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[Special Topic]

COSTS AND CHOICES:

THE EFFECTS OF EDUCATING YOUNG ADULTS ABOUT TRANSPORT PRICES

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This paper reports on research examining the effects of educating 17-18 year olds about the financial costs associated with different kinds of travel behaviour. Results suggest that with only a minimal educational intervention, significant changes in attitude can be achieved, relating to the desirability of car ownership and use, and the attractiveness of owning a more environmentally-friendly vehicle. This paper discusses the theoretical rationale for making this type of educational intervention with this age group, the detailed results of the experiment, and plans for future work.

Key Words: *travel education, teenagers, transport costs, car ownership, car use*

1. INTRODUCTION

In countries throughout the world, there are concerns about growing traffic levels, and associated problems including accidents and pollution. At the same time, it is increasingly recognised that people's travel decisions are not purely rational evaluations of different options, but are also affected by previous habits, preconceived expectations and a range of other psychological and behavioural factors. Hence, various interventions are being made, to try and influence how people perceive their options, as well as making changes to what those options actually are. As such interventions become more sophisticated, it is also recognised that the timing and nature of such interventions will be critical to their success. This paper reports on the first phase of a research project being undertaken jointly in Japan and the UK (see Appendix note i), investigating the effects of educating 17-18 year olds about the financial costs of different transport options, engaging students via a series of practical mathematics exercises. The paper describes the experiment and explains why 17-18 year olds were chosen; why financial costs were the focus of the intervention; and why the materials were designed as they were.

2. OBJECTIVES OF THE STUDY

In this study, the hypothesis is that teaching students about the financial costs of travel will alter their travel preferences in a socially desirable direction (see Appendix note ii). Specifically, it is hypothesized that education about costs could reduce the attractiveness of car ownership and use, whilst increasing the attractiveness of alternative modes of travel, safer driving and smaller, more environmentally friendly, cars.

This paper describes the first phase of the study, which has involved educating a group of 38 Japanese high school students, and evaluating whether the intervention has altered their attitudes towards travel issues, in comparison to the attitudes of a control

group. This phase was planned as an exploratory investigation, intended to produce insights about both methodology and content, which would be taken up in further work. The sample size is therefore somewhat larger than a conventional pilot survey (and indeed, a certain amount of piloting took place prior to administering the education and evaluation materials), being large enough to produce some results which are interesting, but tentative. The next phases of the study will attempt to repeat the experiment with larger sample sizes in both Japan and the UK.

3. RELATED WORK / LITERATURE REVIEW

There have been many interventions attempting to affect people's knowledge and opinions about different transport options. Large European projects, notably INPHORMM (Hamer, 1997-)[1] and CAMPARIE (Papaioannou, 1997-)[2], have recently assessed the criteria affecting the effectiveness of such programmes in general.

Educational interventions aimed at students or children have been less common, and have traditionally focused on road safety. In Japan, there are only a few attempting to influence mode choice (Matsumura, Takajo & Nitta, 2000[3]; Fujii, Nishinaka & Kitamura, 2002[4]; Fujii, forthcoming[5]). In contrast, in the UK, there have recently been an increasing number of interventions attempting to influence modal choice. This is largely due to the increasing number of children who are driven to school, which is leading to concern about children's health and social development (including social skills and independence) as well as concerns about the generated traffic. There are many references to such interventions – see Appendix note iii, and a database of potential teaching resources has been established – see Appendix note iv. However, typically, such materials have been aimed at younger age groups, and have tended to focus on the 'fun' aspects of walking and cycling, or environmental arguments. There are also education materials for children in Europe, and in other parts of the world, aimed at promoting responsible car use, which have typically focused on safety or pollution or energy use.

Few of these materials have been assessed to establish their effects on children's attitudes to different travel modes. (However, some materials have been assessed in terms of whether they are used by schools (Bhabra, 1999)[6] and others form part of a much larger programme, including many physical changes to the school environment, where the programme is being assessed as a whole – see, for example, the Sustrans Safe Routes to Schools work, Appendix note v).

To the authors' knowledge, there are also only a few interventions in the world which have attempted to teach students about the financial costs of driving, or the financial costs of alternative travel modes, or which have focused specifically on the economics of travel *for the individual*.

These include work by the UK London Borough of Barnet's Accident Prevention Centre, where 17 year olds debate an economics scenario about buying a car (Baker, 2001)[7]; and work in Victoria, Australia, where an education pack called 'Motivation 2' includes homework exercises about the financial implications of different transport choices for individuals (VicRoads, 1997)[8]. Both programmes have been well received, but there has not been any formal evaluation of their effects on children's travel. Meanwhile, in a more formal study, in Finland, Pekkarinen is investigating the effects of 'economical driving' techniques, being taught to young drivers as part of the Finnish driving test, although her results are not yet publically available, (Pekkarinen, forthcoming)[9].

A final relevant project involving 12-23 year olds was undertaken in the UK by Pilling & Turner (1998)[10]. During this project, students were asked to spend about 6 hours (over 4 evenings) developing an advertisement for a non-car mode, focusing on any positive aspect of their choice. Before and after surveys were undertaken, focusing on the attitudes of young people to different travel modes. Specifically, those involved were asked to comment on the importance of different attributes of their travel. Interestingly, prior to the intervention, "cost" was rated as important or very important by 78% of respondents, although it came third, after "convenience" and "safety". Notably, following the intervention, there was a statistically significant increase in the rating given to cost, whilst there was no change in the rating given to convenience or safety. Hence, the authors report that *"the intervention has sensitised the group to the importance of cost in their travel decisions."* In their analysis, they also found that there were only significant changes in the attitudes of those aged under 17 year olds (pre-drivers). The researchers concluded that *"maybe once people become established car drivers/users, their attitudes are more resistant to change"*. The findings

Assume that you work every Saturday at the local hamburger restaurant, earning 6,000yen per day. If you get 1 parking fine and 1 speeding ticket (according to the fees given on the information sheet), how many Saturdays will you have to work to pay for these? Note that for speeding, you must also pay for a compulsory retraining class, (else you have to take driving lessons and full driving test again)

Total cost of traffic offences	
Number of weeks to pay for traffic offences	

Figure 1 Example of question from the maths calculation exercise

that perceptions of cost may be one of the most influencable aspects of how young people evaluate their travel, and that it is important to target pre-drivers, reinforce some of the justifications for this study given in section 5.

4. METHOD

The educational intervention reported here consisted of three phases, all of which were led by the classroom teacher. The three phases were: a) an introductory transport cost quiz; b) a maths calculation exercise; and c) an evaluation questionnaire. Students in the experimental group completed all three phases, whilst the control group only completed the evaluation questionnaire.

(1) Procedure

More details of the intervention materials are as follows:

a) Introductory transport cost quiz

This was a multiple-choice test of 25 questions (with 3 answer options) asking about different costs – for example "how much is a litre of petrol ?", "how much is the train fare between Kashiwa and Tokyo". This took about 15 minutes and was carried out on October 30th 2000.

b) Maths calculation exercise

This was comprised of 7 mathematical questions, asking students to calculate different costs. They were given an information sheet with relevant costs, and the answer spaces were structured to help guide their calculations. An example is given in **Figure 1**. This took about 35 minutes of classroom time and was carried out on November 10th 2000.

c) Evaluation questionnaire

A control group and the intervention group both completed an evaluation questionnaire on November 27th 2000, which took approximately 15 minutes. The nature of this questionnaire is shown in Table 2 in section 4(3).

A 'before/after' survey design was considered, instead of, or in addition to, the 'experimental/control' design that was used. However, it was not adopted because, without a very long timescale, it seemed impossible to administer a 'before' questionnaire, which would not influence student's reception of the subsequent teaching materials, and potentially affect their responses to the 'after' questionnaire. (Specifically, instead of the information being seen as neutral, factual data about costs, there was a danger that it would seem aimed at achieving a particular outcome, and also that students would feel obliged to give different answers in the 'after' questionnaire, to fulfil perceived expectations of the survey team.)

(2) Subjects

The study took place at Kashiwa Minami high school, about 25km outside central Tokyo. The school is in a middle class area, where most students would have realistic public transport, cycle and walk options for many journeys. **Table 1** provides the characteristics of the intervention sample and the control sample. Both the head teacher and the classroom teacher felt that the two classes selected would not discuss the study work, such that they would constitute valid independent samples. The school also nominated the two classes on the basis that they would be comparable for survey purposes.

Actual analysis of composition showed that the two groups were relatively similar, in terms of high household car ownership, low levels of car usage for

Table 1 Characteristics of the experimental and the control samples

		Experimental (38 students)		Control (40 students)	
Sex	Male	47%	(n=18)	38%	(n=15)
	Female	53%	(n=20)	63%	(n=25)
Minutes to train station (on foot)	<10	21%	(n=8)	20%	(n=8)
	10-20	48%	(n=18)	41%	(n=16)
	20-30	13%	(n=5)	20%	(n=8)
	>30	18%	(n=7)	20%	(n=8)
Household car ownership	0	11%	(n=4)	5%	(n=2)
	1	55%	(n=21)	60%	(n=24)
	2+	34%	(n=13)	35%	(n=14)
Main modes of travel to school*	Train	50%	(n=19)	65%	(n=26)
	Bicycle	50%	(n=19)	23%	(n=9)
	Car	3%	(n=1)	5%	(n=2)
	Other	18%	(n=7)	15%	(n=6)

* Students were asked to choose as many modes as applied.

travelling to school and living relatively close to a train station. However, there was a significant difference in the sex balance. Specifically, the control group contained more girls (a problem which was unavoidable due to circumstances at the school). Forthcoming work by the authors suggests that this is important, in that girls are more likely to display 'desirable' transport behaviour (ie. be less attracted to car ownership and use, and place a greater value on other modes of transport, safe driving and smaller cars). Hence, the difference in composition of the two groups reduced the likelihood of being able to measure an effect from the teaching. This problem is discussed later.

(3) Content of the intervention

In general, the interventions and the evaluation covered five areas:

i) *the costs of car ownership* (including vehicle purchase and resale costs, insurance, road tax, vehicle inspection fees and resident parking charges)

ii) *the costs of car use* (including petrol, parking and expressway fees)

iii) *the costs of alternative modes of travel* (including express train, local train, bus, taxi, car-hire, cycling and walking)

iv) *the costs of accidents* (in terms of insurance premiums and driving fines)

v) *the costs of 660cc cars compared with larger-engined cars* (as 660cc cars are generally considered to be more environmentally friendly. In Japan, 660cc cars are also cheaper, as they use less petrol, and qualify for cheaper expressway fees, reduced road tax and lower vehicle inspection fees).

The questions were carefully tailored to the local travel situation (to reflect journeys and choices that students would expect to make). There was also an attempt to put the cost figures into context, (for example, by asking students to consider them in relation to average wages for 17-18 year olds).

Table 2 shows the structure of the evaluation questionnaire and the nature of the questions. Except for the sections about 'expected future mode choice', 'personal details' and 'knowledge about costs', 11-point scales (1 - 11) were adopted. Students were asked to mark how strongly they agreed or disagreed with different statements (where 11 indicated strong agreement and 1 indicated strong disagreement).

Table 2 Structure of the evaluation questionnaire

Section	Nature of questions	Number of questions in each section
Current importance of transport costs	Opinion statements *	2
Future intentions about learning to drive, car ownership and car use	Opinion statements *	7
Expected future mode choice for hypothetical journeys	Multiple choice	6
Importance of cost to mode choice for hypothetical journeys	Opinion statements *	6
Relative expensiveness of car use for hypothetical journeys	Opinion statements *	6
Importance of cost as a deterrent to car ownership, use and unsafe driving	Opinion statements *	4
Factors affecting future choice of car (including cost)	Opinion statements *	5
Personal details	Mixture of multiple choice and 'complete-the-space'	5
Knowledge about costs	Multiple choice (5 answer options)	5

* Students were asked to respond to opinion statements on 11-point scales.

5. RATIONALE FOR THIS PARTICULAR STUDY

When initiating the study, three particular criteria were considered:

a) the age and life-stage of the participants
b) the content of the intervention
c) the form of the intervention.

(1) Why 17-18 year olds

There is a strong case for attempting to influence people at a relatively young age, for various related reasons.

First, there are numerous studies showing that 'habit' can be a strong determinant of future actions and that one develops habitual methods of making transport decisions (see, for example, Verplanken, Aarts & Knippenberg, 1997[11], and Gärling, Fujii & Boe, 2001[12]). In both Japan and the UK, ages 17-18 are critical from this perspective, since many people start learning to drive shortly afterwards, and will therefore develop 'car-driving habits'. Educating people about transport decisions before they have developed such habits is likely to be more influential than doing so afterwards, not least because, as highlighted by Verplanken *et al*, habit is often *"accompanied by less motivation to search out information, regardless of whether this information is unknown, and regardless of its importance"*.

17-18 year olds are also an important age group to target, because they have a reason to consider their options. The importance of a 'trigger' for generating a (re)consideration of travel options, which will then result in a relatively stable pattern of behaviour until there is another major reason for change, has been noted in various contexts. As reported by Parkhurst (1997)[13], *"experiments considering route selection for journeys to work have demonstrated that the number of potential options becomes reduced relatively quickly to a single possibility or subset. Where spatial activity locations are more various, such as with grocery shopping, a period of initial limited, local sourcing is followed by wider exploration then a subsequent stabilising of options (Golledge & Zannaras, 1973)[14]."*

The importance of a stimulus for change has also been highlighted by Cairns, Hass-Klau & Goodwin (1998)[15], *"even within a year, a significant proportion of people change their house or job location, car ownership level, household structure, income and other factors. Each of these changes requires or enables them to change their travel patterns"*. The practical implications of this finding are spelt out by Fergusson *et al* (1999)[16] who argue that *"given the importance of major life events as stimuli for changing behaviour... well designed interventions by appropriate and well-placed actors could improve the likelihood of desirable changes taking place in response to these stimuli"*. In other words, interventions at times when people are making

decisions about how to travel due to other changes in their lives are likely to be most effective, as people are likely to be more receptive to new information.

Linked to the issue of habit, as reviewed by Swanson (1998)[17], work by psychologists such as Thaler (1992)[18] also highlights that people have a '*status quo bias*', where they are likely to defend choices they have already made, and find it harder to 'give things up' than to never possess them in the first place. For example, Kahneman (1993)[19] describes two parallel experiments. In one, subjects were offered a choice between a mug and a sum of money (where the sum of money was varied, and choices were made until the point of indifference was found). In another, they were given the mug and asked what value they would trade it for. The first group valued the mug at $3.50, whilst the second valued it at $7.12.

Moreover, 'status quo bias' is compounded by the phenomenon of cognitive dissonance (as proposed by Festinger, 1957)[20]. This highlights that if changing existing behaviour is problematic (for example, changing from an established pattern of car-use), then new information or arguments may be dismissed or rationalised, to enable attitudes to remain consistent with that behaviour (rather than changing attitudes with a resultant alteration to behaviour).

For all these reasons, students aged 17 and 18 are at a critical transition stage. They have not yet owned their own car or been able to drive. Hence, they have avoided forming car-use habits, which they might then be more likely to defend, and be relatively resistant to changing. They are at a stage when many make decisions about whether to learn to drive, and if so, whether to drive safely, how often to drive, whether to buy a car and what kind of car to buy. Hence, they also have a stimulus to consider changes to their travel behaviour, and may be more receptive to new ideas and information (see Appendix note vi).

(2) Why information about financial costs ?

It is well established that financial cost is only one of many influences on travel choices. As elucidated in the Theory of Planned Behaviour (Ajzen, 1991)[21], many different factors feed into any particular decision – so, for example, the perceived desirability of driving is likely to be affected by individual considerations relating to cost, convenience, entertainment value, peer pressure, habit etc.. Attitudes about each component will be determined by both the individual's knowledge or belief and by the way they evaluate that knowledge or belief. (For the application and extension of this theory in the transport context, see, for example, Stradling *et al* 1996)[22].

The relative importance of such factors in relation to children's choices and opinions of different travel modes is currently limited. There is anecdotal evidence that components vary in importance with time, and that they alter with age and gender. For example, it is reported that cycling is popular amongst children aged 8-13, but subsequently becomes seen as childish, and that boys are more likely to be attracted to the 'sporty' aspects of cycling, whereas girls may be more attractable to the 'sociable' aspects of walking. As discussed earlier, work by Pilling & Turner (1998)[10] has highlighted that cost is rated as one of the more important factors in evaluating transport choices, and that perceptions of cost may also be relatively susceptible to educational influence. Work on bus fare elasticities by Goodwin *et al* 1983[23] has further suggested that younger age groups may be more susceptible to fare changes than other age groups.

Meanwhile, whilst it may not be the primary factor determining decisions, cost is generally recognised as an important influence in transport choices in a number of contexts. For example, Webster & Bly (1980)[24] clarify the links between public transport use and fares; Goodwin & Dargay (2000)[25] quantify the links between pricing, car ownership and car use; and Ortuzar & Willumsen (1994)[26] explain how transport costs are traditionally taken into account in transport modelling. Debates about road pricing, congestion charging, tolls, public transport subsidies, parking charges and taxation are all predicated on the assumption that pricing will, to a greater or lesser extent, affect car use. In some cases, it may even dominate over other motivations. For example, in a recent survey of 1,524 adults by the Japanese motoring organisation JAF, 90% said that they were concerned, or very concerned about environmental issues. However, when asked about attributes that would be important to them, when buying a new car, only 27% listed 'environmentally friendly', compared to 61% who said that it was important that the car was 'economical' (JAF, 2000)[27]. Hence, information about financial costs may be particularly pertinent to future decisions about issues like car ownership.

Hence, it seems reasonable to suggest that transport prices may be one important component in transport decisions taken by all age groups, including young adults. It is also important to consider the role of costs in association with lifestage. As highlighted

previously, 17-18 is the age when many people learn to drive.

Learning to drive has many implications – and many argue that it is seen as a rite of passage, into adulthood (see, for example, Goodwin *et al* 1995[28], Mackay, 1998[29]). Work by Solomon (1998)[30] has highlighted how strong this desire can be, where, in a survey of 75 17-18 year old UK school students, and 92 19-21 UK urban-studies university undergraduates, over 70% of both groups said that they would choose "the right to obtain a driving license" in preference to "the right to vote in an election", if they were allowed to choose only one option.

However, learning to drive, car use and car ownership do not need to be inevitably linked. Thinking about the separate costs involved may be one way of encouraging students to consider learning to drive as a separate issue from buying their own car or choosing to use one, whereas, at present, many may blur the distinctions between the three activities.

In addition, many students may lack the appropriate knowledge to make fully informed decisions. The costs involved in different modes of transport are complex. This is particularly true for cars, where they may involve initial purchase costs, lost interest on savings, loan repayments, vehicle depreciation, vehicle excise duty, repairs, servicing, the fees for compulsory tests of vehicle road-worthiness, motoring organisation membership, insurance, garage costs, petrol and parking – many of which vary according to who you are, where you live, what car you choose and how you use it. At the stage when they learn to drive, many students are likely to be subsidized by their parents (either directly or via use of the family car), and to be unaware of all the different charges involved. Meanwhile, they are subject to a large amount of advertising from the motoring industry, stressing factors such as convenience, speed and image. An educational intervention supplying information about costs may therefore supply an information deficit, resulting in more balanced decision-making.

Thus, in brief, the context of this study is that price is known to be one of many factors influencing travel choice. The hypothesis proposed here is that 17-18 year olds may have imperfect knowledge about transport costs, and that providing them with better information could alter their travel decisions in a socially desirable direction. As such, the study rationale is not that cost is necessarily more important than any other factors. Assessing its relative importance would be a different study. Instead, the intention was to assess the effects of education about costs, on the grounds that it could be influential.

(3) Why a practical maths exercise ?

The form of the intervention was also considered carefully. A practical exercise, that utilised general knowledge and basic mathematical ability was devised. The exercise was deliberately designed to be pragmatic and realistic, and, as far as possible, was tailored to the students' own situation. The exercises deliberately aimed to include information (not simply opinion-based discussion) and to avoid making value judgements on the information. This was because it was assumed that 17-18 year olds might react against any materials that appeared too didactic, whilst they would welcome practical factual information about decisions they might shortly be making. Notably, Petty & Cacioppa (1986)[31], for example, argue that attitude changes are more enduring if they result from 'advocacy', *"as a result of a person's careful and thoughtful consideration of the true merits of the information"*, as opposed to a single cue, such as an exhortation backed by a respected agency.

The mathematical calculations were devised as a way of encouraging assimilation of the information. Work by Verplanken *et al* (1997) [11] has shown that individuals are likely to consider their mode choice for a journey more carefully if they feel they may need to prove that they have processed all relevant information in reaching their decision. Although students were not held accountable for the travel preferences that they expressed in the evaluation questionnaire, they were told that the intervention exercises would be marked, thus giving them an incentive to interact fully with the material.

Given that influencing mode choice is not a universally accepted goal, in designing the intervention, it was also assumed that exercises involving the application of mathematical skills to real world problems, and which involved basic financial planning issues, would be more popular with teachers, who might, consequently, be more willing to use such materials.

The intervention was deliberately designed to be short in duration. Of course, a more lengthy intervention might be more effective. However, the school circumstances affected what could be done. Designing a short intervention also seemed wise given that limited school time is likely to be a general constraint for transport education programmes. Moreover, work in other contexts has shown that

Table 3 Results of the knowledge tests

No.	Subject of question	Students with right answer		p value		Average cost in Yen	
		Experimental	Control	Chi 1	Chi 2	Experiment	Control
14	Overall costs of owning a small car for a year	55% (n=21)	40% (n=16)	0.20	0.18	417,105	513,750
15	Cost of driving into Tokyo and parking once a month for a year	24% (n=9)	35% (n=14)	0.75	0.27	46,842	52,500
16	Financial penalties for speeding	53% (n=20)	35% (n=14)	0.07 +	0.27	34,737	43,250
17	Why young drivers pay more insurance	50% (n=19)	33% (n=13)	0.28	0.12		
18	Cost reductions for compact cars	40% (n=15)	25% (n=10)	0.39	0.17		

NB Chisquare 1 tests for difference considering all the answer options
Chisquare 2 tests for difference considering proportion of correct answers
+ = 90% probability that the result is significant.

relatively short interventions can be effective. For example, work by Ogawa (1999)[32], involving one 90 minute intervention with 10 year olds, demonstrably increased children's understanding and ability to spot traffic hazards.

6. RESULTS

As outlined in Table 2, the evaluation questionnaire consisted of various sections. These are discussed below. A range of statistical evaluation has been carried out on the data (including the Sign test, T-tests, Mann-Whitney U tests and Chi-square analysis – see Appendix note vii). In the tables, p values are quoted, which highlight the probability of there being a significant difference between the experimental group and the control group. Given the small sample, it was not expected that there would be many statistically significant differences between the two groups. Nonetheless, despite the small sample, there were some marked differences between the two groups for some questions, and in the overall pattern of answers.

(1) Effects on knowledge

It was expected that the intervention would have both a direct impact (increasing students knowledge of transport costs) and an indirect impact (making them think about costs in general). The evaluation questionnaire included 5 questions about the knowledge of different transport costs, to assess directly whether the intervention had made any difference to the knowledge of the intervention and the control group. The results are shown in **Table 3**.

For 4 of the 5 questions (about car ownership costs, driving fines, insurance premiums and 660cc car discounts), a higher proportion of students in the intervention group got the right answer. However, according to the Sign test, the occurrence of this response combination is not statistically significant, (p=0.188).

Looking at individual questions, the differences in responses between the two groups were statistically significant for the question about the financial penalties for speeding (where students might perhaps be expected to have least existing knowledge from their family experiences).

However, the experimental group did not display a better knowledge about car running costs, and there was much more variation in the answers from both groups. The 'Chi 1' test demonstrates that there is a 75% chance that the responses of the two groups can be considered to be the same. The high degree of variance in the answers suggests that neither group was well informed on this issue (and that the teaching had had little effect on the knowledge of the intervention group).

In relation to the knowledge tests, perhaps the more surprising result was that, averaged overall, the control group considered that car ownership, car use and driving fines were likely to be more expensive than the intervention group did (although there was also more variability in their answers). This could potentially have a confusing effect on the results – if both groups think that cost is important, and the control group believes those costs to be more expensive, it might be inferred that the control group (instead of the taught group) would be more deterred by cost. This issue is discussed further in section 7.

Table 4 Future mode choice for hypothetical journeys

"Suppose that you get a driving license after you graduate. How would you make the following journeys (from your home)"

No.	Hypothetical journey	Students who chose cars				p values	
		Experimental		Control		Chi 1	Chi 2
4.1	Visit to a friends house about 5km away	42%	(n=16)	55%	(n=22)	0.19	0.26
4.2	Go to a family restaurant about 5 km away	74%	(n=28)	85%	(n=34)	0.48	0.22
4.3	Go snowboarding with a friend in Nagano (about 250km away)	45%	(n=17)	48%	(n=19)	0.97	0.81
4.4	Travel to university in Tokyo every day	3%	(n=1)	5%	(n=2)	0.57	0.59
4.5	Travel to a part-time job at a fast-food restaurant in Kashiwa twice a week	3%	(n=1)	13%	(n=5)	0.44	0.10 +
4.6	Go shopping with friends in Central Tokyo once a month	3%	(n=1)	5%	(n=2)	0.56	0.59

NB Chisquare 1 tests for difference considering all travel options
Chisquare 2 tests for difference considering car versus not car
+ = 90% probability that the result is significant

(2) Effects of expected future mode choice

As well as factual questions relating to transport knowledge, students were asked a range of questions about their opinions of different travel options. In particular, in question 4, they were asked to choose how they might make 6 hypothetical journeys. The results are shown in **Table 4**. For all 6 of the journeys, less of the intervention group thought that they would drive. According to the Sign test, it is highly unlikely that this could have occurred by chance ($p=0.016$). However, looking at individual questions, there was only a statistically significant difference between the two groups for one journey – a journey to the town of Kashiwa, twice a week, for a part-time job in a fast-food restaurant ($p=0.10$).

(3) Opinions about future car ownership, use, safe driving and car choice

In addition to questions on knowledge and particular mode choice, students were asked a total of 30 questions relating to cost and mode choice, where they were asked to indicate agreement or disagreement with statements on a scale of 1 – 11. The full results are shown in **Table 5**.

For the majority of the questions, there were small differences in the average results of the intervention and the control group, and for all but 5 of these questions, the differences were as predicted. Namely, the intervention group:

a) saw cost as more important

b) were less likely to consider car ownership and use as desirable

c) were more likely to drive safely due to higher insurance penalties following an accident

d) were more likely to consider buying an environmentally friendly, 660cc car.

According to the Sign test, the probability that the differences between the two groups' responses would occur in the hypothesized direction *by chance* for at least 25 out of the 30 questions is very small, ($p<0.001$).

To test whether the responses of the two groups were significantly different for individual questions, both T-test and Mann-Whitney U tests were carried out, as shown in **Table 5**. Perhaps partly due to the small sample size, there were significant differences between the average results of the two groups for only 6 questions.

Statistically, on average, the experimental group agreed less strongly with the statements:

- "I want to learn to drive as soon as possible",
- "A car will be a necessity after graduation", and
- "If I was going to buy a car, the image (brand/coolness) would be very important"

They agreed more strongly with the statements:

- "Because of cost, I do not always travel by my favourite method"
- "I would be more likely to drive safely due to the high insurance premiums if I have an accident"
- "If I buy a car, I want to buy a compact car".

(None of the differences were significant for the five questions where the differences between the two groups were in an unexpected direction).

Next, the distribution of results was considered. Notably, for 29 of the 30 opinion statements, there was more variance in the answers of the intervention group than in the answers of the control group. Again,

Table 5 Students' opinions about travel

No	Qu.	Mean average		Standard deviation		p values		
		Experimental	Control	Experimental	Control	T-test	MW-U	Chi
Current importance of transport costs								
1	Cost is important in choosing how I travel now	8.2	7.8	2.4	2.0	0.17	0.11	0.63
2	Because of cost, I do not always travel by my favourite method	8.6	7.9	2.7	2.4	0.11	0.03 *	0.20
Opinions about behaviour after graduation								
3.1	I want to learn to drive as soon as possible	8.6	9.2	3.4	3.0	0.22	0.29	0.73
3.2	I want to buy my own car as soon as possible	6.9	8.2	3.8	3.1	0.06 +	0.06 +	0.51
3.3	I can live without a car	5.5	5.0	3.2	2.9	0.25	0.27	0.71
3.4	A car will be a necessity after graduation	3.6	5.2	2.9	2.6	0.01 *	0.00 *	0.09 +
3.5	Car-rental and taxis could provide good alternative to owning my own car	3.3	3.5	3.0	2.3	0.35	0.11	0.08 +
3.6	Once I start driving, I will use the car most of the time	5.9	6.7	3.2	2.7	0.13	0.18	0.68
3.7	After getting a license, I don't expect to drive much	4.0	4.1	3.0	2.8	0.46	0.41	0.39
Importance of cost for hypothetical journeys								
How important is cost when choosing how to make the following journeys ?								
5.1	Visit to a friends house about 5km away	4.9	4.1	3.7	2.8	0.13	0.25	0.30
5.2	Go to a family restaurant about 5 km away	4.8	4.7	3.6	3.0	0.48	0.35	0.05 *
5.3	Go snowboarding with a friend in Nagano (about 250km away)	8.2	8.1	3.1	3.1	0.41	0.37	0.69
5.4	Travel to university in Tokyo every day	7.6	7.2	2.9	3.0	0.25	0.29	0.68
5.5	Travel to part-time job at a fast-food restaurant in Kashiwa twice a week	5.6	5.1	3.7	3.3	0.23	0.20	0.62
5.6	Go shopping with friends in Central Tokyo once a month	5.7	5.5	3.2	2.9	0.37	0.40	0.19
Perceived expensiveness of cars for hypothetical journeys								
Do you think the cost of using a car (inc. petrol, parking and expresway fees) is expensive compared with other modes for these journeys ?								
6.1	Visit to a friends house about 5km away	5.7	5.6	4.1	3.7	0.45	0.46	0.54
6.2	Go to a family restaurant about 5 km away	5.6	4.9	3.8	3.7	0.22	0.21	0.59
6.3	Go snowboarding with a friend in Nagano (about 250km away)	6.3	6.3	3.5	3.2	0.45	0.47	0.73
6.4	Travel to university in Tokyo every day	7.4	7.3	3.2	2.8	0.45	0.41	0.88
6.5	Travel to a part-time job at a fast-food restaurant in Kashiwa twice a week	6.8	6.8	3.2	3.1	0.49	0.48	0.62
6.6	Go shopping with friends in Central Tokyo once a month	6.8	7.2	3.1	2.9	0.29	0.31	0.89
Deterrent effect of costs associated with car ownership and use								
Do you think twice about the following activities, due to the associated costs								
7.1	Car purchase (due to the costs of the vehicle, tax, insurance and parking)	6.2	6.2	3.3	3.0	0.47	0.47	0.40
7.2	Car use (due to petrol, parking and expressway fees)	5.8	5.2	3.0	2.8	0.18	0.20	0.10 +
Do the following costs make you drive in a way that avoided accidents or breaking the traffic laws								
7.3	Traffic fines	9.2	9.5	2.9	2.1	0.26	0.47	0.26
7.4	Higher insurance premiums after an accident	9.5	9.0	2.4	2.2	0.17	0.08 +	0.63
Car purchase								
If you were going to buy a car, would the following statements apply to you								
8.1	I want to buy a 660cc car	4.5	3.6	3.3	2.7	0.09 +	0.14	0.17
8.2	I want to buy a smallish car	5.4	5.4	3.6	3.2	0.47	0.49	0.65
8.3	I want to buy a big, powerful car	4.7	4.8	3.2	2.8	0.48	0.40	0.72
8.4	The image of the car (like brand/ 'coolness') would be very important	5.8	6.9	3.3	2.8	0.06 +	0.09 +	0.49
8.5	The price and running costs of the car wiould be very important	7.6	7.8	2.8	2.2	0.36	0.45	0.90

NB Students marked answers on an 11-point scale, where 1 = most strongly disagree, to 11 = most strongly agree
MW-U = Mann-Whitney U test for comparing two independent samples
Chi = Chi-square test for comparing two independent samples
+ = 90% probability that the result is significant; * = 95% probability that the result is significant

the probability that the intervention group's responses would show greater variance *by chance* for at least 29 out of the 30 questions is extremely small ($p<0.001$). The difference in variance makes sense if it is assumed that the intervention had more effect on some students than on others (an entirely plausible hypothesis). Hence, for example, the control group's desire to 'own a car as soon as possible' is clustered around a rating of 8.2. For the 'educated' group, the mean has been reduced to 6.9, with some students registering a substantially lower desire, although some continue to give the statement a very high rating.

Chi-squared analysis highlighted statistically significant differences between the distribution of

responses from the two groups in relation to 4 statements.

These statements were:

- "A car will be a necessity after I graduate"
- "Car rental and taxis could provide a good alternative to owning my own car"
- "Cost would be very important when choosing how to travel, with friends, to a family restaurant about 5km away"
- "Car use costs would deter me from driving"

Examination of the results suggests that, for the latter three statements, students have become more polarised in their views, with a higher proportion either agreeing strongly, or disagreeing strongly (rather than recording a relatively neutral opinion).

It is notable that, whilst both groups agreed strongly that traffic fines and higher insurance premiums would be an incentive to drive safely, the experimental group was (significantly) more deterred by the insurance premiums, whilst the control group was (possibly) more deterred by the driving fines. This is consistent with the effects of the knowledge tests – where the experimental group were more aware that younger drivers pay more insurance because they have more accidents, whilst the control group believed that traffic fines are higher than they actually are.

7. DISCUSSION, CONCLUSIONS AND FUTURE WORK

The results of this work are promising. On the basis of two short interventions, the work suggests that the attractiveness of car ownership and use can be reduced, and students may be encouraged to drive more safely and to consider buying more environmentally friendly vehicles (assuming that such vehicles are cheaper). Given the small sample size, and the higher proportion of girls in the control group, it was particularly encouraging to have achieved some statistically significant differences between the two groups, although further investigation is necessary to validate these findings.

It is notable that, in the knowledge assessment, the control group was inclined to assess car ownership and use as more expensive than the intervention group. Since both groups considered costs to be very important in their decision making, the results might therefore have been expected to be reversed. The fact that the intervention group was more deterred by cost, even though they perceived those costs as cheaper, suggests that stimulating students to think about the different costs involved in different transport options (ie. the indirect effect) rather than increasing their knowledge (the direct effect) may be the most important part of the educational intervention.

Interestingly, this type of paradoxical result has been observed in other research. Notably, Anderson *et al* (1998)[33] undertook two parallel surveys with adults, asking about their opinions of different transport policy measures. One involved a standard 'tick-box' type survey (PQ), whilst the other aimed to be a far more interactive exercise (GJG), encouraging the participants to consider various reasons for implementing certain policy measures as well as asking about their opinions. In subsequent evaluation, the group subjected to the interactive questionnaire expressed more positive attitudes towards different transport policy measures, but less willingness to change their own behaviour. Anderson *et al* explain this on the basis that *"It is possible to argue that the experience of working through the GJG made respondents more thoughtful in their replies... which may reflect a more realistic response than the arguably more 'tick happy' PQs"*. Hence, the effects of an intervention may be as much determined by stimulating consideration of an issue as by increasing knowledge about it. To fully test this hypothesis, it would be useful to carry out the experiment with three groups, providing one group with detailed information about costs, encouraging a second group to discuss the issue in general, and to have a control group which does not receive any teaching prior to evaluation.

As well as needing to investigate the results with a larger sample, it is also important to recognise that current opinions about future behaviour cannot necessarily be taken as a good proxy for actual future behaviour. This is partly because of the many other factors that can affect decision making. For example, work by Parkhurst (1997)[13] demonstrated that many people's stated intentions to use a new light rail system introduced in the UK city of Sheffield proved inaccurate in terms of their subsequent behaviour. In analysis, he concluded that this was not because of irrationality, but because it is never possible for people to receive and consider all relevant information in advance of actual decisions that arise, and because their personal circumstances, and the general travel environment, will always be changing, resulting in new criteria for how they choose to travel. In relation to car ownership, a new trend in the UK seems to be that grandparents who now consider that they themselves are 'too old to drive' choose to give their vehicles to their grandchildren as presents. Such

trends may significantly affect patterns of future car ownership.

However, achieving any change in the transport decision making of young adults is inevitably going to depend on a wide range of factors (ranging, for example, from attractive public transport fare structures to the availability of parking at university campuses). Educational interventions can presumably form a useful part of any package that aims to affect such decision making, and the analysis work carried out here suggests that the intervention developed in this study may have desirable effects.

In the future, the aim of this project is to undertake further trials, both in the UK and Japan to establish whether the results from the first phase of the work are replicated with a larger group. Future work will also draw on the lessons drawn from this phase of the research. If further work suggests that this type of educational intervention does achieve desirable changes in attitudes, providing such materials as a widely available educational resource will be investigated.

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APPENDIX

i. Japan and the UK have been chosen for the work, because of the nationalities of the researchers, and the sources of funding for the study. In addition, the two countries have interesting contrasting financial structures for transport. However, the international differences are not the focus of this paper, and will be explored further in later work.

ii. The term 'financial cost' is used here to mean the monetary costs incurred by an individual in a particular mode choice. As such, it excludes the financial implications of an individual's mode choice for society.

iii. The website for the UK Department for Transport provides a useful starting point:
http://www.local-transport.dft.gov.uk/schooltravel/index.htm

iv. http://www.databases.dft.gov.uk/schools

v. Details are available via:
http://www.safetroutestoschools.org.uk

vi. Of course, there are also good arguments for interventions at other ages, and much work in the UK is currently trying to influence children at a younger stage, on the basis that becoming a car passenger at an early age is an important factor encouraging driving when older. Work by Mackett *et al* (2000) will assess this theory[34].

vii. For the opinion statements where students were asked to range their views on a scale of 1-11, both T-test and Mann-Whitney U tests were undertaken. The Mann-Whitney U test is a non-parametric method of assessing whether two independent samples are significantly different, and it does not rely on the assumption of normally distributed data. The T-test values have been included for comparison, because the assumption of normalcy cannot be ruled out. The Sign test is a non-parametric test which can be used to assess the probability that the differences between a number of paired observations could have occurred in a consistent direction by chance.

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