

Use of video technology and GPS as a tool for driver education – a preliminary investigation with older drivers

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Abstract

Driver education programs have traditionally taken two general forms: in-classroom or in-vehicle. This study explores a variation on traditional in-vehicle driver education programs by using video technology instead of a driver educator in the passenger seat. A program of this type would be appropriate for currently licensed drivers. Advantages of using video technology include: the possibility of driver behaviour more like their everyday driving, increased safety for the driver educator, and more effective instruction.

In this study, 8 subjects aged 70 and older drove a 26 km road course in Winnipeg, Manitoba, Canada while their driving was recorded. The course included all road types including residential, collector, arterial and expressway. Subjects were shown the video and global positioning system (GPS) speed data some time after performing the drive. Subjects watched the video first without feedback, and then with feedback and instruction from a driver educator. Common feedback from the driver educator included instruction on changing lanes, signaling, and stopping at stop signs.

Subjects were given three questionnaires at various stages to evaluate the perceived effectiveness of the program. Subjects all agreed that the program was useful to them and all but one self reported using the lessons from the driver educator in their everyday driving 2 to 4 weeks after the video session. The subjects found watching the video

with the driver educator feedback more useful than watching the video without feedback.

Using in-vehicle video technology is a new opportunity for driver education programs and is an alternative to in-classroom programs for those looking to update their driving skills.

Résumé

Les cours de formation à la conduite automobile ont toujours été offerts en deux volets, un en salle de classe et l'autre à bord d'un véhicule. Cette étude permet d'explorer une variante des cours de formation conventionnels donnés à bord d'un véhicule, à savoir l'utilisation d'une vidéo au lieu d'un moniteur de conduite automobile assis sur le siège du passager. Un cours de ce genre conviendrait aux conducteurs qui ont déjà leur permis de conduire. Les avantages d'utiliser la vidéo sont notamment la possibilité pour le conducteur de se comporter comme dans sa conduite de tous les jours, une sécurité accrue pour le moniteur et des directives plus efficaces.

Dans cette étude, 8 sujets âgés de 70 ans et plus ont participé à une course automobile de 26 km à Winnipeg (Manitoba) au Canada, alors qu'on enregistrerait leur conduite. La course comprenait tous les types de routes, notamment résidentielles, collectrices, à grande circulation et express. Quelque temps après leur performance, on a montré aux sujets la vidéo ainsi que les données du système GPS relatives à la vitesse. Les sujets ont d'abord visualisé la vidéo sans commentaires, puis ensuite avec les commentaires et les instructions du moniteur de conduite automobile. Les observations du moniteur portaient particulièrement sur le changement de voie, la signalisation et l'arrêt aux panneaux d'arrêt.

On a remis aux sujets, à divers stades, trois questionnaires visant à évaluer l'efficacité du cours. Les sujets ont tous conclu que le cours leur avait été utile, et tous, sauf un, ont affirmé avoir mis en

pratiquer les leçons du moniteur dans leur conduite de tous les jours 2 à 4 semaines après la séance de visionnement. Les sujets ont trouvé qu'il était plus utile de regarder la vidéo avec les commentaires du moniteur que sans.

L'usage de la vidéo à bord du véhicule est une nouvelle possibilité qui s'offre aux cours de formation à la conduite automobile ainsi qu'une solution de rechange aux cours en salle de classe pour ceux désirant mettre à jour leurs habiletés de conduite.

Introduction

Traffic collisions continue to be a significant cause of death and injury. In 2001 alone, traffic collisions resulted in almost 3000 deaths and 17 000 injuries in Canada.¹ On an annual basis, the cost of those crashes to the Canadian health care system is approximately \$10 billion or about 1% of gross domestic product.² Although older drivers do not overly contribute to the absolute numbers of traffic crashes, those over 65 years of age have disproportionately high fatality rates – those over 65 represented 12.7% of the population but accounted for about 17% of traffic fatalities in 2001.³ Moreover, there will be exponentially more older drivers on the roads in the near future, as this is the fastest growing segment of our population.³

Older drivers are at an increased risk of motor vehicle crashes and fatalities when exposure (distance driven) is considered.⁴ On a per kilometer basis, older drivers and their counterparts aged 16-24 years old have the same number of collisions; however older drivers are more likely to be injured or die.³ Aging and its associated diseases may impair driving in several ways including: vision/perception factors, cognitive factors and psychomotor skill factors.⁵ Difficulties with these factors may lead to a cessation of driving, which potentially leads to isolation, decreased social interaction, and lack of access to services. This is especially true in rural areas of Canada, where

viable transportation alternatives are not available. Until such alternatives are provided, both in urban and rural areas, strategies must be found to assist older drivers to continue to drive safely to prevent injuries and fatalities to themselves and to other road users.

Driver education programs have been specifically designed for older adults. These programs can either assist participants in overcoming the problems or deficiencies that they face, or assist them in identifying problems and learning how to compensate for those difficulties.⁶ Often these programs for mature drivers, such as the 55 Alive program run through the Canada Safety Council, are classroom-only and do not contain an in-vehicle component that would provide direct feedback based on the way in which they are actually driving. If they do have an in-vehicle component, it is with a Driver Educator in the passenger seat. This study was designed as a pilot to explore the possibility of using in-car video and global positioning system (GPS) technology as a driving education tool.

Older drivers were shown a video of themselves driving an approximately 26km road course. They watched the video in two phases: first by themselves and then with a driver educator who discussed their errors and gave them feedback. This pilot study exploring the technology was designed to: 1) determine the logistical aspects of using in-vehicle video technology with GPS; and 2) to examine the response of subjects to the use of this method.

Methods

Background

All the subjects in this exploration had participated in an earlier study according to the methods of Porter and Whitton (2002)⁷. Subjects drove an approximately 26km road course while their driving was recorded using a digital video camera positioned in the passenger seat, and a GPS unit

recorded position and speed. Subjects were evaluated by an independent observer based on the Manitoba Vehicle and Driver Licensing Class 5 road test examination form. Demerit points were assigned based on the infractions seen on the video and speed infractions based on the GPS data. Participants were informed of their results including what infractions they committed (but not how many and where) and their demerit total. The participants in this study therefore were aware of the general results of the evaluation by the observer but did not know the specifics.

Subject Selection

Subjects were recruited from those that had participated in an earlier study on neuromuscular factors related to older drivers using GPS and in-vehicle video. The present study focused on older driver education, and subjects were drawn from those aged 70 years and older (n=8).

Subjects did not drive the course again and the video already obtained was used. The time between the filming of the video and watching it by each subject was approximately 15 to 17 months.

Driving Protocol

The video was recorded using a Canon Optura digital video camera (Canon Inc. Tokyo, Japan) mounted on a specialized vehicle tripod (Gruppo Manfrotto, Bassano del Grappa, Italy) attached to the passenger side window. The camera was positioned about where a passenger's head would be. The camera was able to see the road ahead, including vehicles and signs in front of the vehicle, but was not able to observe the subject. The record for each subject was stored on a DVD. The position and speed data were collected using a GeoExplorer II GPS receiver with a Trimble Range Pole antenna (both Trimble, Sunnyvale, CA). Position (on the course) and speed data were used to determine if a subject was speeding (exceeding the posted limit by more than 4 km/hr).

Subjects were given written instructions regarding the route they would be driving. The assigned course was a 26km road course in the southern portion of Winnipeg, Manitoba, Canada and involved all road types including residential, collector, arterial and expressway.

Video Feedback Session

Each subject first watched the video with no input from the driver educator. Subjects were given a work sheet to record infractions/errors that they observed. The Driver Educator was not allowed to control the video during this first viewing. Subjects rarely wrote on the worksheets provided; they simply watched the video.

The second viewing of the video allowed the Driver Educator to control the video in order to stop, re-watch certain sections, fast forward others, and go through the errors the subject made on the course. The Driver Educator used this ability often, and would proceed through the instruction either by topic (showing repetition of the same type of error) or chronologically (showing differing types of errors in the order which they occurred along the course). The Driver Educator would explain the relevant rule of the road, or generally give tips regarding the subject's driving. The use of DVD made it easy to view errors at different time points on the recording. The speed related infractions were shown to the subject using a graph of the velocities over the whole course. Where applicable the circumstances would also be shown on the DVD.

Feedback from the Driver Educator was for the most part dependent on the errors committed by a subject. However, the Driver Educator would sometimes give instruction on a common mistake not necessarily committed by that subject, or review the rule of the road in a particular situation (such as at a railway crossing). Nearly all subjects were given instruction on changing lanes, signaling and stopping at stop signs.

Questionnaires

To explore the effectiveness of the program, three questionnaires were given to the subjects and one to the driver educator. The subjects completed the first questionnaire after the first viewing of the video. After the second viewing, the subject completed the second questionnaire and the driver educator completed the Driver Educator questionnaire. The third questionnaire was given to the subject on the day they watched the video and they were instructed to complete it 2 to 4 weeks post watching the video. All subjects completed the third questionnaire in the correct time period and returned it via the post. The texts of the questionnaires are included as appendices.

The subjects' questionnaires had three general sections in common. The first section asked subjects to agree or disagree with value statements about watching the video. The second section had subjects self identify the types of difficulties they had and where the Driver Educator gave them suggestions. The third section asked more targeted questions (with open ended follow ups) to see if there was a systematic feeling about their interaction with the roadway and if any particular elements were causing problems. The questionnaire post watching the video with the Driver Educator had an additional section evaluating the perception of the whole program. The mail in questionnaire did not ask any targeted questions about interaction with the roadway, but did ask about the incorporation of the driver educator's suggestions into their normal driving.

The questionnaire for the Driver Educator was designed to elicit feedback on the logistics of the program, as well as the perception of the program in the eyes of the Driver Educator. The first section paralleled the first two subject questionnaires and asked value statements about watching the video. The rest of the questionnaire focused on the workings of the program to see if the Driver Educator would have preferred a different structure.

Results

Perception of Value

Although subjects did not record many errors on the worksheet they had been given, they generally felt that watching the video on their own had been useful in helping them learn something and that their driving will change for the better (See Table 1). Fifty to 87.5% agreed with questions 1-5 and no subjects answered 'disagree' to any of the questions. After watching the video with the Driver Educator, more felt that it had been useful in helping them learn something and that their driving will change (See Table 1). There was 75% - 100% agreement with questions 1-5 and no subjects answered 'disagree' to any of the questions. Some that were neutral to the effectiveness of watching the video shifted to agreeing with the statements after watching the video with the Driver Educator.

Table 1: Frequency of responses to questions 1-5 of the first and second subject questionnaires

	Post watching video by self			Post watching video with Driver Educator		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
I learnt something about my driving	6	2	0	7	1	0
I will be a safer driver	5	3	0	7	1	0
Watching the video will help me with my driving in the future	4	4	0	6	2	0
My driving will change because of the video	4	4	0	6	2	0
I found the process useful	7	1	0	8	0	0

After 2 to 4 weeks had passed, the subjects seemed to become less definite in believing the program had made them a safer driver. Table 2 shows the results of the questions on being a safer driver for both the mail in questionnaire and the questionnaire post watching the video with the driver educator. However, since the question on the mail-in

questionnaire asked for a scaled judgment (A lot/some/none) as opposed to a normative judgment (agree/disagree or yes/no), the total who believed they did become safer in some fashion (7 including both 'A lot' and 'Some') is not changed from the total who believed they will become a safer driver both post watching the video (7) and after the entire program (7).

Table 2: Frequency of responses for the questions regarding being a safer driver on second and third subject questionnaires

	Post watching video with Driver Educator		
	Agree	Neutral	Disagree
Compared to yesterday, I believe I will be a safer driver	7	1	0
	Post watching video with Driver Educator (Section regarding whole program)		
	Yes	Maybe	No
I will be a safer driver because of what I learned today	7	1	0
	Post 2 to 4 Weeks		
	A lot	Some	None
I have become a safer driver since the day I watched the video	3	4	1

A significant portion of driver education is updating participant knowledge of the 'Rules of the Road'. This is especially true with older drivers, as they have had many years to develop habits that may conflict with proper driving practice. All the participants unanimously agreed that their understanding of the 'Rules of the Road' had increased because of the instruction of the Driver Educator (See Table 3). An increase in understanding does not necessarily precipitate a change in behaviour, but all but one subject reported they were more conscious of the 'Rules of the Road' in their everyday driving after the video session, and 62.5% of subjects reported that they were 'A lot' more conscious. All but one subject reported that they were more attentive to their driving after the video session, and 75% of subjects reported that they were 'A lot' more attentive. It was the same subject who answered that they were not more conscious of the 'Rules of the Road' in their everyday driving and not more attentive of their driving. In general, all subjects left the video

session with a better understanding of the 'Rules of the Road', were more conscious of them, and were more attentive to their driving.

Table 3: Frequency of responses for the questions regarding Rules of the Road on second and third subject questionnaires

	Post watching video with Driver Educator		
	Agree	Neutral	Disagree
My understanding of the 'Rules of the Road' has increased	8	0	0
	Post 2 to 4 Weeks		
	A lot	Some	None
I am more conscious of the 'Rules of the Road' since watching the video	5	3	1
I have become more attentive about my driving since watching the video	6	1	1

Incorporating Suggestions

After watching the video with the Driver Educator, all subjects said they would try to incorporate some of the suggestions from the Driver Educator and the lessons that they learned in their future everyday driving (See Table 4). After 2 to 4 weeks had passed, subjects were asked to self identify if they use the lessons they had learned in their everyday driving and if they use specific suggestions from the Driver Educator. All but one of the subjects identified that they used the lessons in some fashion, and 75% identified that they used the lessons learned 'Most of the time'. Only one subject did not use at least one of the suggestions from the Driver Educator. The same subject who did not use the lessons learned or any of the suggestions given by the Driver Educator did not believe they had become a safer driver because of watching the video and was not more conscious of the 'Rules of the Road'.

Table 4: Frequency of responses for the questions regarding incorporating lessons learned on second and third subject questionnaires

	Post watching video with Driver Educator		
	Yes	Maybe	No
I am going to try to use some of the lessons that I learned today in my future driving	8	0	0
	Post 2 to 4 Weeks		
	Most of the time	Occasionally	Not at all
I use the lessons learned from watching the video of me driving in my everyday driving.	6	1	1

For the most part, subjects incorporated the suggestions of the driver educator into their everyday driving. Subjects self reported that nearly 90% of the suggestions given by the driver educator were used ‘Most of the time’ (See Table 5). Only two of the subjects used at least one of the suggestions ‘not at all’, and one subject self reported that they did not use any of the suggestions from the driver educator. Besides this one case, the subjects seemed to want to use the suggestions given and the lessons learned, and for the most part self reported that they were successful in doing so.

Table 5: Frequency of incorporating suggestions into everyday driving on third subject questionnaire

	Most of the Time	Occasionally	Not at All	No suggestions given
I incorporate the specific suggestions that the driver educator had to do with:				
Signaling	7	0	0	1
Stopping at stop signs	5	2	1	0
Stopping at traffic lights	5	1	1	1
Changing lanes	6	0	1	1
Railway crossing	5	0	1	2
Speeding	5	1	0	2
Turning in general	5	0	0	3
Turning left with no green arrow	5	0	0	3
Driving in correct lane	7	0	0	1
Total	50	4	4	14

Roadway interactions

Subjects were asked to identify changes in perception of interaction due to driver education, as well as identify if there were particular interactions that they thought created difficulty.

For the most part, subjects reported that the street signs and traffic signals were easy to see and easy to understand (See Table 6). However, before watching the video with the driver educator, subjects reported that they had difficulty with seeing or understanding the street signs. Nearly 38% reported that street signs were only ‘occasionally’ easy to see, and 25% reported that street signs were only ‘occasionally’ easy to understand. All other subjects reported that street signs were easy to see or understand ‘most of the time’. Three subjects identified the same stop sign as being covered by trees and thus difficult to see. After watching the video with the driver educator, only one individual reported that they had difficulty seeing or understanding the street signs. The Driver Educator seemed to have a positive impact on the subjects’ ability to see and understand street signs, but had no impact regarding traffic lights as subjects did not report they had any difficulty to begin with.

Table 6: Frequency of responses on questions regarding ease of being able to see and understand street signs and traffic signals

	Post watching video by self			Post watching video with Driver Educator		
	Most of the time	Occasionally	Not at all	Most of the time	Occasionally	Not at all
I found the street signs easy to see	5	3	0	7	1	0
I found the street signs easy to understand	6	2	0	7	1	0
I found the traffic signals easy to see	8	0	0	8	0	0
I found the traffic signals easy to understand	8	0	0	8	0	0

The subjects also tended to report a greater amount of difficulty with pedestrians and cyclists after

watching the video with the Driver Educator. Only one individual reported ‘occasionally’ having difficulty with pedestrians and cyclists before watching the video with the Driver Educator, while after watching the video with the Driver Educator 25% of subjects reported ‘occasionally’ having difficulty with pedestrians and 38% of subjects reported ‘occasionally’ having difficulty with cyclists (See Table 7).

Table 7: Frequency of responses on questions regarding difficulty with pedestrians and cyclists

	Post watching video by self			Post watching video with Driver Educator		
	Most of the time	Occasionally	Not at all	Most of the time	Occasionally	Not at all
I had difficulty with pedestrians	0	1	7	0	2	6
I had difficulty with cyclists	0	1	7	0	3	5

The remainder of the questions regarding roadway interaction did not show any notable differences between the first and second questionnaires and thus watching the video with the Driver Educator did not cause a large change in the subjects’ reported perception. However, some of the interactions themselves are of note to traffic safety professionals as they indicate how older drivers may perceive the roadway they are driving on (See Table 8).

First off, 38% of subjects occasionally felt confused by which lane to drive on and 50% felt confused by some elements of the road design. Lack of painted lines was mentioned several times as contributing to the confusion in the follow up questions to the above, and over 60% had trouble seeing the lane markings. Also, at least 50% of subjects felt their line of sight was occasionally blocked. Clearly, a significant portion of subjects felt confused or that the roadway hindered them in their driving.

Table 8: Frequency of responses to questions about roadway interaction

	Post watching video by self			Post watching video with Driver Educator		
	Most of the time	Occasionally	Not at all	Most of the time	Occasionally	Not at all
I felt confused by which lane to drive on	0	3	5	0	3	5
I was confused by some elements of road design	0	4	4	1	3	4
I had trouble seeing the lane markings	0	4	4	1	4	3
My line of sight was blocked	0	6	2	0	4	4
I was able to properly negotiate curves at my operating speed	8	0	0	7	1	0
I was able to properly turn at intersections	7	1	0	6	2	0

Overall impressions from the participants

Overall, the participants rated the program highly. They perceived it as having improved their driving skills, aided in their understanding and consciousness of the rules of the road, and incorporated most of the suggestions of the Driver Educator. As a measure of the perceived overall value of the program, 75% of subjects would recommend the program to their friends, while the remaining 25% would maybe do so. One participant even commented “I really enjoyed the whole program - would do it again”!

In terms of the actual workings of the program, all but one of the subjects found watching the video with the Driver Educator more useful than watching the video alone. As a driver education program, the use of video allowed for subjects to be shown their errors and how to correct them. As one subject put it, “[t]his was the most effective driver education. It takes the "fantasy" out of our perceptions about our driving practices and our capabilities and abilities!”

Program Logistics

The program had both subjects and the Driver Educator watch the video for the first time together. The Driver Educator did not give feedback during the first viewing, and instead was able to observe the errors that the subjects caught themselves. During the second viewing the Driver Educator gave feedback. The process took about 2 hours, sometimes more for those that wrote extensively on the questionnaires. For the education component only, excluding the questionnaires, it would likely take a maximum of 90 minutes.

In terms of the operation of the program, the Driver Educator felt that more time per subject and more preparation would be desirable. The Driver Educator did not feel prepared enough for about half of the subjects, and wanted more time with each subject in about half of the cases. How much more time was never specified by the Driver Educator as it was subject dependent. The Driver Educator did express a strong preference for watching the video for the first time without the participant there, and a strong preference for being able to rewind and re-watch the video that first time. However, the Driver Educator also preferred to have participants go through the video before giving any feedback, so the Driver Educator could observe the errors that the subjects caught themselves. It appears that the Driver Educator's preferred process would be as follows:

- 1) Driver Educator watches the video sometime before the video session with the subject.
- 2) Driver Educator and subject watch the video together, but the Driver Educator gives no feedback.
- 3) Driver Educator goes through the video with the subject and gives feedback.

The Driver Educator also expressed a desire for the course to challenge the participants more. If the course does not have any unusual intersections, or otherwise does not test the abilities of the

participants, it is difficult for the driver educator to show the participant any errors and give instruction. In particular, the Driver Educator noted that more left turns at lights would be useful.

Overall, however, the program logistically worked well, despite some small suggestions for changing the process. Caution must be given to any suggestions however, as the feedback in the process is based on the opinion of only one Driver Educator. Both the Driver Educator and the participants found watching the video useful, and recommended that more people go through this type of program.

Discussion

Advantages of video

Driving education programs have traditionally taken two general forms: in-classroom or in-car. The first allows for detailed explanations and video demonstrations of situations, but is not customized to a person's actual driving ability. In-car driver education programs allow for customized instruction, but it may be difficult to enact lessons as situations cannot be reviewed. This study explored a modification of the second method by using in-car video.

Having an in-car Driver Educator may possibly change the participant's driving behaviour, likely causing them to drive more cautiously than they would normally. A video camera has much less presence in the vehicle and may result in less change in driver behaviour than a person in the passenger seat recording errors or giving continuous/periodic feedback. Use of the video camera may thus allow the Driver Educator to observe driving closer to 'everyday' driving when educating the participants. The difference in driver behaviour with a driver educator vs. a video camera and how both compare to everyday driving behaviour has not yet been evaluated in the available literature.

One difficulty faced by an in-car driver educator is that they are unable to replay a situation for a participant to explain or demonstrate how a maneuver should have been properly executed. The lesson is dependent on the driver educator's ability to communicate a visualization to the participant so they can understand it, and on the ability of both to remember the situation if the lesson is performed at the end of the drive. Having a video record also ensures believability, as a participant may refuse to believe that they committed a certain infraction. Allowing the Driver Educator to review a video of the situation with the participant removes the ability of a participant to reject that a particular situation happened and gives the driver educator the chance to explain with a clear visual aid.

The implication of someone undergoing a driver education program is that their driving needs improving. A Driver Educator who is in the passenger seat with someone who needs improvement in their driving at the wheel is at an increased risk. By replacing the Driver Educator with a video camera, the Driver Educator can perform the education program without getting in the vehicle, reducing the risk the Driver Educator would otherwise face on a daily basis.

On the other hand, if the Driver Educator is in the vehicle and corrective action needs to be taken, the Driver Educator can take control of the vehicle. If the course is designed to be challenging or otherwise exceeds the ability of the participant, the participant may be at an increased risk if a video camera is used instead of an in-car driver educator.

In-car feedback also precludes the participant being able to notice their own errors. Their attention cannot be focused on self evaluation and looking for errors, and must instead be (at least partially) on driving. By separating the two functions, the Driver Educator can allow the participant to 'self discover' their own errors, and also use it to see where the participant is at in their understanding.

As well, in-car feedback must take place during the actual drive. A video based education program could either occur immediately following the drive or it could occur after some time has passed after the drive. The time between the filming of the video and watching of the video by subjects in this study was very long, as the initial study was not conducted for this purpose. Obviously, a shorter timeframe would be desired. However, having some time pass between the driving portion and the education portion would allow for some 'reflection' on the part of the participant.

Unlike the classroom driver education programs, the in-vehicle video program involves education on a participant's actual driving performance, and customized instruction based on the errors they commit and the personal difficulties that they face.

Limitations of the study

The study was not intended to make a conclusion about if in-vehicle video was an effective driver education program or tool. All surveys asked for the subject's self evaluation of the program, and no independent verification was performed of that evaluation. For example, all three surveys asked the subject if they felt they had become a safer driver because of the program, and asked for an Agree/Neutral/Disagree response. A self evaluation of 'Agree' does not necessarily mean that the subject has actually become a safer driver, but does mean that the subject has a perception that the program did help them in that end. In this way, the evaluation concentrated on the participants' belief it was beneficial. Further study would be required to determine if the program increased driver safety.

Improved driver safety is usually measured by a decrease in vehicle collision rate, usually by exposure. A study to evaluate effectiveness at reducing vehicle collision rate would need to follow methods similar to that of Owsley, McGwin, Phillips et al.⁸, including two groups (one that undergoes the education program and one control group that does not) with enough subjects to

determine if the education program statistically reduces the collision rate. Owsley et al.⁸ evaluated the effectiveness of the educational curriculum KEYS (Knowledge Enhances Your Safety), a classroom based program focusing on strategies that visually impaired drivers can use to avoid situations they find challenging. Owsley et al.⁸ found that the KEYS program did not reduce the rate of police reported collisions, and went on to assert that “there is no empiric support that educational programs enhance older driver safety (ie. reduce crash rates) despite their widespread popularity.” However, Owsley et al.⁸ noted that older drivers that underwent the KEYS program had greater use of strategies to reduce their exposure to challenging driving situations as compared to the control group. While the use may not have been enough to achieve a statistical reduction in crash rates, the program was successful in its goal of having at-risk older drivers employ self-regulation techniques to reduce their exposure. Owsley et al.⁸ stated in introducing their report that “[it] is premature to abandon the idea that educational interventions are effective in enhancing older driver safety.” Indeed, safety measured in other ways may be improved by such educational programs, but it is not apparent in the metric used to evaluate the programs. The actual benefit or effectiveness of different programs could be compared using another non-perceptive measure, such as the number of infractions.

The videos used in the study were not intended to be used as an education tool originally, and the route was repetitive in certain actions and avoided difficult situations. The Driver Educator expressed a desire for a more challenging route, but caution must be given to doing so as that may unduly increase the risk to the driver. The course used in this study was standardized for suburban driving. If a subject deliberately avoids driving in certain situations, such as on one-way streets or on expressways, there may be no need to have the subject drive those roads and give instruction for them. The course could be individually customized to the normal driving experience of the subject, so the instruction would assist them with their

everyday driving in an area familiar to the subjects, such as near their home.

The fact that subjects were not recruited into the original study to be educated on their driving may explain why one driver did not use the lessons from the instruction. Research on behaviour change suggests that there are different stages in the readiness to change.⁹ These stages are: Precontemplation, Contemplation, Preparation, Action, Maintenance and Termination. Although it was not specifically assessed, from observation, this individual was likely in the precontemplation stage, and did not think there was any need for their driving to change. This is important for educators to consider. Drivers who are mandated to receive education might be reluctant to change their driving behaviours. In a typical study examining driver education programs, the subjects would likely be in the contemplation or preparation stage and would attempt to change their behaviours. The use of video and GPS may possibly assist in moving individuals from the precontemplation stage to the contemplation stage if the educator can use the tools to convince the driver that they are deficient in their driving skill.

Conclusions

In-vehicle video and GPS present an opportunity for older driver education. All of the participants felt they gained from the program and that it was effective in helping them with their driving. Almost all participants retained or used the lessons from watching the video of their driving. The important questions to answer should be: 1) if more participants follow through, retain or use the lessons they learned through an in-vehicle video driver education program than through other programs; 2) do those that do retain or use the lessons learn more through in-vehicle video; and 3) do those lessons actually increase the driver safety of the participants. Given the overall impressions of the subjects in this study, it seems that subjects felt that this style of program was an effective driving

education program. This style of program could be the choice for those that have self assessed that they need to improve their driving and need customized instruction to deal with their personal difficulties. In-vehicle video and GPS could also be useful for assisting those drivers that have not yet identified that they have difficulties with driving in coming to that realization. This is a necessary step to improving the driving skills of older drivers and the safety of our roadways.

This was only designed as a pilot study and definitive conclusions cannot be made about the above questions. Further study is needed to compare the actual effectiveness of the various styles of mature driver education, such as classroom-based, in-vehicle with a driver educator and in-vehicle video with GPS.

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Appendices

First subject questionnaire
"Post watching video by self"

1 Compared to yesterday, I learnt something about my driving while watching the video (Agree/Neutral/Disagree)

2 Compared to yesterday, I believe I will be a safer driver because of what I learned while watching the video (Agree/Neutral/Disagree)

3 Compared to yesterday, I believe the video will help me with my driving in the future (Agree/Neutral/Disagree)

4 Compared to yesterday, I believe my driving will change because of watching the video (Agree/Neutral/Disagree)

5 I found the process of watching the video useful (Agree/Neutral/Disagree)

6a I was surprised at some of the errors I noticed (Agree/Neutral/Disagree)

6b If so, which errors? (text box)

7 From watching the video, I seemed to have difficulty with the following on the course: (Most of the time/Occasionally/Not at all)

Signaling

Stopping at Stop Signs

Stopping at Traffic Signals

Changing lanes

Railway Crossings

Speeding

Turning in General

Turning left where there is no green arrow

Driving in the correct lane

Other _____

8 From watching the video, I seemed to have difficulty with the following: (Most of the time/Occasionally/Not at all)

Intersections with Traffic Signals

Intersections with Stop Signs

Residential Streets

Medium Streets

Major Roads

Expressways

9a I found the street signs easy to see on the course (Most of the time/Occasionally/Not at all)

9b If not, which ones were difficult? (text box)

10a I found the street signs easy to understand on the course (Most of the time/Occasionally/Not at all)

10b If not, which ones were difficult? (text box)

11a I found the traffic signals easy to see on the course (Most of the time/Occasionally/Not at all)

11b If not, which ones were difficult? (text box)

12a I found the traffic signals easy to understand on the course (Most of the time/Occasionally/Not at all)

12b If not, which ones were difficult? (text box)

13a I felt confused regarding which lane to drive on (Most of the time/Occasionally/Not at all)

13b If so, what caused the confusion? (text box)

14 I had trouble seeing the lane markings (Most of the time/Occasionally/Not at all)

15a At certain locations, I felt my line of sight was blocked by fixed objects (Most of the time/Occasionally/Not at all)

15b If so, where? (text box)

16a I was able to properly negotiate curves at my operating speed (Most of the time/Occasionally/Not at all)

16b If not, which locations were problematic? (text box)

17a I was able to properly turn at intersections (Most of the time/Occasionally/Not at all)

17b If not, where did you have trouble? (text box)

18a I was confused by some elements of the design of the road at certain locations (Most of the time/Occasionally/Not at all)

18b If so, what elements and where? (text box)

19 I seemed to have trouble with pedestrians on the road (Most of the time/Occasionally/Not at all)

20 I seemed to have trouble with cyclists on the road (Most of the time/Occasionally/Not at all)

Second subject questionnaire

“Post watching video with Driver Educator”

1 Compared to yesterday, I learnt something about my driving while watching the video with the Driver Educator (Agree/Neutral/Disagree)

2 Compared to yesterday, I believe I will be a safer driver because of what I learned while watching the video with the Driver Educator (Agree/Neutral/Disagree)

3 Compared to yesterday, I believe watching the video with the Driver Educator will help me with my driving in the future (Agree/Neutral/Disagree)

4 Compared to yesterday, I believe my driving will change because of watching the video with the Driver Educator (Agree/Neutral/Disagree)

5 I found the process of watching the video with the Driver Educator useful (Agree/Neutral/Disagree)

6 The Driver Educator gave me suggestions to do with: (Check all that apply)

Signaling

Stopping at Stop Signs

Stopping at Traffic Signals

Changing Lanes

Railway Crossing

Speeding

Turning in General

Turning left at Traffic Signals with no green arrow

Driving in the correct lane

Other _____

7a I was surprised at some of the errors the Driver Educator pointed out to me. (Agree/Neutral/Disagree)

7b If so, which errors and why were you surprised at them? (text box)

8 From watching the video with the Driver Educator, I seemed to have difficulty with the following on the course: (Most of the time/Occasionally/Not at all)

Signaling

Stopping at Stop Signs

Stopping at Traffic Signals

Changing lanes

Railway Crossing

Speeding

Turning in general

Turning left at Traffic Signals with no green arrow

- Driving in correct lane
Other _____
- 9 From watching the video with the Driver Educator, I seemed to have difficulty with the following on the course: (Most of the time/Occasionally/Not at all)
Intersections with Traffic Signals
Intersections with Stop Signs
Residential Streets
Medium Streets
Major Roads
Expressways
- 10a I found the street signs easy to see on the course (Most of the time/Occasionally/Not at all)
10b If not, which ones were difficult? (text box)
- 11a I found the street signs easy to understand on the course (Most of the time/Occasionally/Not at all)
11b If not, which ones were difficult? (text box)
- 12a I found the traffic signals easy to see on the course (Most of the time/Occasionally/Not at all)
12b If not, which ones were difficult? (text box)
- 13a I found the traffic signals easy to understand on the course (Most of the time/Occasionally/Not at all)
13b If not, which ones were difficult? (text box)
- 14a I felt confused regarding which lane to drive on (Most of the time/Occasionally/Not at all)
14b If so, what caused the confusion? (text box)
- 15 I had trouble seeing the lane markings (Most of the time/Occasionally/Not at all)
- 16a At certain locations, I felt my line of sight was blocked by fixed objects (Most of the time/Occasionally/Not at all)
16b If so, where? (text box)
- 17a I was able to properly negotiate curves at my operating speed (Most of the time/Occasionally/Not at all)
17b If not, which locations were problematic? (text box)
- 18a I was able to properly turn at intersections (Most of the time/Occasionally/Not at all)
18b If not, where did you have trouble? (text box)
- 19a I was confused by some elements of the design of the road at certain locations (Most of the time/Occasionally/Not at all)
19b If so, what elements and where? (text box)
- 20 I seemed to have trouble with pedestrians on the road (Most of the time/Occasionally/Not at all)
- 21 I seemed to have trouble with cyclists on the road (Most of the time/Occasionally/Not at all)
- 22 My understanding of the "Rules of the Road" has increased because of watching the video with the Driver Educator (Agree/Neutral/Disagree)
- >>General questions regarding watching video both times<<
- 23 I believe I will be a safer driver because of what I learned today (Yes/Maybe/No)

- 24 I am going to try to use some of the suggestions from the Driver Educator in my future driving (Yes/Maybe/No)
- 25 I am going to try to use some of the lessons that I learned today in my future driving (Yes/Maybe/No)
- 26 I would recommend the process of having my driving videotaped and watching it afterward to my friends (Yes/Maybe/No)
- 27a I would be prepared to pay for this type of program including watching the video with a Driver Educator (Yes/Maybe/No)
- 27b If Yes or Maybe, how much would you be willing to pay? (\$ _____)
- 28a I found it more useful to go through the video with the Driver Educator than to watch the video on my own (Agree/Neutral/Disagree)
- 28b If so, why was watching the video with the Driver Educator more useful? (text box)
- 29 A particular section of road that I had difficulty with was: (text box)
- 30 What I found most helpful about the process: (text box)
- 31 One thing I would suggest for improvement: (text box)
- 32 General Comments: (text box)

*Third (mail-in) subject questionnaire
"2 to 4 weeks post watching video both times"*

- 1 I believe that I have become a safer driver since the day when I watched the video of my driving (A lot/Some/None)
- 2 I have become more attentive about my driving since the day when I watched the video of my driving (A lot/Some/None)
- 3 I am more conscious of the "Rules of the Road" since watching the video of my driving with the Driver Educator (A lot/Some/None)
- 4 I use the lessons learned from watching the video of me driving in my everyday driving (Most of the time/Occasionally/Not at all/Not sure)
- 5 I incorporate the specific suggestions that the driver educator had to do with: (Most of the time/Occasionally/Not at all/No suggestions given)
- Signaling
 - Stopping at Stop Signs
 - Stopping at Traffic Signals
 - Changing lanes
 - Railway Crossing
 - Speeding
 - Turning in general
 - Turning left at Traffic Signals with no green arrow
 - Driving in correct lane

6 One thing I would suggest for improvement is: (text box)

7 General Comments: (text box)

Driver Educator questionnaire
“For the Driver Educator”

1 I believe the participants learnt something about their driving (Agree/Neutral/Disagree)

2 I believe the participants will be safer drivers because of what they learnt (Agree/Neutral/Disagree)

3 I believe that watching the video will help the participants with their driving in the future (Agree/Neutral/Disagree)

4 I believe that the participants will be safer drivers because of what they learned from watching the video (Agree/Neutral/Disagree)

5 I found the process of watching the video useful (Agree/Neutral/Disagree)

6a I was surprised at some of the participants errors that I noticed (Agree/Neutral/Disagree)

6b Which ones?

7 I was prepared enough to speak to the participants about their driving (Agree/Neutral/Disagree)

8a I had enough time while watching the video the first time to note what errors I wished to speak to the participants about (Agree/Neutral/Disagree)

8b I would have preferred more/less (circle one) time

8c How much per subject? (_____)

9 I would have preferred to be able to rewind the video the first time to re-watch particular sections of the video prior to speaking to the participants about the video (Agree/Neutral/Disagree)

10a I would have preferred to have watched the video the first time without the participant there (Agree/Neutral/Disagree)

10b Why? (text box)

11a I preferred watching the video immediately prior to discussing it with the participants (Agree/Neutral/Disagree)

11b Why?

12 I preferred seeing what the participants thought were errors before discussing the video with them (Agree/Neutral/Disagree)

12b Why?

13a I found the participants agreed with most of my suggestions for improvement (Agree/Neutral/Disagree)

13b If they did not agree with me, they usually disagreed with: (text box)

14 What I found most useful about the process: (text box)

15 One thing I would suggest for improvement is: (text box)

16 General comments: (text box)

Copies of the actual questionnaires can be obtained by contacting the authors.

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