

# PROVUS' DISCREPANCY EVALUATION OF THE DRIVESMART NOVICE DRIVER CD-ROM TRAINING PRODUCT

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## ABSTRACT

The Monash University Accident Research Centre (MUARC) recently completed a research program culminating in the development of a CD-ROM based training product, known as *DriveSmart*, designed to accelerate in young novice drivers the development of perceptual and cognitive skills known to be important in reducing crash risk. While the use of traditional research strategies to evaluate a training product can provide important measures of instructional effectiveness, these strategies do not necessarily provide the type of information needed to identify and remedy specific flaws in the product. Provus' Discrepancy Approach is an alternative strategy for evaluating educational programs where performance standards are established, evidence of compliance with these standards is gathered, discrepancies with standards are identified, and corrective actions are taken. This paper discusses the application of Provus' Discrepancy Approach to the evaluation of *DriveSmart*, focussing on the identification of discrepancies with the standards, and the changes which were made to the product as a result.

## INTRODUCTION

In 1995, MUARC was contracted by the Victorian Transport Accident Commission (TAC) to conduct research using an advanced driving simulator, to investigate and to determine techniques for effectively training four skills which were identified (Triggs, 1994) as critical in moderating the crash involvement of novice drivers. The four skills identified were: risk perception (the ability to detect, perceive and assess the degree of risk associated with actual and emerging traffic hazards); attentional control (the ability to prioritise attention); time-sharing (the ability to share limited attention between multiple competing driving tasks); and calibration (the ability to moderate task demands according to one's own performance capabilities). In 1999, this research (see Triggs and Regan, 1998) culminated in the development of a CD-ROM training product known as *DriveSmart* (see Regan, Triggs and Wallace, 1999 for a full description of the product). The content for *DriveSmart* was drawn from the road safety literature and from the findings of the research program referred to above. Content areas drawn from the literature included: insight training; optimism, commentary driving; prediction; and situation awareness. The remaining content areas were derived from the simulator experiments conducted by MUARC. The approach of Incremental Transfer Learning (ITL; Wallace and Regan, 1998) was selected as the general instructional strategy underpinning the product. ITL places considerable importance on the need to plan for both *near-transfer* and *far-transfer* of skills.

*DriveSmart* was launched in Victoria in May 2000. Since its release to the public, in July 2000, over 10,000 copies have been distributed free of charge to learner drivers and various learning and other institutions in Victoria. The purpose of this paper is to report on an evaluation of the CD ROM which was conducted by MUARC under the direction of an independently appointed Project Advisory Committee prior to the product's release. The evaluation had two major components. The first of these is described in a companion paper presented at this conference (Regan, Triggs & Godley, 2000) that involved an experiment, using an advanced driving simulator, to evaluate the instructional effectiveness of the CD ROM product. The second component, using Provus' Discrepancy model for curriculum evaluation (Brady, 1983), is the subject of the present paper.

Methods which are traditionally used to evaluate products, such as the simulator-based evaluation, do not provide a systematic and comprehensive means for identifying flaws that may be contained within the product. The Discrepancy Model for Curriculum Evaluation, developed by Provus (see Brady, 1983), however, provides a mechanism for doing so. Using this model, specific flaws in a given learning program can be identified and rectified by determining any discrepancies that exist between a pre-determined set of standards for the learning program and what actually occurs in the program. According to this model there are essentially six steps that need to be completed in order to conduct such an evaluation:

1. develop a list of standards which specify the characteristics of ideal implementation of a learning program;
2. determine the information required to compare actual implementation with the defined standards;
3. design methods to obtain the required information;

4. identify the discrepancies between the standards and the actual learning program;
5. determine reasons for the discrepancies; and,
6. eliminate discrepancies by making changes to the implementation of the learning program.

Hence, the discrepancy model does not prescribe a specific technique for gathering and analysing information during an evaluation. Rather, it lists the steps required to plan the evaluation itself. This approach is very pragmatic, lending itself equally well to both qualitative and quantitative methods in order to identify and rectify discrepancies. By applying such a technique to a training product such as *DriveSmart*, in addition to an overall evaluation that determines the efficacy of the product (see Regan, et al., 2000 in this volume), it was possible to refine the exercises contained in the CD ROM to maximise the instructional effectiveness of the training prior to the product being released.

The rest of this paper describes how Provus' Discrepancy Approach was used to evaluate *DriveSmart*, along with the outcomes of the evaluation, focussing on the final three steps noted above.

## **PROVUS' DISCREPANCY EVALUATION**

A total of 26 standards for *DriveSmart* were developed by listing learning program features that were considered to provide evidence of validity, reliability, efficiency, practicability, and usability. These aspects were considered to provide a comprehensive coverage of issues critical to the success of the product. The type of information required to compare these standards to what was actually found with the training product was then determined and methods for obtaining this information are described below.

### **Method**

*Participants.* The data were collected from two groups of participants: the "Experimental group" and the "Provus group". The Experimental group was the same group of participants who completed *DriveSmart* as part of the simulator-based evaluation. This group consisted of 50 participants, with approximately equivalent numbers of males and females. Ten different participants, five males and five females, were recruited to form the Provus group. This separate group was included in the evaluation given concerns that the process of collecting data to be used to address some of the defined standards might interfere with the experimental evaluation. All participants were aged between 17 years and 17 years 11 months at the time when the evaluation commenced, and had between 40 and 110 hours of driving experience.

*Materials and Procedure.* The data were collected through the use of several techniques, including questionnaires, interviews, experimenter observations, and the logging of responses during completion of the product. The version of *DriveSmart* which the Experimental Group completed as part of the simulator-based evaluation was programmed to log certain measures of performance while the program was being undertaken. These logged data included: responses to multiple choice questions, the time taken to complete each exercise, and commentaries. In addition, the Experimental group participants completed a questionnaire at the completion of each of five experimental sessions allocated to completing the *DriveSmart* training, after their seventh (and final) experimental session, and over the telephone several weeks following completion of the experiment. The questions were designed to gauge participants' opinions on several features of *DriveSmart* regarding its look and feel, and its potential value as an instructional tool.

Participants in the Provus group attended a single session each, during which they completed several activities using *DriveSmart*, under an experimenter's supervision. The experimenter first made observations of the participant's ability to operate the software and to independently navigate both within and between modules to access certain exercises and features of *DriveSmart*. In turn, the participant completed a series of set exercises from *DriveSmart* with each exercise accompanied with a question from the experimenter to determine the participant's understanding of the exercise. Finally, participants were asked to provide definitions of several terms and phrases which appear in *DriveSmart*.

### **Results and Discussion**

For each standard, the evidence used to determine compliance (or non-compliance) with the standard is discussed, along with a description of the action taken (where appropriate) to eliminate the discrepancy.

#### **Validity**

##### *1. Learners demonstrate achievement of the learning outcomes specified for DriveSmart.*

Logged performance scores of the Experimental group were examined for specific types of exercises. Participants scored highly across these exercise types generally, indicative of achievement of learning outcomes,

and therefore, of general compliance with the standard. Two exercises were identified as particularly problematic, however, evidenced by relatively low scores, and as such, were omitted from the product.

*2. Learners are able to discriminate cues provided through digitised video and audio.*

The ability of Provus group participants to identify particular stimuli in three Scanning exercises was assessed. At least half of the ten participants detected the appropriate cues, indicating that these cues were subtle enough not to be overly obvious, as intended. Hence, these data constituted support for the standard.

*3. Learners comprehend the terms and phrases used in DriveSmart.*

Provus group participants were asked to explain in their own words the meaning of 12 terms and phrases encountered during *DriveSmart* likely to have the greatest potential for misinterpretation. Three terms were poorly defined by participants, providing sufficient evidence of a discrepancy. Consequently, the voice-over scripts were amended to more clearly explain these terms when they are first encountered in the product.

*4. Learners are not confused about the purpose of, or their role in, the “possible events” technique.*

For each “possible events” exercise, users view a video clip and must then decide which of two or three possible events, presented in a multiple choice format, is most likely to have led to a dangerous situation. Provus group participants completed two “possible events” exercises, and following each, were asked to justify their response. Participants’ responses revealed that they were assessing the relative danger of each situation before deciding which option to choose, complying with the intent of the activity, and hence, concurring with the standard.

*5. Learners transfer planned outcomes of DriveSmart to real world driving tasks.*

Following completion of their final session, Experimental group participants were presented with 21 diagrams of different driving scenarios and for each situation were asked to indicate whether they had experienced any of those situations in their real world driving since undertaking *DriveSmart* where the situation had resulted in a crash or a near-crash. Approximately two-thirds of the participants indicated that they had experienced at least one of these situations. In turn, approximately two-thirds of this sub-group of participants indicated that the training had been helpful in identifying key risks, anticipating potential risks, identifying options to avoid danger, avoiding potential hazards, and in simultaneously paying attention to important aspects of the driving environment. Further, in response to a question in their telephone questionnaire, 84% of Experimental group participants indicated that undertaking the Concentration module had been beneficial for learning skills required in real life driving. These outcomes constituted secure support for the standard.

*6. Learners understand and agree with feedback provided to bird’s eye view situational awareness exercise.*

Situational awareness exercises require users to view a video clip and then to position icons of road users and other elements of the driving environment on to a bird’s eye graphic of the traffic situation where the video paused. Verbal feedback is then provided. Provus group participants completed one situational awareness exercise and were then asked whether they agreed with the feedback and whether they experienced difficulty in positioning icons. Participants generally agreed with the feedback. However, all expressed that they encountered problems in positioning icons as desired. The programming technique used to implement these exercises only permitted objects to be placed into pre-defined spaces. There was clear evidence, therefore, of a discrepancy with the standard. In line with recommendations, the situational awareness exercises were re-developed to give users the desired flexibility in positioning icons.

*7. Learners have reasonable opportunity to pause videos as situations become unsafe before a pause is imposed.*

In several exercises, users are asked to pause the video by clicking their mouse button at the point at which they perceive that the situation has become unsafe. Potential problems were envisaged with two of the exercises of this type however, in that an unsafe situation in the video might present itself so quickly that users would not have sufficient time to “click” before the pre-determined pause point. Provus group participants carried out these two exercises and were asked whether they had sufficient time to click before the video reached that point, and if they did not, whether this was because the situation had not yet become safe, or because the situation became unsafe too soon to perform the click. Eight of the ten participants in the first exercise, and six of the ten participants in the second exercise indicated that the time was adequate. While there appears to be a discrepancy with the standard, no action was recommended since these exercises comprise other instructional activities deemed to be more critical to learning.

*8. Presenters are considered to be credible by learners.*

Two presenters, one male and one female, introduce the product to users. To assess presenters’ credibility, after their final training session, Experimental group participants were asked to rate each presenter’s degree of believability and level of competency. Approximately 30% of participants did not consider the female or male presenters to be competent, with a similar outcome for believability. A discrepancy with the standard was evident; however, since there would be no guarantee that different presenters would be perceived as any more credible by more users, it was considered that no corrective action was warranted.

*9. Drivers used in cameos are considered to be credible by learners.*

At the completion of their final training session, Experimental group participants were asked to rate the likelihood that the decisions made by the cameo drivers resemble those made by their peers in the same situations. Approximately one-third of participants considered it unlikely that drivers would behave as portrayed in cameos. It is unclear whether these data are indicative of a discrepancy since there was some uncertainty as to whether poor cameo driver credibility would reduce the effectiveness of the learning activity. Consequently, no changes were recommended.

*10. Learners understand the intended form and content of commentary they are asked to provide.*

Provus group participants carried out a commentary drive exercise and were then asked to specify what aspects of the driving environment they would ask a friend to comment on. In addition, the performance of Experimental group participants on commentary drive exercises was assessed for the mention of key points for which comments should have been made. Across groups, an insufficient number of comments were made on actions of own-car and on the presence of distant risks, constituting evidence of a discrepancy. In compliance with recommendations, the scripts to the introductory guidance on commentary exercises and to the feedback in some of these exercises were modified to explicitly stress to users that they should comment on the actions of own-car and on distant risks also.

*11. Learners elect to listen to commentary they have provided.*

The number of times Experimental group participants replayed their own commentary was logged. Approximately half of these participants opted to listen to their own commentary during earlier commentary drives, however, only 20% of participants replayed their commentaries in later drives. These data were indicative of a discrepancy. Changes were made to the scripts to emphasise to the users the importance of replaying their own commentary.

*12. Learners detect both immediate and distant (longer term) key risks*

This standard was to be assessed by comparing Experimental group participants' mention of immediate risks with their mention of distant risks in their commentaries. The data used for Standard 10, however, indicated that participants might not have always been aware of the requirement to comment on both immediate and distant key risks. Hence, there were no data to assess this standard.

### **Reliability**

*13. Variation in learner performance decreases with exposure to DriveSmart.*

Data to assess this standard comes from the logged responses of Experimental group participants to all exercises. For each exercise type, poor internal consistency would be indicative of a discrepancy. While these data have not yet been formally examined, there does not appear to be any indication of a discrepancy at this stage.

*14. Learners are able to relate to the purpose and content of DriveSmart to their individual real-world driving training*

At the completion of their last session, Experimental group participants were asked to rate how useful they had found the skills developed through their *DriveSmart* training to be for real-world training in each of urban, country and freeway environments. All participants reported that the training had been useful for urban driving, 90% reported that the training had been beneficial for country driving, and 75% felt that the training had been helpful for freeway driving. Hence, there was no evidence of a discrepancy with the standard.

*15. The order of DriveSmart exercises appears logical to learners.*

At the completion of each of their training sessions, Experimental group participants were asked whether the difficulty of exercises appeared to increase within sessions, and whether the modules were presented in a logical order across the sessions. The majority of participants indicated that the exercises became progressively harder, with the exception of session 5, where exercises were of an equivalent level of difficulty. In turn, 91% of participants agreed that the modules were presented in a logical order across sessions. These data, therefore, constituted strong support for the standard.

### **Efficiency**

*16. A single exposure to DriveSmart is sufficient to achieve the intended outcomes.*

After their last session, Experimental group participants were asked whether they would benefit by completing the product a second time, of which only 34% expressed that they would benefit. Participants were also asked whether there were sufficient exercises in each module for them to master the skills being trained. Again, only a small proportion of participants indicated that more exercises were required in any given module. The Experimental group's performance on the more advanced of the final sets of video-based exercises, and on the Concentration module was also examined. Performance on the video-based exercises was generally high,

providing support for the standard. For the Concentration module, however, a discrepancy was apparent since performance was less than expected on the final level of the Headway task. This was attributed to the use of performance assessment criteria that were too stringent. Hence, as recommended, the basis for assessing headway performance at the final level was relaxed.

*17. Learners complete each DriveSmart activity, each DriveSmart module, and the entire DriveSmart program within design maximum online durations*

The times taken by Experimental group participants to complete each activity, each module, and the entire program were as expected and hence, met the standard.

### **Practicability**

*18. Documentation accompanying the DriveSmart program is sufficient to prepare learners in terms of motivation and operation of the software.*

Documentation was incomplete at the time of the evaluation. Nevertheless, Provus group participants were shown draft documentation and directed to install the product. Participants were then asked to specify any problems they experienced with the installation. While only one participant was reported to have difficulty, this was deemed sufficient evidence of a discrepancy. The documentation accompanying *DriveSmart* was revised to be consistent with that accompanying common commercially available software products (e.g. Microsoft).

*19. The Introduction and online Help enable learners to effectively use DriveSmart without external assistance.*

The data to assess this standard came from Experimental group logged data of the number of times participants accessed the Help facility. Additional data were obtained from Provus group comments on aspects of the Introduction with which they were unclear, their level of motivation to complete the product, and, the degree of importance of the product for driving safety. Logged data reflected that the Help file was accessed when difficulties were encountered. However, with some of the Provus group participants rating their motivation and the importance of the product for driving safety as neutral, there was some evidence of a discrepancy. While no changes to the Introduction specifically were recommended at this stage, ways to enhance user motivation and perceived importance of the product were considered in the development of supporting documentation.

*20. Learners are willing to provide commentary where so directed.*

Following each of their training sessions involving commentary drives, Experimental group participants were asked to rate their level of comfort in providing commentary, and further, how likely they would be to provide commentary if undertaking *DriveSmart* at home. Across sessions, approximately 25% indicated some level of discomfort in providing commentary, with a similar proportion expressing that they would be unlikely to provide commentary at home. These data constituted evidence of a discrepancy. Consequently, the voice-over introduction to the commentary drives was adjusted to emphasise the importance of this type of activity.

*21. The achievement of intended learning outcomes is not adversely affected by the schedule for subject use of DriveSmart.*

Following each training session, Experimental group participants were asked whether they had been allocated sufficient time to undertake the components of *DriveSmart* that had been planned for that session. The majority of participants indicated that the time available for each session was adequate, complying with the standard.

*22. The content of DriveSmart does not conflict with information provided to learners by other credible sources.*

To assess this standard, two experienced driving instructors reviewed *DriveSmart*, and the Experimental group was asked, after each training session, and after their final session, whether they had received any advice from another source that conflicted with the information provided in *DriveSmart*. While the data from the Experimental group complied with the standard, comments from the driving instructors did not. For the exercises for which conflicts were identified, the scripts were amended to standardise terms and principles as advised by the driving instructors.

### **Useability**

*23. Procedures for navigating within and between modules are clear to users.*

Provus group participants were given several tasks requiring them to navigate through various parts of *DriveSmart*. The experimenter's observations indicated evidence of non-compliance with the standard for the login procedure specifically. As a result, changes were made to the login process to make it more clear to users and to be consistent with more standard login protocols.

*24. Learners derive satisfaction from use of the product to the extent that they would use it again and would recommend it to their friends.*

After their final training session, Experimental group participants were asked to rate their level of enjoyment in undertaking the product, whether they would recommend it to their friends, and whether they would complete all

of *DriveSmart* if they had undertaken it at home. While only 65% of participants clearly enjoyed undertaking *DriveSmart*, 82% responded that they would recommend it to their friends. Nevertheless, only 55% of participants indicated that they would complete the entire product at home. These data clearly indicate a discrepancy. While no direct action was recommended, it was considered that other modifications to the product would be likely to assist in meeting this standard.

*25. Learners are motivated to undertake and complete the Concentration module.*

In the telephone questionnaire, Experimental group participants were asked how interesting they found the Concentration module, and whether they would complete it at home. Only 20% of participants expressed some level of interest in the Concentration module, and 39% perceived it as boring. Moreover, while 96% of participants indicated that they would complete this module at home, the majority of them said that they would complete only some of it. Again, while there was a clear discrepancy with the standard, no action was taken to directly address this issue at this stage. It was considered that other strategies (e.g. TAC marketing), might be beneficial in addressing this discrepancy.

*26. Learner motivation is not adversely affected by the lack of visual representation of environmental features in the Concentration module driving animations.*

In the telephone questionnaire, Experimental group participants were asked whether they would be more motivated to complete the Concentration module if it had more realistic graphics. Eighty percent of participants responded that they would be more motivated to complete the module with more realistic graphics. In order to eliminate this discrepancy, the Concentration module graphics have been improved as much as is possible given the available resources, to appear more realistic.

## CONCLUSIONS

Provus' Discrepancy Approach was an important component of the *DriveSmart* evaluation, serving to refine the program during the development process in order to maximise its instructional effectiveness. In addition, data yielded from the evaluation suggest that the majority of users of the product derived benefit from the product which transferred to the real world, and derived satisfaction from the use of the product. The TAC is currently undertaking ongoing market research to ascertain to what extent the product is currently being used by learner drivers in the community, and to determine how useful and useable the product is for these learner drivers.

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