member of the research team.

The VR skills assessment consisted of 6 VR tasks, 2 assessed if the children made a safer decision to cross the road and two measured how frequently they looked to their right and left whilst crossing, with 2 covering walking along a footpath. The scores for each set of 2 questions were then combined to provide an overall score for the task. Not all children could complete this task due to time constraints.

The recording software and clips used were specifically designed for the evaluation. The clips and recording software were contained in an App that operated on Android One+ phones and was directly installed onto the phones by the developer. The app recorded the data on the phone which could be stored and then uploaded once the phone had internet access. The phones were placed in headsets for use by the children. The headset used were Duragadget 3D VR headset with JVC light weight headphone.

Clear instructions were given to the children by the researcher at the beginning of the session. Instructions were also repeated for each question within the VR environment. The assessment contained 3 practice clips, one for each of the assessment task types which allowed the children to practice prior to commencing the assessment.

## Results

### Knowledge assessment

#### Total Score

To provide an overall knowledge rating, all scores from the assessment were combined to give a total score. An independent sample t-test found a significant difference between the scores at T2, with the mean score for the treatment group being 11.21 (SD = 2.45) compared to a mean score of 10.16 (SD = 2.54) for the control group, no significant differences were found in scores at T1 (Table 6). These results demonstrate that overall, Arility did improve the participant's road safety knowledge.

Table 6. Total Knowledge questionnaire score - results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	71	9.36 (2.001)	1.410	110	.161
	Control	41	8.78 (2.307)			
2	Treatment	78	11.21 (2.458)	2.128	113	.03
	Control	37	10.16 (2.544)			

As the assessment contained more items than the KS 1 version it was possible to do a more detailed analysis.

#### Knowledge of using a pedestrian crossing

Five questions were designed to test the children's knowledge of how to use a pedestrian crossing safely. The scores totalled to give a maximum score out of 5. The results of an independent t-test found a significant difference at T2 between the control and treatment group, this difference was not found at T1 and would indicate that the Arility session had improved the children's knowledge in this area (Table 7).

Table 7. Table 7. Using a pedestrian crossing - results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	74	2.39 (.976)	.669	113	.50
	Control	41	2.26 (.895)			
2	Treatment	80	3.05 (1.072)	1.942	116	.05*
	Control	40	2.64 (1.087)			

### Route planning

The children's ability to plan the safest route was assessed by a question that used 4 sets of 3 pictures showing different routes to get to a park. The children were asked to indicate which of the pictures showed the safest route. An example is shown in figure 6.

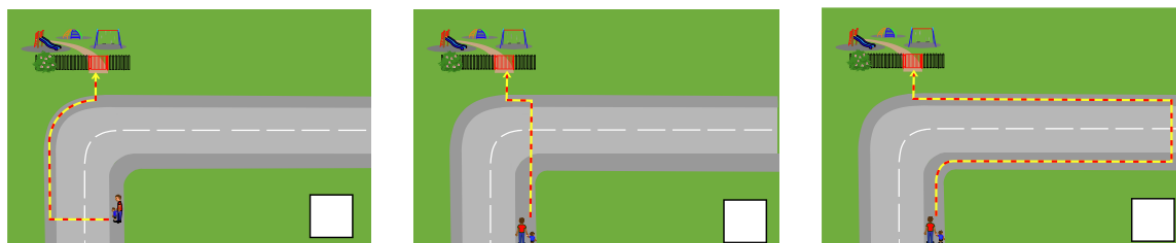


Figure 6. Example of route planning questionnaire

One point was allocated for each correct answer. The number of correct answers for each of the picture sets was then tallied to provide an overall score, with the maximum score being 4. The results of an independent t-test found no significant difference between the groups at either T1 or T2 (Table 8). It should be noted that both group scores improved on their T1 score and this would indicate that exposure to the questionnaire or an external influence, such as the children discussing the questionnaire, impacted the scores.

Table 8. Table 6. Safe routes – results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	74	2.56 (1.073)	1.303	113	.19
	Control	41	2.29 (1.101)			
2	Treatment	80	3.05 (.809)	1.493	118	.13
	Control	40	2.80 (.966)			

### Leaving a car safely

Two questions measured if the children knew what side was the safest when leaving a vehicle. An example of the question is shown in Figure 7. One point was awarded if they correctly identified the **correct side** of the vehicle, whether this be a rear or front seat. The option of both rear and front seat positions was given to reduce any confusion on the children's part, who may have thought the question was asking about being in the back or front of a car. This approach meant that the total maximum score when both questions were totalled was 2.

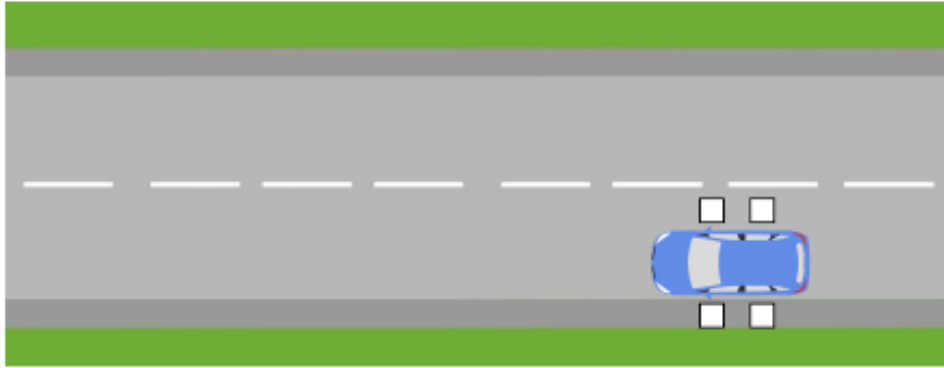


Figure 7. Example of leaving the car questions

An independent t-test found no significant differences at T1 or T2 (Table 9). However, it should be noted that there is a very clear ceiling effect at both T1 and T2. This would suggest that the children were already aware of which doors were safest to use prior to the Arility session.

Table 9. Leaving a car safely - results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	72	1.75 (.644)	.143	111	.88
	Control	41	1.73 (.671)			
2	Treatment	80	1.95 (.380)	1.045	58.02	.30
	Control	40	1.82 (.549)			

### Awareness of vehicles

The children were shown 5 pictures (Figure 8) which asked them to identify which of the pictures gave a clue that a vehicle may be about to pull away. One point was awarded for each correct answer, giving a maximum score of 4. No significant differences were found between groups at T1 or T2 (Table 10).



In the pictures below, tick the pictures that give a clue that the car may move off.

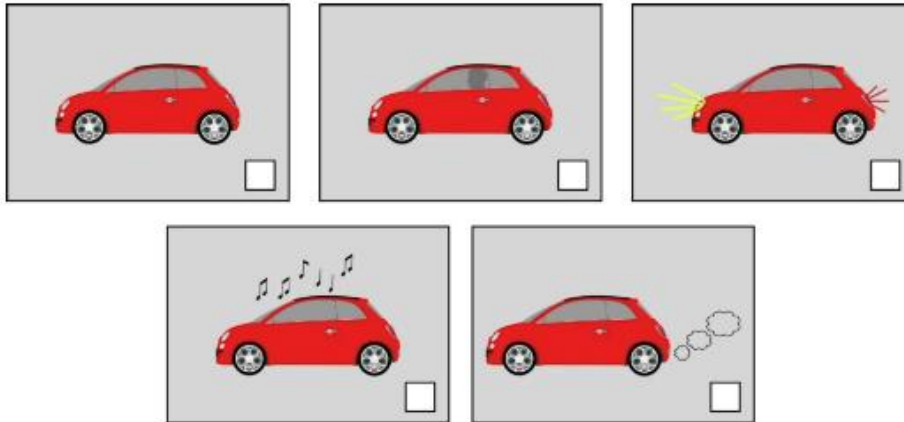


Figure 8. Which picture gives a clue that the car may move off

Table 10. Leaving a car safely – results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	71	1.76 (.801)	-.209	108	.835
	Control	39	1.79 (.864)			
2	Treatment	76	2.39 (1.008)	1.391	110	.167
	Control	36	2.11 (1.008)			

### Stopping at the kerb

The children were presented with 4 pictures (Figure 9), that asked what they should do when they first get to the kerb. The correct answer is stop. No significant differences were found in the scores between groups at either T1 or T2 (Table 11).

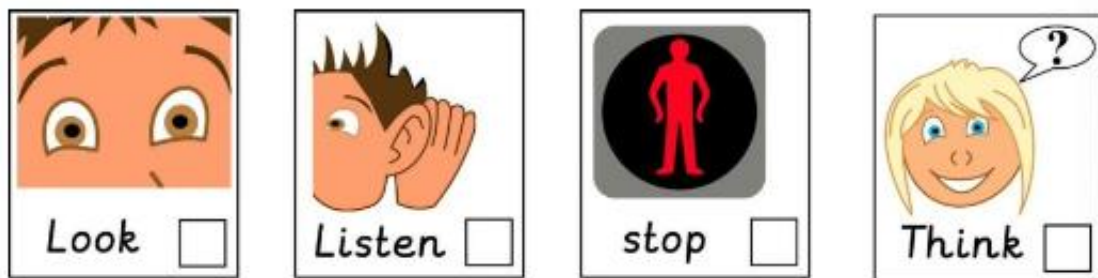


Figure 9. Figure 8. What should you do first when you get to a kerb

Table 11. What should you do first when you get to the kerb? - results of an independent t-test

Time	Group	N =	Mean (SD)	t =	DF	p =
1	Treatment	74	.51 (.503)	1.266	113	.208
	Control	41	.39 (.494)			
2	Treatment	81	.69 (.491)	1.579	64.73	.119
	Control	41	.51 (.637)			

The questionnaire also contained an open-text question that asked what was the most important thing they felt they had learnt? This produced 64 comments which were reviewed and grouped into themes. Two comments were removed from the analysis as these could not be coded as the meaning of the comment was too ambiguous.

This analysis (Figure 10) found that the strongest 3 safety messages to emerge once general safety comments are removed, such as ‘Cars are dangerous. (Child 3) were:

The Stop - Look - Listen - Think routine which was mentioned 14 times.

Safer place to cross which was mentioned 8 times. This theme included statements such as ‘You should always cross at a zebra crossing and never cross at a junction because a car could come.’ (Child 12) and ‘If there is a type of crossing near you go to that crossing.’ (Child 40).

The need to maintain observation when crossing on a green man which was mentioned 7 times. This theme included statements such as ‘Keep looking even though the man is green’ (Child 24).

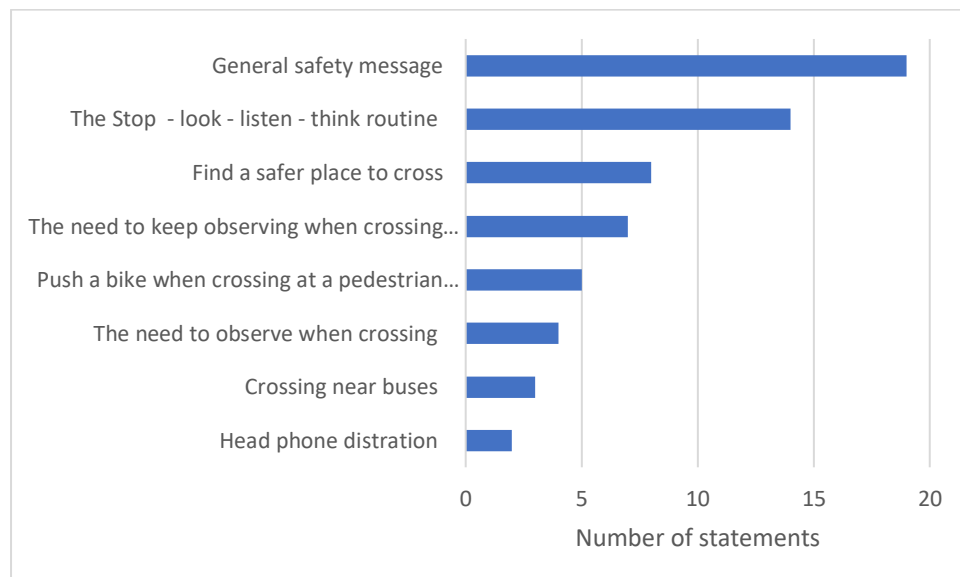


Figure 10. Number of statements placed in each theme

## Reaction

At T2 the treatment group was asked two questions to assess their reaction to the Arility training. The first asked which of the faces (Figure 11) described how they felt about the lesson they had just completed. The ratings were very positive, with 94% of the children indicating they were happy, or very happy, with the lesson (Figure 11).

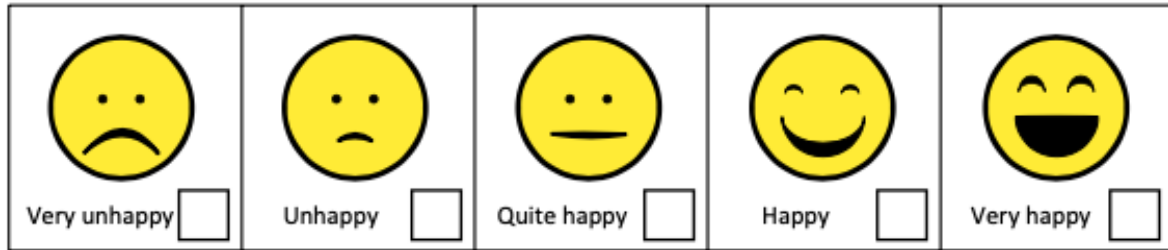


Figure 11. Smiley face scale used to indicate how happy the children felt about the lesson

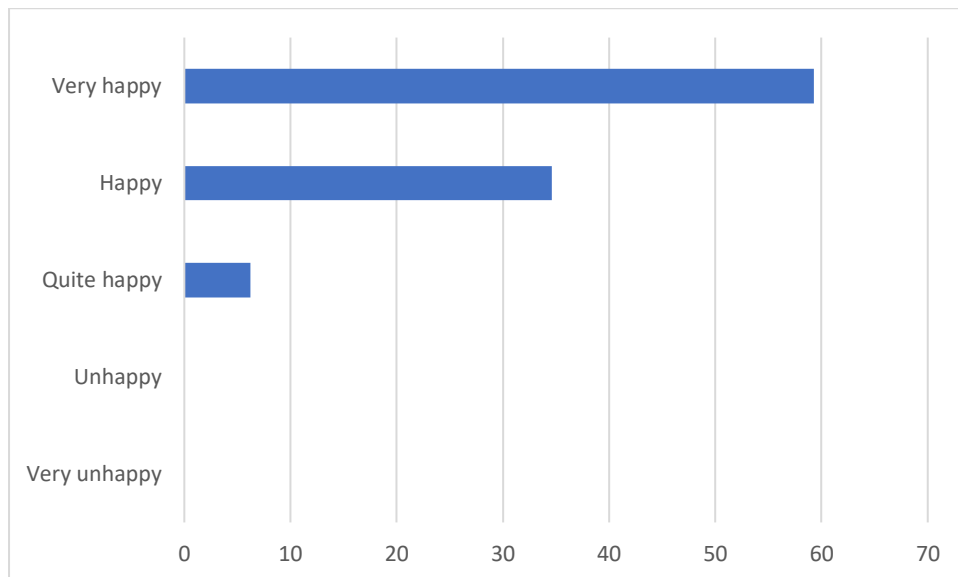


Figure 12. Percentage of replies to 'Which face best describe how you felt about the lesson?'

The second reaction question asked the children to rate how much they enjoyed using the app, using the scale shown in Figure 13. Once again, this produced a strong result with 94% of the children indicating that they have enjoyed or enjoyed it a lot (Figure 14).

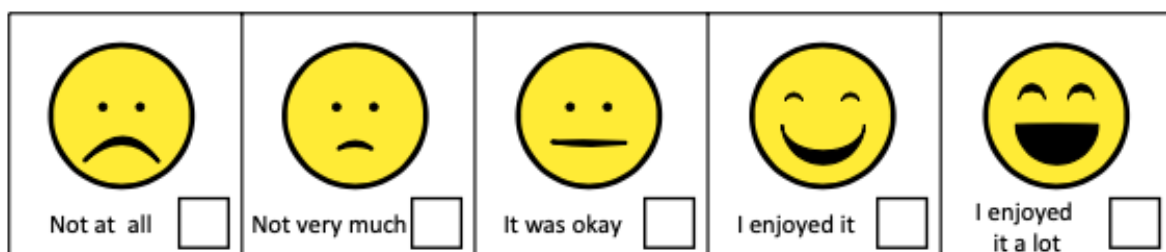


Figure 13. Smiley face scale used to indicate how much the children enjoyed using the app.

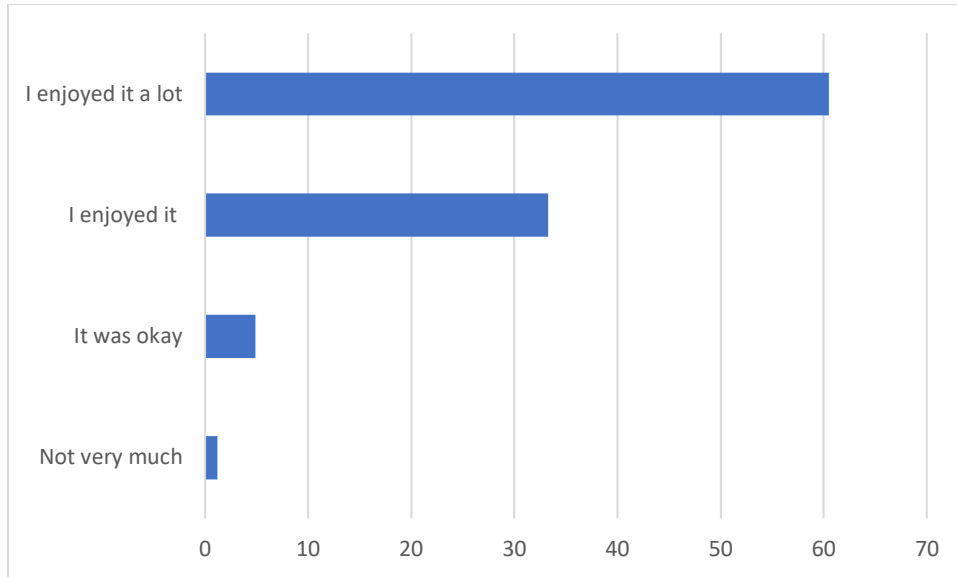


Figure 14. Percentage of replies to 'How much did you enjoy using the tablets.'

## VR Assessment

### Crossing the road

The children were shown 2 VR video clips from the perspective of standing at the kerb and were asked to indicate when they felt it would be safe to cross. They recorded choices by looking at a button on the screen to indicate when they would cross. If the answer was given in the safe scoring window it scored as 1 and if outside of the window it was scored zero.

No significant difference was found at T1 between the groups. However, at T2 a significant difference was found, with 100% of the TG correctly identifying a safe place to cross compared to 82% for the CG. (Table 12)

Table 12. Observations whilst crossing a road

Task	Time	Group	N =	Mean (SD)	t =	DF	p =
Selecting a safe time to cross	1	Treatment	29	1.93 (.257)	.312	60	.75
		Control	33	2.08 (.291)			
	2	Treatment	29	2.00 (0.0)	2.355	60	.02*
		Control	33	1.79 (1.787)			

\*Denotes significance

The second set of tasks asked the children to complete a road crossing. Whilst crossing the road in the VR environment, the software counted the number of times the children looked to their right and left (Table 13). No significant difference in the scores was identified at T1 or

at T2. Although it should be noted that the scores were high for both groups which may indicate that there was limited room for improvement.

Table 13. Observations whilst crossing a road

Task	Time	Group	N =	Mean (SD)	t =	DF	p =
Number of observations whilst crossing the road	1	Treatment	44	6.86 (3.573)	.914	65	.36
		Control	23	6.08 (2.695)			
	2	Treatment	44	7.00 (2.901)	-1.463	65	.14
		Control	23	8.08 (2.859)			

### Footpath assessment

This pair of questions assessed if the children were more aware of the driveways whilst walking down a footpath. They scored 1 point for each of the driveways observed whilst walking past, the maximum possible score was 7. No significant differences were found at T1 or at T2 (Table 14). This would indicate that the Arility session had no impact on the children's awareness when walking along a footpath.

Table 14. Table 13. Observations whilst walking along a footpath

Task	Time	Group	N =	Mean (SD)	t =	DF	p =
Number of driveways observed	1	Treatment	52	5.82 (1.042)	1.642	87	.10
		Control	37	5.43 (1.214)			
	2	Treatment	52	5.78 (.976)	.294	87	.11
		Control	37	5.54 (1.238)			

## Road Safety Officer Feedback

A different Road Safety Officer (RSO) delivered the Arility training package in each of the three areas, all three were asked to provide written feedback on their experience of using the package. When reviewed, the following themes were identified:

### **Overview**

The system was seen positively due to the levels of interaction it offered. It was highlighted that the Arility product made it easy to prompt discussion and encourage reflection. It was seen as a useful resource that a teacher would be able to use easily.

### **Age groups**

The feedback identified that this Arility product was better suited to KS 2, as it was easier for the children to use. It was also highlighted that KS 2 were better able to engage in discussion about the issues being addressed. It was felt that the content of the lesson was possibly too young for the upper reaches of KS 2 children and that the best age for the current content would be 7 to 8-year-olds.

Concern was raised that some KS 1 children did not have the dexterity to use the system easily. It was also felt it was too text heavy for the KS 1 children. There was also concern that the children were too focused on the technology rather than the learning outcomes. It is possible that these issues influenced the responses to the 2 reaction questions contained in the T2 knowledge tests, the KS1 children scored these lower than the KS 2 children.

### **Class management**

It was felt that the children could easily skip ahead and therefore the resource needed to be carefully managed by the teacher. It was also felt that teachers would need guidance notes on how to use the system. It should be noted the learning outcomes are provided on the Arility website and questions for the trainer to ask are provided with the Arility app.

### **Technology**

Whilst Arility can be used offline it is designed to allow the teacher to manage the group through an online connection. Concern was raised about internet connection in schools and that these could be unstable. They also highlighted difficulties getting the tablets online and the need to arrange this prior to attending the schools. It was also reported that occasionally the system could freeze. There could be several reasons for this including internet issues or the tablets being used to deliver the training. Whilst the tablets were relatively inexpensive, they were bought specially for the project.

## Discussion

There is clear evidence which demonstrates that Arility improves KS 2 children's road safety knowledge, with the knowledge assessment finding a significant ( $p < .05$ ) improvement in TG scores at T2 compared to the control group scores. In particular, the new model commissioned by Road Safety GB relating to the use of pedestrian crossing appears to have had a positive impact with a significant improvement ( $p < .05$ ) being identified between the treatment and control group scores at T2 on the set of items specifically testing this area.

The VR on-road skills assessment found a significant improvement ( $p < .05$ ) in the children's ability to select a safe time to cross the road, with 100% of the treatment group selecting a safe time to cross compared to only 82% of the control group. No significant differences were found in the number of times the children looked right or left while crossing a road, or in observing driveways whilst walking along a footpath. However, it should be noted that both groups scored high on both these tasks initially, allowing little room for improvement.

The feedback from the KS 2 children was very positive, with 94% of the children saying they were happy or very happy with the session and 94% saying they enjoyed or enjoyed it a lot, using the tablets. The feedback from the RSOs who delivered the training was also positive and supported the findings of the evaluation for the age group. It was suggested that it would be most effective with the young end of the KS 2 age range. The RSO felt it could be used by teachers, but clear guidance's notes should be made available to the school staff.

The situation is less clear for KS1 where no clear benefits could be identified. The most likely explanation for this finding is that the content for this age group is already being covered in other ways. All 3 of the road safety officers who delivered these sessions had some concerns about the usefulness of the system for this key stage with regards to how easy the children found the resource to use and the difficulty in maintaining the children's focus on the learning outcomes rather than becoming too focussed on using the technology. These concerns could explain the lower scores for enjoying the lesson, with 76% indicating they were happy or very happy with the lesson and 77% indicating they had enjoyed, or enjoyed it a lot, using the tablets. Both figures are lower than those given by KS 2. It is therefore suggested that the system is only used with the oldest children in KS1.

Technology was also identified as an issue. Delivering this evaluation was challenging due to Covid but also due to difficulties in engaging schools willing to install Arility app. This difficulty is not one of Arility's making, but how schools regulate their IT systems. These systems are tightly controlled making it difficult for the class teachers to add new software to their tablets. It is possible this difficulty was only experienced as this was a pilot which may have reduced the schools' motivation to go through the process for what could be a short-term gain. However, this is thought to be unlikely as this was not highlighted during discussions with the schools. Therefore, this may prove to be a barrier to Arility's wider use unless the schools recognise and understand the possible benefits of the system.

To conduct the evaluation, it was necessary to purchase 26 tablets, but even this process had challenges, with the trainers experiencing difficulties accessing the schools' Wi-Fi systems, which limited access to Arility's classroom management tool. However, if road safety teams want to utilise the benefits of the system, they may have to purchase their own tablets, but this raises issues of cost and maintenance.

## Recommendation

That Arility is actively promoted for use by road safety professionals and schools.

That it is used with the younger age groups within KS 2 age range ideally years 3 and 4.

That Arility is used with KS 1 but only for year 2 children.

A set of lesson plans are developed for KS 1 and KS 2 that can be downloaded by the trainers prior to the commencement of the session.

Consideration is given to promoting the benefits of the system to overcome a reluctance by schools to download the system.

That road safety teams who wish to use the system purchase their own tablets for use in schools.



## Appendix A – Lesson plan for Arility pilot delivered, developed by Kate Castle Warwickshire’s Senior Road Safety Officer

Resources:  
 Tablets x 10  
 Markers x 10  
 Cones (to mark areas)  
 Surface Pro / PPT

Slides	Lesson Structure (approximately 30 minutes) Supporting adult to place pupils in 10 x groups of 3, around a marker.	Notes
<b>Key Stage 1 – Year 2</b> <b>Learning outcome:</b> To address specific road safety risks for child cyclists or pedestrians between the ages of 4 and 6 years.		
<b>TBC: Solo or Leader?</b>	<b>Introduction</b> Introduce selves, set out expectations and behaviour management (clap, clap back, listen). Introduce Arility / tablets and marker. Encourage turn taking, three scenarios, each pupil in group can hold the tablet for one scenario. <b>Walkthrough Steps:</b> *Invite pupils to enter details on screen 1 *Invite pupils to scroll down to Scenario 1 – Ball Rolling *Click Start Activity (check camera)	*Record comments for qualitative data *Teacher to group children
	<b>Introduce Scenario 1 – Ball Rolling</b> <i>* This scenario teaches students important safety rules related to traffic and roads.</i> <b>Display introduction on screen.</b> <i>Mel and Ruby are playing with a ball. The ball rolls onto the road. What should Ruby Do?</i> <b>Pre-question</b> Display questions and answers on the screen, read to the class and ask the chn. in groups to discuss the answers and order from safest to least safe. <b>Activity</b> <b>Step 1:</b> Invite children to walk around the marker, looking at surroundings and listening. In groups, consider: What can you see? What can you hear? What are the risks / dangers?	

	<p>Are all road users making the safest choices? Invite responses to above.</p> <p><b>Step 2:</b> Move on and ask chn. in groups to explore different options, which is the safest option? What would you do and why?</p> <p><b>Discussion</b> What would you do in this scenario? Would you ever attempt to get the ball yourself? Why/why not? What did you see Ruby's mum doing before retrieving the ball? (Looking and listening for traffic). Is it ever safe to try and retrieve the ball without an adult?</p> <p><b>Key Messages</b> Always ask an adult for help.</p> <p><b>Questions</b> In groups, chn. to answer question.</p> <p><b>Recap key learning:</b></p> <ul style="list-style-type: none"> <li>• Understand that the road is an unsafe environment.</li> <li>• Recognise importance of seeking help from an adult</li> <li>• Make the safest choices.</li> </ul> <p><b>Arility key learning:</b></p> <ul style="list-style-type: none"> <li>• Students identify unsafe situations</li> <li>• Students make safe decisions in the traffic environment</li> <li>• Students develop skills to seek help in unsafe situations</li> <li>• Students seek assistance from an adult to retrieve an object from the road.</li> </ul>	
	<p>*Invite children to hand tablet to second pupil in group.</p> <p><b>Introduce Scenario 2 – Cross or wait?</b> <i>*This scenario teaches students key safety rules in relation to crossing the road near a pedestrian crossing.</i></p> <p><b>Display introduction on screen.</b> <i>A friend is on the other side of the road waving for Ruby to cross. Is it safe to cross?</i></p> <p><b>Pre-question</b> Display questions and answers on the screen, read to the class and ask the chn. in groups to</p>	

	<p>discuss the answers and order from safest to least safe. Explain vocabulary 'pedestrian lights'.</p> <p><b>Activity</b></p> <p><b>Step 1:</b>  Invite children to walk around the marker, looking at surroundings and listening:  What can you see? (Crossing)  What can you hear? (Friend saying hi, calling you across, pedestrian on mobile phone)  What are the risks / dangers that you can see?  Are all road users making the safest choices?  Invite responses to above.</p> <p><b>Step 2:</b>  Move on and ask chn. in groups to explore different options, which is the safest option?  When would it be the safest to cross the road?</p> <p><b>Discussion</b>  Why is it unsafe to cross when the red man is lit? (Traffic)  Why is it unsafe to cross at any time, even if you can't hear traffic? (Electric vehicles, bicycles, drivers speeding)  Wait for the green man before crossing and remember to check that the traffic has stopped before crossing (lifesaver look). Remember to walk – don't run (trip / not paying attention) and cross with an adult.</p> <p><b>Key Messages</b></p> <p><b>Questions</b>  In groups, chn. to answer question.</p> <p><b>Recap key learning:</b></p> <ul style="list-style-type: none"> <li>• Understand that the road is an unsafe environment.</li> <li>• Recognise importance of seeking help from an adult and holding hands to cross.</li> <li>• Only cross when the green light is displayed, and the traffic has stopped.</li> </ul> <p><b>Arility key learning:</b></p> <ul style="list-style-type: none"> <li>• Students practice using the pedestrian traffic lights</li> <li>• Students identify unsafe situations</li> <li>• Students make safe decisions in the traffic environment.</li> </ul>	
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	<p>*Invite children to hand tablet to third pupil in group.</p> <p><b>Introduce Scenario 3 – Which door?</b></p> <p><i>*This scenario teaches students important safety rules related to traffic at busy locations like school drop offs.</i></p> <p><b>Display introduction on screen.</b></p> <p><i>A car appears next to the school on the road slip lane. An adult is in the driver's seat and a student is seated in the right-hand side of the rear passenger seat.</i></p> <p><b>Pre-question</b></p> <p>Display questions and answers on the screen, read to the class and ask the chn. in groups to discuss the answers and order from safest to least safe.</p> <p><b>Activity</b></p> <p><b>Step 1:</b></p> <p>Invite children to walk around the marker, looking at surroundings and listening:  What can you see? (Cyclist)  What can you hear?  What are the risks / dangers that you can see?  Are all road users making the safest choices?  Invite responses to above.</p> <p><b>Step 2:</b></p> <p>Move on and ask chn. in groups to explore different options, which is the safest option?  Why?</p> <p><b>Discussion</b></p> <p>Discuss hazards for passenger exiting onto the side of the road (bicycles / traffic).</p> <ul style="list-style-type: none"> <li>• Children should always exit the car on the footpath side</li> <li>• The safest door is the door closest to the footpath or kerb</li> <li>• Apply the 'Stop, look, listen, and think' strategy before exiting the car.</li> </ul> <p><b>Key Messages</b></p> <p>Stop: only open door when vehicle has stopped, and engine is switched off  Look all around  Listen to instructions from parents  Think – is it safe to open the door and exit?</p> <p><b>Questions</b></p> <p>In groups, chn. to answer question.  Why isn't s safe to exit the car onto the road?  Order from safest to least.</p>	
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	<ul style="list-style-type: none"> <li>• The safest door is the door closest to the footpath or kerb</li> <li>• Apply the 'Stop, look, listen, and think' strategy before exiting the car.</li> </ul> <p><i>Arility key learning:</i></p> <ul style="list-style-type: none"> <li>• <i>Children should always exit the car on the footpath side</i></li> <li>• <i>The safest door is the door closest to the footpath or kerb</i></li> <li>• <i>Apply the 'Stop, look, listen, and think' strategy before exiting the car.</i></li> </ul>	
	<p><b>Key Stage 2 – Year 3</b></p> <p><b>Learning outcome</b> To address specific road safety risks for child cyclists or pedestrians between the ages of 7 and 11 years.</p>	
	<p><b>Introduce Scenario 1 – Bus Stoppers</b> <i>*This scenario teaches students key safety rules in relation to crossing the road after exiting a school bus.</i></p> <p><b>Display introduction on screen.</b> <i>The bus pulls up and Bella gets off at the bus stop. Where it is safest for Bella to cross the road - in front or behind the bus or at a nearby crossing.</i></p> <p><b>Pre-question</b> Display questions and answers on the screen, read to the class and ask the chn. in groups to discuss the answers and order from safest to least safe.</p> <p><b>Activity</b> <b>Step 1:</b> Invite children to walk around the marker, looking at surroundings and listening: What can you see? (<i>Zebra crossing</i>) What can you hear? What are the risks / dangers that you can see? (<i>Weather – wet/slippy roads</i>) Are all road users making the safest choices? What is likely to happen next? (<i>Bus about to move</i>) Invite responses to above.</p> <p><b>Step 2:</b></p>	

	<p>Move on and ask chn. in groups to explore different options, which is the safest option? Why?</p> <p>What are the risks if Bella walks behind the bus to cross the road? Why would it be unsafe for Bella to cross in front of the bus? How should you cross at a pedestrian crossing? Display introduction on screen.</p> <p><b>Discussion</b> Crossings (name) Where should you cross the road when you exit a bus</p> <p>Where should you stand when waiting for the bus to depart</p> <p>Use of pedestrian crossings</p> <p><b>Key Messages</b> Stop: stand on footpath and wait for bus to leave Look: use nearby crossing Listen: remove headphones Think: is it safe to cross?</p> <p><b>Questions</b> In groups, chn. to answer question 1. The difference between a car stopping at 30mph and 40mph is 45 feet (thinking and braking distance). Could we use ribbon to show 45 feet?! In groups, chn. to answer question 2. Discuss zig-zags – vehicles are braking and moving off. Some vehicles might not be able to stop in time, particularly if it raining or icy.</p> <p><b>Post Question</b> In groups, chn. to order questions. <i>Arility key learning:</i></p> <ul style="list-style-type: none"> <li>• <i>Where to cross the road when you exit a bus</i></li> <li>• <i>Where to stand when waiting for the bus to depart</i></li> <li>• <i>Required use of pedestrian crossings</i></li> </ul>	
	<p><b>Introduce Scenario 2 – Can you see them?</b> <i>*This scenario teaches students key safety rules in relation to crossing two lane crossings.</i></p> <p><b>Display introduction on screen.</b> <i>Ruby is approaching a busy pelican (pedestrian light controlled) crossing with 2 lanes each way and a bike</i></p>	

lane. The green man is already lit as she approaches, and others have already started crossing ahead of her. What should Ruby do?

**Pre-question**

Display questions and answers on the screen, read to the class and ask the chn. in groups to discuss the answers and order from safest to least safe.

**Activity**

**Step 1:**

Invite children to walk around the marker, looking at surroundings and listening:  
What can you see? (Pedestrian crossing, traffic lights red, traffic stopped – bus/cyclist  
What can you hear?  
Are all road users making the safest choices?  
What are the risks / dangers that you can see? (A bike is in the bike lane, a bus is in the inside lane and a difficult to see car on the outside)  
Invite responses to above.

**Step 2:**

Move on and ask chn. in groups to explore different options, which is the safest option?  
Why?

**Discussion**

What other hazards might make this crossing more difficult (weather rain, snow, ice) and how would this affect pedestrians? Driver?

**Key Messages**

Stop: wait for the green man / lifesaver look  
Look  
Listen  
Think – is it safe?

**Questions**

In groups, chn. to answer question 1.  
Discuss flashing green man – dangers/risks if continue to cross.  
In groups, chn. to answer question 2.  
Discuss importance of lifesaver look and checking that all traffic has stopped.

**Post Question**

In groups, chn. to order questions  
*Arility key learning:*

- *Students practice using the pedestrian traffic lights*

	<ul style="list-style-type: none"> <li>• Students identify unsafe situations</li> <li>• Students make safe decisions in the traffic environment.</li> </ul>	
	<p><b>Introduce Scenario 3 - Walk or ride?</b>  <i>*This scenario teaches students in the 7-11 age group important safety rules relating to cycling and pedestrian crossings.</i></p> <p><b>Display introduction on screen.</b>  <i>Bella is riding her bike and stops at an intersection controlled by traffic lights. She pushes the "push to walk" button on the pole and waits for the green man light. Should Bella ride her bike across the road or get off her bike and walk it across.</i></p> <p><b>Pre-question</b>  Display questions and answers on the screen, read to the class and ask the chn. in groups to discuss the answers and order from safest to least safe.</p> <p><b>Activity</b>  <b>Step 1:</b>  Invite children to walk around the marker, looking at surroundings and listening:  What can you see?  What can you hear?  What are the risks / dangers that you can see?  Are all road users making the safest choices?  Invite responses to above.</p> <p><b>Step 2:</b>  Move on and ask chn. in groups to explore different options, which is the safest option?  Why?</p> <p><b>Discussion</b>  Get off bike and walk across if there is only a green man showing.  Mention toucan crossing.  Check all traffic has stopped.</p> <ul style="list-style-type: none"> <li>• a bike is a legal road vehicle. Cyclists must follow the rules</li> <li>• A cyclist must not ride their bike while using a pedestrian crossing</li> <li>• A cyclist must dismount and walk their bike across a road at the pedestrian crossing only</li> <li>• Some controlled crossings have special bike crossing lights. (Can they identify the difference)</li> </ul>	



	<ul style="list-style-type: none"> <li>• Where 'green bike' lights are displayed cyclists can ride across the road</li> </ul> <p><b>Key Messages</b></p> <p>Stop: you must get off and walk bike across unless a toucan</p> <p>Look – use nearby crossing</p> <p>Listen – remove headphones / beeps</p> <p>Think – is it safe?</p> <p><b>Questions</b></p> <p>In groups, chn. to answer question 1.</p> <p>In groups, chn. to answer question 2.</p> <p><b>Post Question</b></p> <p>In groups, chn. to order questions</p> <p><i>Arility key learning:</i></p> <ul style="list-style-type: none"> <li>• a bike is a legal road vehicle. Cyclists must follow the rules</li> <li>• A cyclist must not ride their bike while using a pedestrian crossing</li> <li>• A cyclist must dismount and walk their bike across a road at the pedestrian crossing only</li> <li>• Some controlled crossings have special bike crossing lights. (Can they identify the difference)</li> <li>• Where 'green bike' lights are displayed cyclists can ride across the road</li> </ul>	
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# Appendix B – KS 1 and KS2 Questionnaires

## Pre-Questionnaire (Treatment Group age 4 to 8)

School:  Today's date:

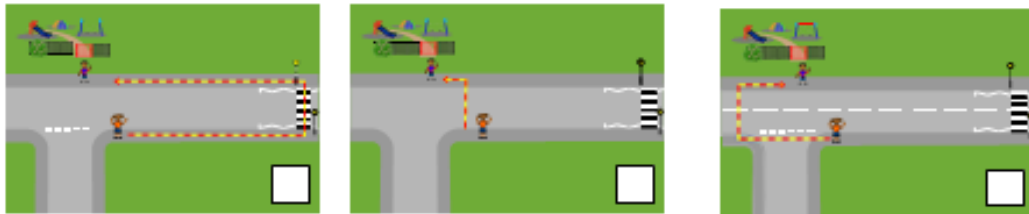
Year:  Pupil details:

Initials Day Surname

1. Mel and Ruby are playing with a ball. The ball rolls onto the road. What should they Do?



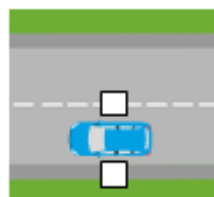
2. A friend is on the other side of the road waving for Ruby to cross. Which is the safest route for Ruby to take?



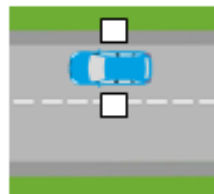
3. Which of the two pedestrian lights means must you not cross the road?



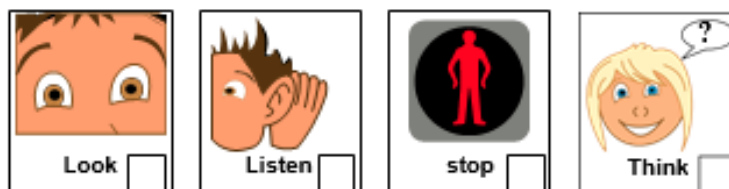
4. If you were getting out of this car which do you think is the safest side to get out of?



5. If you were getting out of this car which do you think is the safest side to get out of?



6. Before opening the car door to get out, what should you do?



Post-Questionnaire (Treatment Group age 4 to 8)

School:  Today's date:   
 Year:  Pupil details:     
 Initials:      
 Day:  Month:

1. Mel and Ruby are playing with a ball. The ball rolls onto the road. What should they do?



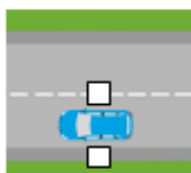
2. A friend is on the other side of the road waving for Ruby to cross. Which is the safest route for Ruby to take?



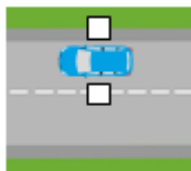
3. Which of the two pedestrian lights means must you not cross the road?



4. If you were getting out of this car which do you think is the safest side to get out of?



5. If you were getting out of this car which do you think is the safest side to get out of?



6. Before opening the car door to get out, what should you do?



7. Which face best describes how you feel about the lesson you have just done?



8. How much did you enjoy using the app on the tablet?



Pre-Questionnaire (Treatment Group age 7 to 11)

School:  Today's date:

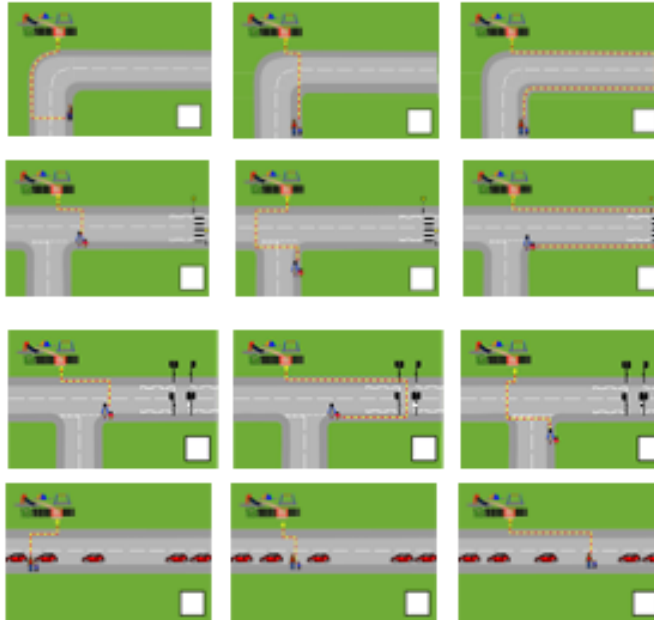
Year:  Pupil details:  Initials:  Day:  Month:

When you get off a bus you should never:

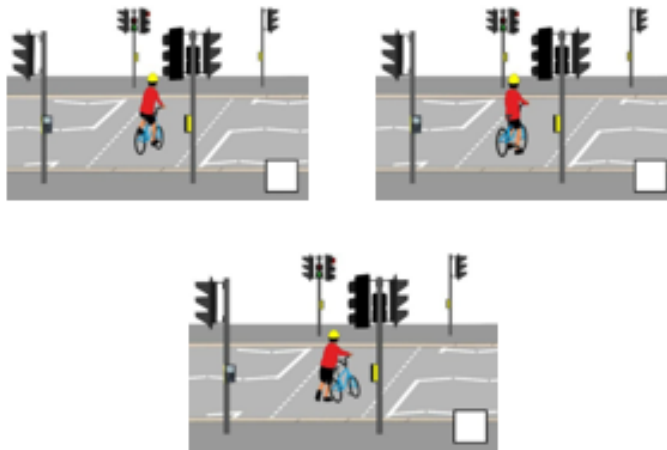
- Cross behind the bus
- Cross in front of the bus
- Wait for the bus to move before crossing



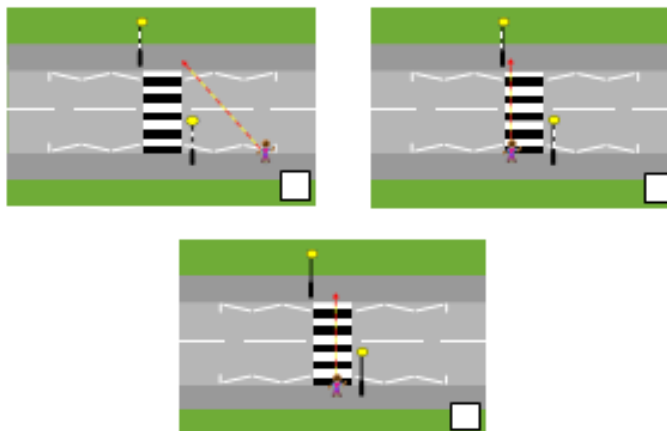
Which of the pictures show the safest route to the park?



Which of the following pictures shows a child behaving safely?



Which of the following pictures shows a child behaving unsafely?



What does a green man at a pedestrian crossing mean?

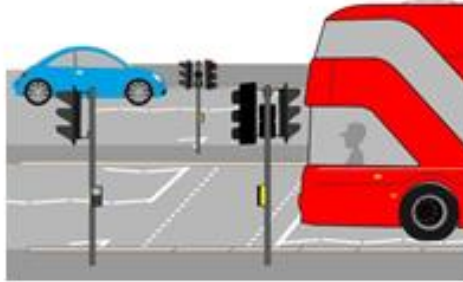
- It is safe to cross
- The traffic will stop for you
- It may be safe to cross



When crossing at a pedestrian crossing when the green man is on, what should you always do?

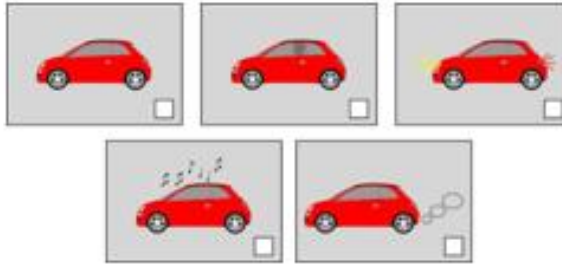
- Keep watching the green man as you are crossing
- Keep looking all around to make sure the traffic is waiting for you
- Walk straight across the road

Look at the picture, what is the hidden danger here?



- The blue car may set off
- Another vehicle may be behind the bus
- The green man may change to red

In the pictures below, tick the pictures that give a clue that the car may move off.



What should you do first when you get to the **queue**?



If you **wasn't** getting out of this **car**, put a cross next to the doors that you think are the safest to get out of.



If you **wasn't** getting out of this **car**, put a cross next to the doors that you think are the safest to get out of.



Post-Questions (Treatment Group age 7 to 11)

School:  Today's date:

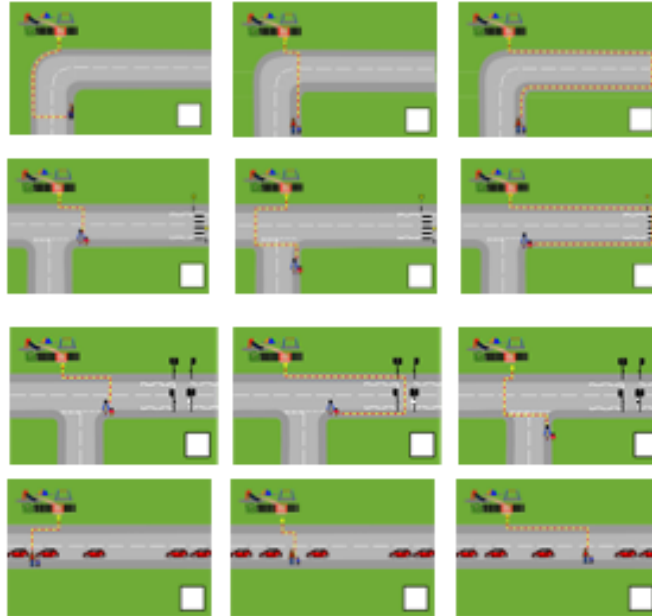
Year:  Pupil details:      
Initials:  Day:  Month:

When you get off a bus you should never:

- Cross behind the bus
- Cross in front of the bus
- Wait for the bus to move before crossing



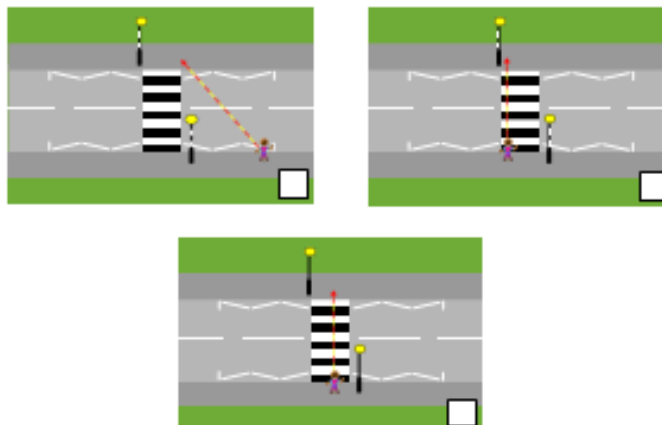
Which of the pictures show the safest route to the park?



Which of the following pictures shows a child behaving safely?



Which of the following pictures shows a child behaving unsafely?



What does a green man at a pedestrian crossing mean?

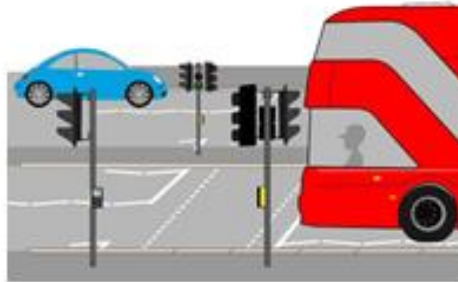
- It is safe to cross
- The traffic will stop for you
- It may be safe to cross



When crossing at a pedestrian crossing when the green man is on, what should you always do?

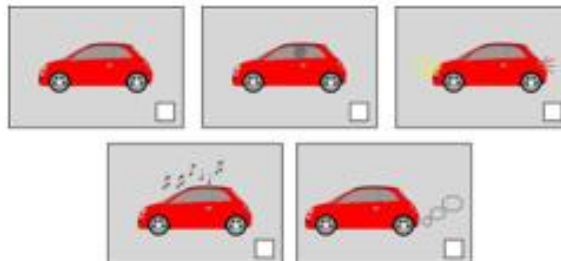
- Keep watching the green man as you are crossing
- Keep looking all around to make sure the traffic is waiting for you
- Walk straight across the road

Look at the picture, what is the hidden danger here?



- The blue car may set off
- Another vehicle may be behind the bus
- The green man may change to red

In the pictures below, tick the pictures that give a clue that the car may move off.



What should you do first when you get to the **toob**?








If you were getting out of this car, put a cross next to the doors that you think are the safest to get out of.








If you were getting out of this car, put a cross next to the doors that you think are the safest to get out of.



Which face best describes how you feel about the lesson you have just completed?

				
Very unhappy <input type="checkbox"/>	Unhappy <input type="checkbox"/>	Quite happy <input type="checkbox"/>	Happy <input type="checkbox"/>	Very happy <input type="checkbox"/>

How much did you enjoy using the app on your tablet?

				
Not at all <input type="checkbox"/>	Not very much <input type="checkbox"/>	It was okay <input type="checkbox"/>	I enjoyed it <input type="checkbox"/>	I enjoyed it a lot <input type="checkbox"/>

What was the most important thing that you learnt?