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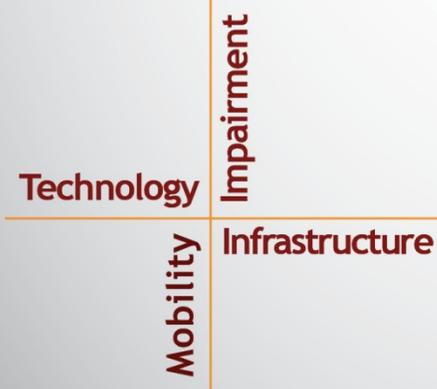
National Surface Transportation Safety Center for Excellence

Parent Perceptions of Real-Time and Non-Video Feedback from the Driver Coach Study

Final Report

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LIST OF ABBREVIATIONS AND SYMBOLS

CNC	crash/near-crash
DC	Driver Coach
g	g-force (gravitational force)
GDL	Graduated Driver Licensing
LED	light-emitting diode
mph	miles per hour
ms	millisecond
m/s	meters per second
NSTSCE	National Surface Transportation Safety Center for Excellence
TRIP	Teen Risk and Injury Prevention
VTTI	Virginia Tech Transportation Institute

CHAPTER 1. INTRODUCTION

BACKGROUND

Motor vehicle crashes are the leading cause of death for teens (Centers for Disease Control and Prevention, 2017). Crash rates are particularly high in the first six months after licensure (Mayhew, Simpson, & Pak, 2003). Though the risk for teens is elevated, there are ways it can be reduced. Research indicates that an effective way to improve teen safety is the use of in-vehicle monitoring devices that provide feedback to teens and parents (U.S. Department of Transportation, 2018). A study done by Simons-Morton et al. (2013) found that providing immediate feedback from an in-vehicle monitoring system to teens alone does not reduce risky driving. Yet, when that feedback is combined with parents being informed about the teen's driving behavior, the teen's risky driving is reduced. Such findings about the protective potential of combining in-vehicle monitoring with parental involvement are promising and need further exploration.

Monitoring devices provide teens with real-time feedback on their driving behavior and parents with post hoc feedback that allows them to monitor their teen and coach them as they learn to drive. Different forms of monitoring devices have been developed. Some provide video of the teen driving, while others are simpler, less-sophisticated systems without video feedback. Non-video feedback systems typically use sensors to capture information on unsafe driving behavior (e.g., hard braking) and provide in-vehicle alerts to the teen driver as well as post hoc feedback to parents on the teen's driving behavior. Video feedback systems go a step further and capture video of unsafe driving behavior for later parent/teen review. Recent research indicates that video feedback reduces unsafe driving behaviors in newly licensed drivers, especially when parents are informed about the teen's driving behavior (McGehee, Raby, Carney, Lee, & Reyes, 2007; Simons-Morton et al., 2013; United States Department of Transportation, 2018). Unfortunately, research results are mixed regarding whether non-video feedback reduces risky behaviors among teen drivers; however, parental involvement has been shown to be a critical factor in the reduction of risky driving behaviors among teens (Farmer, Kirley, & McCartt (2010). These findings suggest that further research is needed to develop effective non-video monitoring systems that are protective for teens because non-video systems may be preferred by parents who are tentative about installing monitoring devices that include video due to concerns about their teen's privacy and corrosion of trust (United States Department of Transportation, 2018).

The Teen Risk and Injury Prevention (TRIP) group at the Virginia Tech Transportation Institute (VTTI) conducted the Driver Coach Study (DCS), which looked at both parental involvement and in-vehicle monitoring. The DCS tested if real-time and post hoc feedback delivered to teens and parents reduced crash/near-crash (CNC) rates for novice drivers during the high-risk first 6 months of driving after they received their independent license. The teens experienced real-time audio/visual feedback when they engaged in risky driving behaviors, and parents received e-mail notifications that directed them to a secure password-protected website that contained not only video but graphs and coaching notes designed to support parent involvement and coaching. Findings from the DCS revealed that real-time and post hoc feedback reduced the CNC rates and prevalence of risky driving behaviors in novice teens when parents actively monitored (defined as having logged in to the DCS website) their teen's driving performance as compared to a

control group that did not receive real-time or post hoc feedback (Klauer et al., 2017). The variety of non-video feedback tools that were a part of the DCS were of interest for this analysis.

PURPOSE OF THE STUDY

Research shows that the combination of real-time feedback to teens and post hoc feedback to parents is protective. Thus, it is important to understand how the feedback tools provided via the Driver Coach system were perceived by the parents that used them. The aims of this analysis were to understand if parents that logged in to the Driver Coach website utilized the provided non-video feedback tools and to summarize opinions about the real-time and non-video feedback components. The focus on real-time and non-video feedback stems from researchers' desire to contribute to the development of teen driver monitoring systems that may improve driver safety and encourage parental involvement while avoiding the creation of barriers to involvement for parents concerned about video post-feedback (e.g., privacy and trust issues). A list of key takeaways from this analysis is included in the Discussion section of this report for use by developers of these systems.

To explore how parents viewed the real-time and non-video feedback tools, the research team looked at a sample of exit interviews conducted with parents involved in the DCS. Parents were selected who had recorded logins to the Driver Coach website so that their comments on both the real-time and the non-video feedback components could be explored. The following research questions were addressed via analysis of the exit interviews.

1. Did the parents believe that the real-time feedback (e.g., hard braking alert) provided to their teens was accurate/reliable?
2. Did the parents believe that the real-time feedback improved their teen's driving safety?
3. How effective were e-mail notifications in prompting parental monitoring?
4. Did parents use the non-video feedback tools (e.g., graphs, coaching notes) available to them to monitor their teen driver and if so, did they find these tools useful?

A limitation of using the DCS to examine non-video feedback is that parents were also likely to be logging in to see video of their teen driving. However, the research team felt that there was enough useful information about the real-time and non-video feedback to glean some helpful information for the development of non-video monitoring and feedback systems.

DRIVER COACH SYSTEM DESCRIPTION

The Driver Coach system was designed to alert teens when they displayed risky driving behavior and to provide parents information regarding that risky behavior so they could coach their teens to be safer drivers. Below is a description of the real-time and the non-video feedback available as part of the Driver Coach system. The description draws heavily from the report *Driver Coach Study: Using Real-time and Post Hoc Feedback to Improve Teen Driving Habits*. For more information, please see the report (Klauer et al., 2017), which provides ample details on the system.

Real-Time Feedback

The Driver Coach system used sensors, cameras, and vehicle network data to monitor teen driving behavior and provide real-time feedback if a risky maneuver was performed. Below is a description of the types of triggers that were used in the Driver Coach system and the corresponding alerts the triggers set off.

Triggers

There were six types of risky driving behaviors that were monitored through the Driver Coach system: hard braking, hard turning, rapid accelerations, lane departures, swerving, and speeding. If any of these risky maneuvers were performed, the system would be triggered to provide an alert. The thresholds that had to be reached before an alert would trigger are provided in Table 1. For example, if a subject made a high-g turn (± 0.5 g lateral acceleration, minimum vehicle speed of 11 mph), they would trigger a Hard Turn epoch. “Epoch” is a generic term used to define the sensor data and video window in which a captured safety-related event occurred.

Table 1. Trigger types and thresholds.

Trigger Type	Trigger Threshold Values	Alert Speech Component
<i>Longitudinal Deceleration (Hard Brake)</i>	≤ -0.55 g longitudinal deceleration for duration of ≥ 500 ms. Minimum speed threshold of 5 m/s (11 mph).	<i>“Hard Brake”</i>
<i>Longitudinal Acceleration (Fast Start)</i>	≥ 0.35 g longitudinal acceleration for duration of $\geq 1,000$ ms. No minimum speed threshold.	<i>“Fast Start”</i>
<i>Lateral Acceleration (Hard Turn)</i>	± 0.5 g lateral acceleration with a minimum speed of ± 5 m/s (11 mph).	<i>“Hard Turn”</i>
<i>Lane Departure Warning (Lane Crossing)</i>	Crossing a lane line without turn signal activated. Minimum speed of 20.1 m/s (45 mph).	<i>“Lane Crossing”</i>
<i>Swerve</i>	Monitors the derivative of yaw rate to find cases where the signal defines one complete cycle of a sine waveform and exceeds 19 deg/s/s with similar signed slopes within 2,000 ms. The minimum speed is 8.94 m/s (~20 mph).	<i>“Swerve”</i>
<i>Speed</i>	≥ 75 mph for a duration of greater than 15,000 ms.	<i>“Speeding”</i>

Real-Time Alerts

When a participant exceeded a trigger threshold, they were given an audible three-tone alert, followed by a speech descriptor of the trigger type; for example, “beep-beep-beep-Hard Brake.” A light-emitting diode (LED) indicator light on the windshield-mounted data acquisition system simultaneously flashed amber three times. The system then created an epoch of the triggered event. The epoch consisted of video, audio, and sensor data of approximately 8 seconds prior to

the triggered event to 8 seconds after the triggered event. This epoch was then uploaded to a secure VTTI server via a cellular network.

Post Hoc Feedback

When the epoch of the triggered event was received by the VTTI server, it was placed in a data reduction queue for review. Trained video data reductionists reviewed the triggered event and determined the validity of the event (e.g., actual risky behavior or system/sensor misreading). If valid, the epoch was assigned an epoch type and reductionists coded categorical variables (roadway type, traffic flow, seatbelt usage, lighting, and weather) that described the environment in which the triggered event occurred. Reductionists also coded any driver distractions, errors, or Graduated Driver Licensing (GDL) policy violations that were present during the triggered event. Finally, reductionists determined if the triggered event was recommended for coaching. All coaching-recommended epochs were released to the participant's webpage each Wednesday morning, at which time they were available for parent and teen to review.

Website Access

At the start of the study's feedback period, an e-mail was sent to the parent participant (and teen, if applicable) that contained instructions, credentials, and a link to the VTTI-developed participant website (see Appendix A). At the start of the data collection period, parents were also provided with a reminder about the types of alerts the system was capable of providing and what the alert would consist of:

- Audio: Tone and a speech descriptor of trigger
- Visual: Blinking amber LED on system

E-mail Notification

Once access to the website had been provided to participants and feedback was enabled, an e-mail was sent to the parents of teens who had coaching-recommended events during a release week, notifying them that there were new events available for review on the participant webpage. Parents of teens that did not have a coachable event during a release week did not get an e-mail. Figure 1 is an example of the types of information included in the e-mail (e.g., epoch type, number, and date-time).

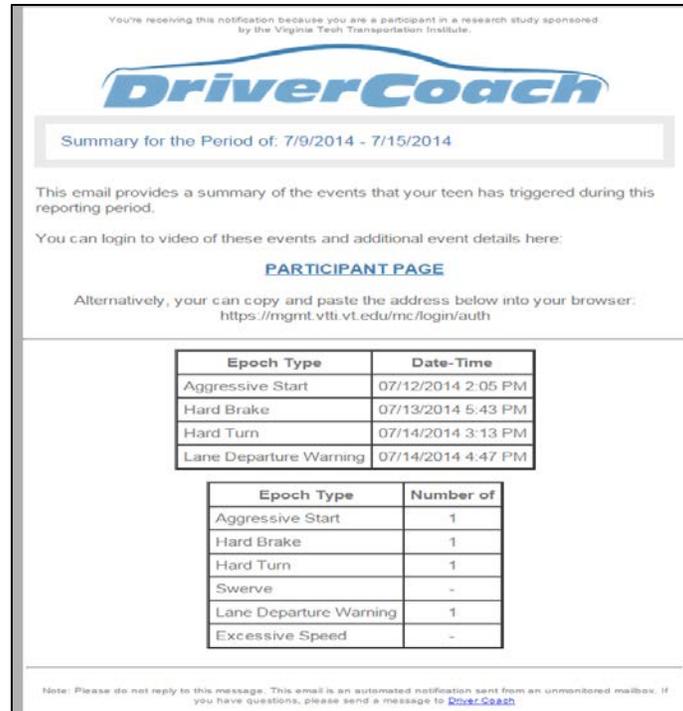


Figure 1. Screenshot. Example of weekly summary e-mail.

Once parents responded to the notification and logged in to the website, they would see two main tables: Report Card and Event Player.



Figure 2. Screenshot. Driver Coach Report Card tab.

Report Card

The Report Card tab allowed parents to view summary graphs and information about the type and frequency of epochs triggered over the course of a four-week period (Figure 2). It included information on the following:

- How often the teen participant was determined to be at-fault in the captured events;
- The number and types of safety events, including any crashes or near-crashes that the teen generated during the current release week and the three prior release weeks;
- The number of lane departures the teen generated during the current release week and three prior release weeks;
- The number and type of potential GDL violations the teen had during the current release week.

This analysis utilized the charts/graphs component of the Report Card, which provided a tally of the number of triggered events the teen had experienced.

Event Player

The Event Player tab (Figure 3) consisted of a Safety Event Inbox, which contained a list of coaching-recommended epochs. The list contained information regarding the epoch occurrence date, time, type, and fault rating (at-fault, not at-fault, good conduct). A participant could select an event within the inbox and play video of the event in the video player located to the right of the inbox. Below the video, participants could review the event summary (Figure 4), which

included information on the environment (e.g., lighting, roadway type), seat belt usage, GDL policy violations, and distractions/errors during the triggered event.

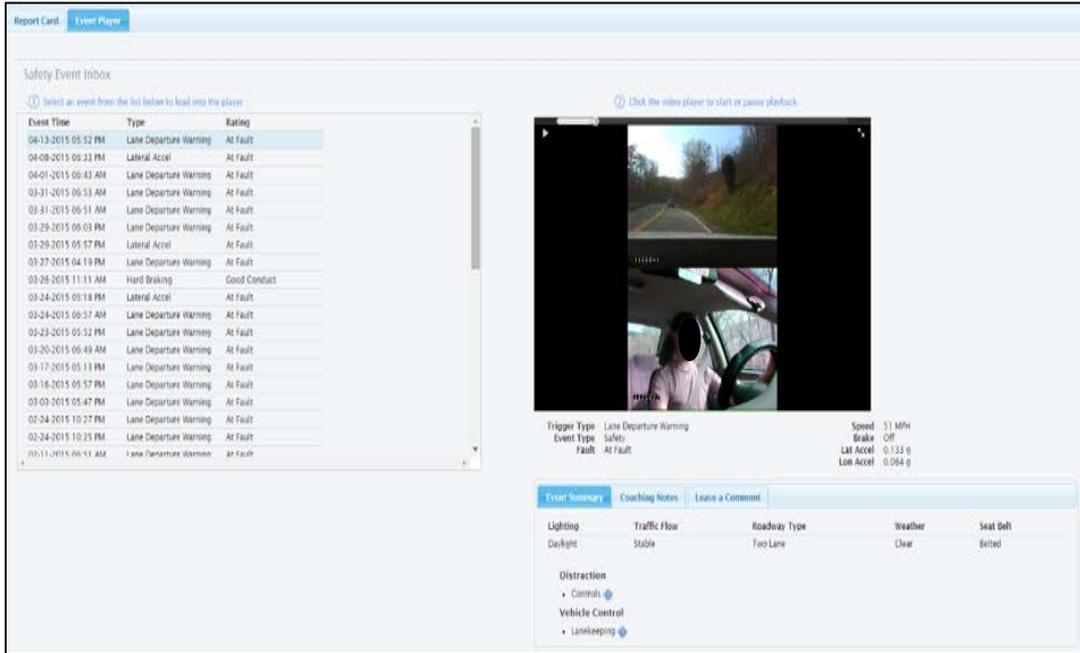


Figure 3. Screenshot. Driver Coach Event Player tab.

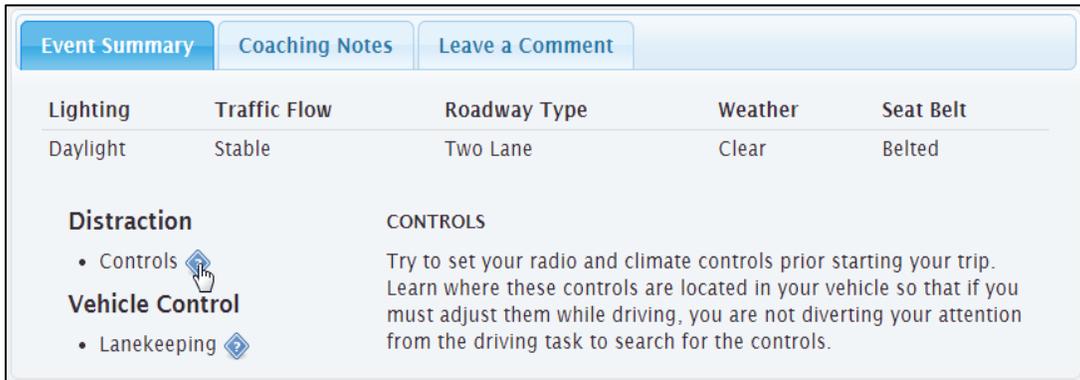


Figure 4. Screenshot. Event Summary tab, including example of fly-out question mark text of individual coaching tips for distractions/errors.

Additionally, standard coaching notes were displayed, based on the trigger type (Figure 5). Participants were also able to leave a comment in response to the selected event (Figure 6).

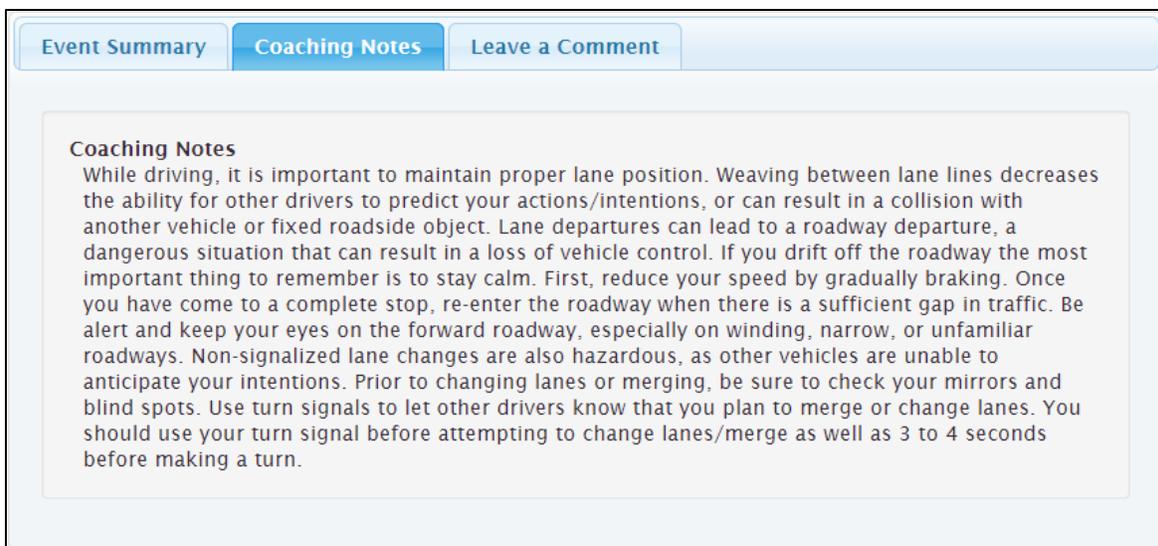


Figure 5. Screenshot. Coaching notes for lane departure.

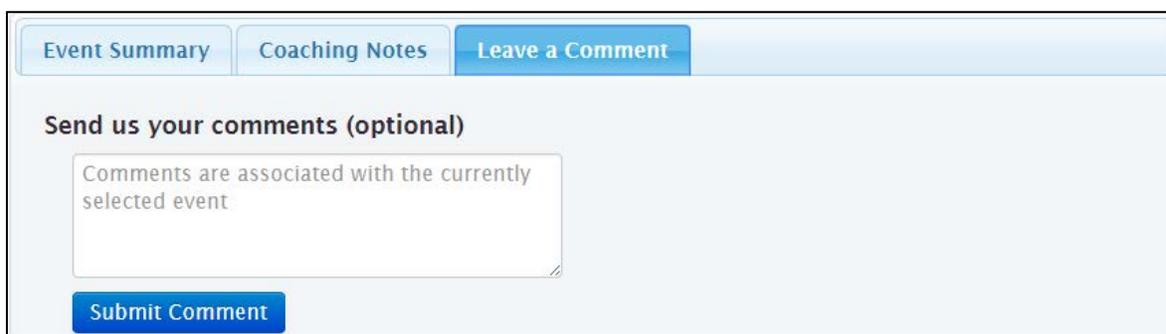


Figure 6. Screenshot. Participant comment feature.

Table 2 includes examples of a few of the comments participants submitted during the DCS. Examples are not limited to the parents involved in this interview analysis.

Table 2. Example parent comments.

Sometimes the machine seems to be sensitive to the outside line more than usual. It is strange.
So what is the speed limit here?
He was driving too fast for the road and he knew it.

The aspects of the event player that were considered in this analysis were the coaching notes and comments feature.

CHAPTER 2. APPROACH

This section includes a description of the parents selected for inclusion in the analysis as well as the reduction and analysis approach. It should be noted that this analysis is qualitative in nature, based on comments from a subset of parents involved in the DCS. Quantitative data excels at answering certain questions, but to understand how parents felt and thought about the real-time and non-video feedback portions of the Driver Coach system, researchers believed a qualitative approach would be preferable. Because this study is qualitative, it avoids the use of numerical data beyond a few basic counts, for example, how participants rated the safety benefit of the various triggers.

PARTICIPANTS

The DCS included 92 parents. Of those 92, 54 logged in to the website and 38 did not. Of those that logged in, 15 (28%) had a teen with at least one crash or near-crash (C/NC). Of those that did not log in, 12 (32%) had a teen with at least one C/NC (Table 3). Since this analysis focuses on understanding how parents felt about the real-time and post hoc feedback, parents that did not log in to the website were not included in the analysis since they did not review the post hoc feedback.

Table 3. Number of teen drivers by C/NC and parent login.

Login Status	C/NC	No C/NC	Grand Total
No Parent Login	12	26	38
Parent Login	15	39	54
Grand Total	27	65	92

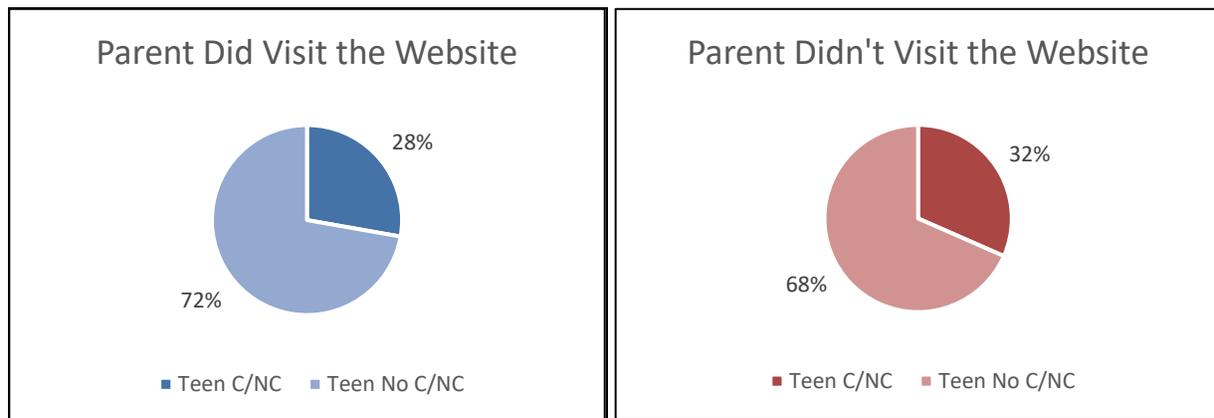


Figure 7. Chart. Percentage of C/NC vs. No C/NC by parent visit to website.

From this group of parents that logged in to the website, researchers decided to consider for the analysis those who logged in to the website two or more times as an indicator of monitoring behavior. From that pool of parents who logged in at least two times, two groups were established: (1) those whose teen had a C/NC and (2) those whose teen did not have a C/NC. The research team decided to look at the parents of teens who had a C/NC and those that did not

because a C/NC is a clear indicator of risky driving behavior. A table with each participant selected for this analysis and their number of C/NCs and logins is found in Appendix B.

The parents whose teen had a C/NC (11 parents) and who logged in to the website two or more times were included in the analysis, with the exception of two parents. These two parents were excluded because one of these parents said during the interview that s/he did not recall logging in and the other said that his/her spouse had been the one to log in. Researchers then selected 11 parents whose teen did not have a C/NC and who logged in to the website two or more times. Those parents with the most recorded logins were included. Parents with more frequent logins were selected from this group because the research team wanted to include parents that had ample experience with the system who would be able to provide feedback on the various features (e.g., graphs).

Table 4. Parent website logins.

	Logins of parents of teen with no C/NC	Logins of parents of teen with C/NC
Selected Parents	11	11
Average (Mean) Logins	16	10
Minimum Logins	6	3
Maximum Logins	45	23

Within this relatively homogenous group, the research team wanted to include a mix of parents (i.e., no teen C/NC and teen C/NC). Though two sets of parents were included in the analysis, the focus was not on differences between these two sets of parents. Rather, it was on how this overall group of involved parents used and felt about the real-time and non-video feedback tools available through the Driver Coach system (e.g., did they improve safety?).

APPROACH

As mentioned earlier, several areas of interest were examined via the analysis of the parent exit interviews:

1. Did the parents believe that the real-time feedback (e.g., hard braking alert) provided to their teens was accurate/reliable?
2. Did the parents believe that the real-time feedback improved their teen’s driving safety?
3. How effective were e-mail notifications in prompting parental monitoring?
4. Did parents use the non-video feedback tools available to them to monitor their teen driver (e.g., graphs, coaching notes) and if so, did they find these tools useful?

To address these questions, the research team conducted a qualitative analysis. The approach used was a modified version of framework methodology (Ritchie & Spencer, 1994). Using this iterative approach, an analyst reduced the data through summarization and synthesis while maintaining the links to the original data, thus allowing for a comprehensive and transparent analysis. The five steps of the analysis process are summarized as follows:

1. **Determine Focus:** The research team determined that the focus of the qualitative analysis would be on parents who logged in and their opinions of the real-time and non-video feedback tools.
2. **Familiarization:** An analyst created partial transcripts of questions and discussions that were related to real-time and non-video feedback from participant exit interviews. After transcription was completed, the same analyst reviewed each transcript to become familiar with the data set (i.e., transcripts for 22 participants).
3. **Identify Thematic Framework:** Based on a review of the data set as well as awareness of the priorities outlined in Step 1 (Determine Focus), the analyst identified themes that applied to the research focus. The themes included Real-Time Feedback (Triggers and Real-Time Alerts), Non-Video Feedback (E-mail Notifications, Graphs, Coaching Notes, Comment Section), and Suggestions.
4. **Data Coding and Charting:** The analyst applied the thematic framework to each transcript, color coding comments by theme and then arranging them in Microsoft Excel spreadsheets (or thematic charts). These thematic charts were further sorted by emerging subthemes, where appropriate, and analyzed. For example, two subthemes emerged under the theme Speeding Trigger, Inflexible at Higher Speeds and Incapable of Monitoring at Lower Speeds. Some of the smaller thematic areas (e.g., Swerve Trigger, Hard Turn Trigger) were not broken out further by subtheme because there were too few comments from parents. While the thematic framework and coding/charting were carried out by one primary analyst, the outcomes were reviewed by multiple members of the research team.
5. **Interpretation:** The analyst applied the themes and subthemes detailed in the charts to better understand the information provided by the parents. When reporting out the data, the analyst only used themes/subthemes that were mentioned by at least three unique parents.

The results of this analysis should be viewed as input into the development of monitoring systems, not as definitive directives of what needs to be included in such systems.

CHAPTER 3. RESULTS

The results of the data interpretation are provided for both the real-time and non-video feedback components of the Driver Coach system. Comments made about these components were pulled in relation to specific key questions (e.g., “Did you feel that any of the alerts were noticeably inaccurate or unreliable?”), as well as anytime they were mentioned by a participant throughout the transcript. A summary of the issues that arose from parent comments is provided in each section below. Example quotes from parents are also included. The major themes covered in the results section include Real-Time Feedback (Triggers and Real-Time Alerts) and Non-Video Feedback (E-mail Notifications, Graphs, Coaching Notes, Comment Section), and Suggestions. Descriptions of the real-time and non-video feedback can be referenced in the background section.

REAL-TIME FEEDBACK

Real-time feedback included two categories that were closely aligned, triggers and real-time alerts. The triggers and real-time alerts worked together to provide real-time feedback to teens on their driving behavior. An analysis was conducted on parents’ opinions of the triggers and real-time alerts as the research team felt it was important to understand if parents believed the triggers and alerts were accurate and improved their teen’s safety.

Triggers

The Driver Coach system included six trigger types: lane crossing, swerve, hard turn, hard braking, fast start, and speeding. Parents were asked a couple of specific questions about these triggers. The questions included in this analysis were:

1. “Each of the alert triggers were chosen based upon past research on novice driver safety. Please rate the following alert triggers on their ability to improve your teen driver’s safety on a scale of 1 to 5, with 1 being the alerts did not improve safety and 5 being the alerts greatly improved safety.” [Options: lane crossing, swerve, hard turn, hard braking, fast start, speeding]
2. “Did you feel that any of the triggers were noticeably inaccurate or unreliable?” [Options: lane crossing, swerve, hard turn, hard braking, fast start, speeding]
 - “Please describe how the particular trigger was inaccurate or unreliable.”

As the analyst processed the transcripts, information was coded if it related to these questions. Any comments about the triggers that arose in other areas of the interview transcript were also coded. Each trigger type was treated as a theme. Several of the themes were large enough that they permitted subthemes to emerge, while others were so small that no description is provided beyond noting how parents ranked the triggers in terms of their ability to improve safety.

A key question asked to all the participants dealt with parental perceptions of the safety benefit of each of the triggers/alerts (Table 5). Parents could rate each alert on a scale of 1 to 5, with 1 being they believed the particular alert did not improve safety and 5 being they believed the alert greatly improved safety. Parents only provided a rating if they recalled their teen experiencing the alert.

In terms of perceived safety, hard braking and speeding were rated as the most beneficial on average (4.4 out of 5). Fast start (3.6 out of 5) and lane crossing (3.9 out of 5) were seen as the least beneficial. The other triggers/alerts received at least a safety rating of 4 on average from parents. All of the parents indicated that their teen had experienced the lane crossing alert (22), while only 9 parents said their teen had experienced the swerve alert.

Table 5. Parent rating of ability of triggers/alerts to improve teen driver’s safety.

(Scale 1 to 5, with 5 being greatly improves and 1 being did not improve safety)

Participant	Lane Crossing	Swerve	Hard Turn	Hard Braking	Fast Start	Speeding
Number (N)	22	9	16	18	14	13
Average (Mean) Score	3.9	4.3	4.2	4.4	3.6	4.4
Standard Deviation	0.81	0.50	0.98	0.92	0.93	1.12
Minimum	2	4	2	2	2	1
Maximum	5	5	5	5	5	5

Throughout the interviews, parents made comments about the triggers. The trigger that received the most comments was the lane crossing trigger, and the trigger that received the least comments was the swerve trigger. Each trigger was treated as a theme in the analysis, but subthemes only emerged under lane crossing, fast start, and speeding (Table 6). Some cross-cutting issues related to the triggers (e.g., parent involvement) identified during the interviews are included in this section.

Table 6. Real-time feedback themes and subthemes.

Theme	Subtheme
Lane Crossing Trigger	Inaccurate
	Sensitive
	Frustrating/Annoying
	Encouraged Turn Signal Use
Fast Start Trigger	Inaccurate
	Acceptable/Unavoidable
Speeding Trigger	Incapable of Monitoring at Lower Speeds
	Inflexible at Higher Speeds
Real-Time Alerts	Startling
	Bit Loud
	Coaching Tool
Cross-Cutting	Parent Involvement
	Self-Reporting
	Increased Awareness

Lane Crossing Trigger

The lane crossing trigger was the only trigger that all the parents recalled their teens experiencing. All 22 parents rated the trigger in terms of how much they believed it improved their teen's safety. It was given an average rating of 3.9 out of 5 in terms of its safety benefit.

When discussing the lane crossing trigger, parents had a variety of comments that emerged as subthemes, including the accuracy of the trigger, the sensitivity of the trigger, and how it encouraged turn signal use. When discussing the lane crossing trigger, in some cases the parents were referring to their teen's experience and other times they were discussing their own experience with the trigger.

Inaccurate: Parents were asked during the interviews if any of the triggers were noticeably inaccurate or unreliable. Parents also tended to bring up lane crossing in a similarly worded question ("Do you believe the DC misjudged an event?"). Several parents responded to these questions and indicated that they thought the lane crossing trigger was inaccurate, unreliable, or had misjudged an event. A few parents cited specific circumstances when the trigger would go off, such as going around curves or turns, exiting the highway, or driving in snow.

- Parent: "It had a problem with lane crossings on turns, it would go off when you really weren't crossing a lane."

As background, during the course of the DCS, members of the VTTI research team performed diagnostics on a weekly basis that could indicate potential system issues and reviewed any specific participant complaints concerning trigger activations. If upon review, the research team believed the system was not performing accurately, a maintenance appointment was scheduled. If the triggers were deemed valid after review, no action was taken. Yet, even though the research team went through this process to verify that the lane crossings were accurate, there was apparently still a perception among some parents that the lane crossing trigger was at times inaccurate or unreliable.

It is also worth noting that early in the course of data collection, the lane departure trigger was adjusted from a 20-mph minimum vehicle speed to a 45-mph minimum speed. This change was made to reduce the volume of lane departure warning epochs that participants were generating by maneuvering around parked vehicles on residential streets (lower risk) versus changing lanes without using the turn signal on highways (higher risk). This analysis included at least one participant who experienced the lane crossing trigger at lower speeds prior to the threshold being raised to 45 mph. This lower speed threshold may have impacted his/her rating of the safety benefit and comments about the trigger's accuracy. The vast majority of these comments, though, refer to lane crossings at or above 45 mph.

Sensitive: A couple of parents commented that the lane crossing trigger was sensitive. The lane crossing trigger was designed to provide an alert when a lane line was crossed without the use of a turn signal.

- Parent: "I felt like the lane change or out of lane alert was way over-sensitive particularly on the right hand side and it would actually make you overcompensate to the center."

Frustrating/Annoying: Another issue cited by some parents was frustration or annoyance with the lane crossing trigger. This seemed to be related to the sensitivity of the trigger or the alert triggering if the turn signal was not used when changing lanes. For instance, one parent discussed how his/her teen was aggravated by the sensitivity of the lane crossing trigger even though he was admittedly crossing a lane line.

- Parent: “Reason I’m not saying number 5 [*rating of trigger*] is because it was more aggravating to him than it was beneficial to him. He felt it was very, very sensitive. For example on a roadway where there would be a bike lane and his tire might cross a little bit into the bike lane on the right, he did not feel like that was truly going off the road. He did realize that that was trying to get him to stay within his lines and that sort of thing, we had many discussions about that. So he was aggravated with it many times.”

Encouraged Turn Signal Use: A few parents discussed how the lane crossing trigger/alert encouraged turn signal usage. Comments were in relation to both the parents’ and the teens’ turn signal behavior.

- Parent: “It ingrained certain habits, the turn signals in particular. Most people are sloppy about even using them. Forced her to just make that a habit.”

Swerve, Hard Turn, and Hard Braking Triggers

The swerve, hard turn, and hard brake triggers received so few comments during the interviews that no subthemes specific to them emerged since more than three unique parents needed to discuss an issue before it was considered a subtheme. Yet there were some issues under these trigger types that are considered in the cross-cutting issues section (e.g., Parent Involvement) because, though they were raised by less than three parents under the specific trigger type, when combined with comments from other trigger types, they could be considered a subtheme. For instance, “Parent Involvement” was mentioned by at least one parent under each of these themes and is noted in the cross-cutting section.

Each parent was specifically asked if their teen had experienced each of these triggers, and if so, how much they thought it improved their teen’s driving safety on a scale of 1 to 5 (see Table 5). Parent opinions of the safety benefit of these triggers is provided below:

- The swerve trigger had the fewest parental ratings of all the triggers. Only 9 of 22 parents reported their teen had experienced it. The swerve trigger received an average score of 4.3 on a scale of 5 for improving teen safety.
- Sixteen of the 22 parents rated the hard turn trigger, giving it an average of 4.2 out of 5 for its ability to improve teen driving safety.
- Thirteen of the 22 parents said that their teen had experienced the hard braking trigger. It received one of the highest average scores (4.4 on scale of 5) of all the triggers in terms of parents’ belief that it improved teen driving safety.

Fast Start Trigger

Fourteen of the 22 parents rated the fast start trigger; the rest said they did not believe their teen had experienced it. The fast start trigger had the lowest average score of all the triggers in terms of parents' belief that it improved their teen's driving safety (3.6 on a scale of 5). Two subthemes emerged under the Fast Start theme even though only a few parents made specific comments about the trigger.

Inaccurate: One subtheme dealt with the perceived inaccuracy of the fast start trigger. A few parents mentioned that a fast start was triggered when it did not seem like the vehicle was moving or moving very fast.

- Parent: "So the fast start she always got at the stoplight at SCHOOL because you were starting uphill and it calls it fast start but it is simply because of the way the car engages so that is not exactly accurate and I wouldn't have deemed it in any way unsafe."

Acceptable or Unavoidable: The other subtheme that emerged dealt with a few parents telling their teens that it was okay to trigger the fast start in certain circumstances or believing that such fast starts were unavoidable. Examples of circumstances given included intersections where crossing the road quickly was deemed important or turning onto a road with a high speed limit (e.g., 55 mph). In a couple of the cases, parents described talking about specific situations with their teen when they felt a fast start was acceptable or unavoidable.

- Parent: "So he was taught that he had to kind of get across that road once he saw that the way was clear, to kind of get across there quickly because you have such a short distance to see if there is a car coming up on you, like 55, 60 mph."

Speeding Trigger

The speeding trigger received an average score of 4.4 out of 5 for improving teen driving safety. Thirteen of the 22 parents scored the speeding trigger; the rest said they did not believe their teen had experienced it. Several parents commented on the speeding trigger and two subthemes emerged.

Incapable of Monitoring at Lower Speeds: The first subtheme was that the speeding alert was incapable of monitoring lower speed conditions (e.g., neighborhoods, back roads) where parents wanted the alerts to be provided.

- Parent: "And so we were curious to know as he got more confident, especially in the neighborhoods or the back roads that were 35, was he really going 45 or 50?"

It is worth noting that sometimes a teen's speeding behavior was provided to parents via the website under other trigger types. For instance, if speeding behavior was identified when a data reduction manager was reviewing a swerve event, it was noted in the Event Summary tab.

Inflexible at Higher Speeds: The other subtheme raised by a few parents was the inflexibility of the speeding trigger threshold. They felt the trigger setting of 75 mph was not flexible enough to

take into account areas where speed limits were 70 or higher. In this case, sometimes parents were referring to their own driving behavior (e.g., not wanting it to go off when they were driving 75 in a 70-mph zone).

- Parent: “Some of the states we were in, like he drove to Boston, some of them had [a] higher speed limit. It was like 70 or sometimes I think one was 75 and it went off.”

These parents appear to want the trigger threshold pegged to the actual roadway’s speed limit, not just fixed at a set speed of 75 mph without regard for the actual speed limit.

Real-Time Alerts

Parents were asked a number of questions about how they felt about the real-time alerts. Again, this theme is included with the triggers under real-time feedback since the two are so closely intertwined as the trigger sets off the real-time alert, which was both audible and visible. The key questions asked about the alerts included:

1. “Did your teen receive any alerts while you were present in the vehicle?” [Options: Yes, No, Not sure]
2. “Would you consider the alerts your teen received while driving very annoying, moderately annoying, neutral, moderately acceptable, or very acceptable?”
3. “Please provide any additional feedback on the real-time alerts.”

Over half of the parents answered the question about whether the alerts their teen received were annoying or acceptable (see Table 7). Not all of the parents answered the question, though some parents explained that their teen did not receive any alerts while they were present in the vehicle. Of those that responded, the category chosen most often was *moderately acceptable*. Only two participants said the alerts their teen received were annoying.

Table 7. Parent rating of alert (annoying or acceptable).

Very Annoying	Moderately Annoying	Neutral	Moderately Acceptable	Very Acceptable
0	2	0	8	3

The Real-Time Alerts theme included several subthemes. Subthemes emerged about how the alerts sounded/looked (i.e., scary/startling, bit loud) and how they served as a coaching tool. A description of each subtheme is provided below.

Startling: Several parents said that the alerts were scary or startling. Sometimes the parents were referring to their own experience with the alerts and sometimes they were referring to the teen’s experience. Several parents specifically said they were referring to the audible alerts. One parent referenced the visual alert, and the remaining few parents did not designate if it was the audible or visual alert that was unsettling.

- Parent: “I guess moderately annoying based on what she just said that it really scared her you know when it would go off.”

Bit Loud: Though some parents commented that the alerts were startling, several others just felt they were a bit loud.

- Parent: “The volume on it was a bit loud.”

As background, during the development of the alerts for the DCS, the research team had human factors safety experts listen to and evaluate potential alerting schemes for Driver Coach prior to selection and implementation. The reason that the tonal alert may have been perceived as “startling” or “a bit loud” is that the tone selected was purposely at the higher frequency range to allow for the alert to cut through any radio noise present.

Coaching Tool: Several parents commented that the alerts were useful as a coaching tool for their teens. They commented on how the real-time feedback was a way to raise their teen’s awareness of risky behaviors and allowed them to learn and adjust their driving behavior. Similarly, a couple of parents commented on how they liked that the real-time alerts provided their teen with feedback/coaching that did not involve a parent having to tell the teen what to do.

- Parent: “I just think it is a good way to show your teen what they are doing driving-wise and get them to basically drive better. I think the alerts and all makes them aware of things they are doing incorrectly and gives them time to correct them.”

Cross-Cutting Subthemes

There were three cross-cutting issues or subthemes that came up during the analysis of the triggers and real-time alerts. As mentioned earlier, cross-cutting subthemes are those that emerged across themes and did not seem to apply to a specific theme. These issues were parent involvement, self-reporting, and increased awareness.

Parent Involvement: Parent involvement was an issue that was mentioned by parents across almost all trigger types. Parents commented on how the triggers/alerts provided an opportunity to discuss driving behaviors with their teen.

- Parent: “He had one swerve and hopefully that greatly improved. He only had it one time but we talked about that.”

Self-Reporting: Teen self-reporting was another issue mentioned across hard turn, hard brake, and real-time alerts. Some parents indicated that their teens would let them know that they had received an alert. This is related to the issue of parent involvement since such self-reporting could open the door for communication about what had happened to trigger the alert.

- Parent: “She would come home ‘oh, mom it beeped.’ [I’d say] ‘What was the situation, what happened?’ So we had kind of talked about it and I think she recognized the situation that she was in and we had kind of talked about it.”

Increased Awareness: Increased awareness is a safety benefit that spans several trigger types (hard braking, hard turn, and lane crossing). Parents commented on how the alert triggers heightened their teen’s awareness about their driving behavior.

- Parent: "... it made her more aware of what is going on around her because it would go off if she hard braked."

NON-VIDEO FEEDBACK

This section provides information on the post hoc feedback parents received that was not video related, including e-mail, graphs, coaching notes, and the comment section of the website. Table 8 outlines the themes and subthemes identified for the non-video feedback.

Table 8. Post hoc feedback themes (non-video).

Theme	Subtheme
E-mail	No E-mail
	Difficulty Remembering Passwords
Graphs	Too Few Events
	Did Not Recall Graphs
Coaching Notes	Supported Parent Discussions
	Not Helpful
Comment Section	Did Not Recall Comment Section
	Feedback on Triggers/Events

E-mail Notification

Parents were asked during the interview about the e-mail notifications they received informing them of new events that were now available to view on the website. The e-mails were intended as a prompt to encourage parents to go to the website and view the event details. Parents were asked the following key questions after confirming they had received an e-mail:

1. "How long after you saw the e-mail did you go to the website and view the event?" [Options: Within a few hours, within 24 hours, within a few days, within a week, within a few weeks, never]
2. "How often did you visit the site?" [Options: Every day, several times a week, about once a week, about once a month, less than once a month, never]

The first question dealt with how quickly parents would visit the website once they received the e-mail. Nineteen of the 22 parents confirmed that they had received an e-mail. Three parents said they did not remember getting an e-mail but had checked the website. Of the 19 parents that recalled receiving an e-mail, 8 of the 19 (over 40%) said they would go look at the website within a few hours of receiving the notification (see Table 9). Only one participant said it took him/her longer than a week to visit the website after receiving the e-mail.

Table 9. Timeframe to visit website after e-mail notification.

Timeframe	Number of Parents
Within a few hours	8
Within 24 hours	4
Within a few days	4
A week	2
Within a few weeks	1

Several parents commented on how the e-mail notification prompted them to immediately log in and view the event. The e-mail appeared to be an important tool in the monitoring process, prompting parents to check on their teen’s driving behavior.

- Parent: “It would send me an alert and I would log in immediately from the e-mail. And I really like the fact that it sent me the e-mail to let me know and I could log in from there and look and see what had happened.”

The second question dealt with how often parents visited the website. The question appeared to be challenging for some parents because they did not visit the website at set frequencies (e.g., every day, once a week); rather they visited when they received an e-mail notification. In retrospect, one of the response options for this question should have been “after receiving notification.”

- Parent: “I visited when we got the e-mails.”

A couple of small subthemes emerged related to the e-mail notifications, including participants saying they did not recall/did not receive the e-mails and participants having trouble remembering passwords.

No E-mail

A few parents reported having trouble getting the e-mails or did not recall getting them. A couple of parents cited reasons for having trouble getting the e-mails (i.e., SPAM, parent’s e-mail server). It is worth noting that VTTI researchers ran the weekly e-mail message through a variety of spam detection and scoring filters to ensure that the message would pass through most major e-mail hosts’ spam filters.

- Parent: “I think I had a little trouble at first because for some reason I think that some of my first notifications went to my SPAM folder so I ended up having a problem because I thought there weren’t any.”

Difficulty Remembering Passwords

During analysis, a subtheme about passwords emerged in relation to e-mail notifications. Several participants mentioned how it was difficult to remember their password when they wanted to log in. A few participants indicated that just remembering passwords can be a challenge. It is worth

noting that participants had the option to reset their password from the one provided by VTTI at the start of the study.

- Parent: “I’ve got so many passwords to remember ... I didn’t use it enough to really memorize it.”

Graphs

Parents were asked one key question about the graphs available on the website:

1. Did you find the website graphs to be informative, confusing, no opinion, or never used?

Over half of the parents indicated that they had never used the graphs, had no opinion about them, or did not recall them. While a few parents said they were informative, others said the graphs were not useful even though that was not one of the response options. A couple of subthemes, too few events and did not recall graphs, emerged from the comments about graphs that are useful in terms of potentially explaining why parents did not provide many positive ratings in regard to the graphs.

Too Few Events

Several parents described how there were so few events that the graphs were not helpful. A couple of parents indicated that it might have been more informative if a longer period of time had been displayed.

- Parent: “Well there were just so few so it wasn’t very helpful.... Of course I guess if you included several months at a time then you would have more data and the graphs could be a little bit more interesting and saying well you can see a decrease in lane departure warnings or something.”

Did Not Recall Graphs

A few parents commented that they did not recall the graphs or remember much about them. Though the graphs were presented on the Report Card tab, some parents appear to have overlooked them or not realized what was being provided. The issue of education and training on the various feedback tools, such as the graphs, is covered under the section on “Suggestions.”

- Parent: “I must have no opinion because I don’t recall the graphs.”

Coaching Notes

In regard to the coaching notes, parents were asked one key question:

1. “Did you find the coaching notes to be helpful?” [Options: Yes, No, Not sure, or Never used.]

While over half of the parents indicated that they found the coaching notes helpful, almost a quarter of parents said they had never used them. A subtheme emerged that provides some

insight into why parents found the coaching notes to be helpful, which was that the notes supported parent discussions.

Supported Parent Discussions

Several parents said that the coaching notes supported parent discussions. These parents described how they would review the coaching notes and that the notes helped them with coaching discussions.

- Parent: “I would read over those, those kind of gave me an idea of some phrases to use and some things to kind of help get the conversation started. Especially since I am not a driver instructor.”

Not Helpful

While no clear subtheme emerged for why parents did not find the coaching notes to be helpful, several parents cited reasons they did not like the coaching notes. Some examples mentioned by parents for why the notes were not helpful included the notes were canned (i.e., not specific to the situation), a bit obvious, too technical (read like a textbook), and parent advice was sufficient.

Comment Section

The Comment section was located next to the Coaching Notes tab in the Event Player. Parents were asked a series of questions about the Comment section during the interview:

1. “Did you write a comment in response to the Coaching Notes?” [Options: Yes, No]
2. “Did you find the ability to add your own comments in response to the Coaching Notes useful?” [Options: Yes, No, Not applicable]
3. “Do you think that the comments section should remain on the website?” [Options: Yes, No]

Over half of the parents said they did not write a comment in response to the coaching notes or were unsure if they wrote a comment. Those that did write a comment, liked the ability to be able to do so. There was almost unanimous agreement that a comments section should be available.

- Parent: “Yeah, I think there is always a reason that somebody may want to leave a comment.”

Two subthemes emerged in relation to the Comment section, Did Not Recall Comment Section and Feedback/Trigger Event.

Did Not Recall Comment Section

A few parents commented that they did not recall seeing the Comment section but would have found that helpful if they had known it was there.

- Parent: “I don’t remember that feature.... So I could’ve complained about it [event] then you are saying? That would’ve been nice to do.”

Feedback on Trigger/Event

There may have been confusion due to the wording of the question about the Comment section since it was described as being an avenue for responding to the Coaching Notes when in fact it was intended to be a way for commenting about the corresponding event in the Event Player tab. In retrospect, the question could have been better worded. A couple of parents did say they had used it as a means of providing feedback about triggers/events.

- Parent: “I provided feedback just on the fact that it had been triggered there, not on the notes.”

It should be noted that during the DCS, VTTI staff only responded to user comments if they were in need of some form of technical support or a system performance or maintenance issue was apparent from the content of the comment.

SUGGESTIONS

Throughout the interviews, there were times when participants would offer suggestions or provide insights into how the Driver Coach system could be improved. Participants were not prompted to provide suggestions, but they occasionally emerged over the course of exit interviews. Some of the suggestions that emerged included system education and training, an adaptable speeding trigger, and a longer installation period.

System Education and Training

Several parents indicated that they did not completely understand or were unaware of various aspects of the Driver Coach system. This seems to suggest that more education or training about the system and its features would have been helpful for some parents. Although the comments were similar—they indicated a lack of knowledge about some aspect of the Driver Coach system—in most cases there was not a consistent area mentioned by more than one parent. Most of the examples had to do with the real-time feedback, including needing more information on the various trigger types, trigger thresholds, and how the alerts would sound when they went off (to avoid startling the teen). Other parents wanted more information on what was available on the website (i.e., Comment section, graphs). These issues, as well as knowledge of graphs and the Comment section, are also covered in the Results section under Non-Video Feedback.

- Parent: “I think maybe the only other suggestion that I would have and maybe you did and I just missed it would be a little more information about the website. I don’t know if that was shared and like I said and I just missed it.”

Adaptable Speeding Trigger

A few parents commented on their desire for the speeding trigger to adapt to the current speed limit, not just trigger at 75 mph. This topic was also touched on earlier in the Results section under Speeding Trigger.

- Parent: “I’m more concerned as the parent about speeding in that middle of the road speed limit. So I would like to see the program address that. For example on a 35 mph road and they are going 45. That greatly concerns me. Not that high speed over 65, it does concern me. But I’m just saying the chances of them speeding around town is more in that middle range than it is over 65 is my feedback ...”

One parent took his/her suggestions about the speeding trigger a step further and said it would be helpful if the speeding trigger could also alert the teens if they needed to adjust their speed based on weather and darkness.

- Parent comment: “And if there was a way with alerts to help them understand that with weather or darkness in neighborhoods you need to go a little slower.”

Longer Installation

Finally, a couple of parents commented on how they wished they could have the system for a longer period. They did not want the system to be de-installed. A related comment came from a parent that was considering installing a monitoring system on the teen’s vehicle after the study ended. S/he was not suggesting longer installation of the Driver Coach system specifically but was considering installing a driver monitoring system. These comments were combined into a general suggestion for a longer period of driver monitoring in the teen’s vehicle.

- Parent comment: “I wish it wasn’t over. I wish it could go until they are 18.”
- Parent comment: “I’m actually thinking about getting one from my insurance company to put in the car when you guys pull it out.”

CHAPTER 4. DISCUSSION

The 22 transcripts that were analyzed for this study provide insights that may be used to inform the development of future monitoring systems. The analysis examined parent input on the real-time and non-video feedback, as well as suggestions parents had for improving the system. The aim of this study was to use this input from parents to provide guidance to developers of monitoring systems that use a combination of real-time and non-video feedback. To that end, the research team developed a list of key takeaways collected from the parent input. The list of key takeaways is by no means exhaustive. Developers may find other helpful information in the Results section to inform the development of monitoring systems. Also included in the discussion section is a list of lessons learned from the analysis process and opportunities for future research.

KEY TAKEAWAYS

The following are the key takeaways from this analysis that may support the development of real-time and non-video monitoring systems:

1. **Education and Training**

During the analysis, comments emerged related to the need for education and training. It may be beneficial to provide parents and teens with information and training on the various aspects of the system (e.g., trigger types, trigger thresholds, alert sounds/lights, location of website comments section, etc.) so that they can better utilize the feedback and monitoring tools available to them. For instance, parents and teens may be less frustrated with the lane crossing trigger if they understand that it will go off if a turn signal is not used even if there are no other cars around. Training can also help teens to become comfortable with the system (e.g., so they are less likely to be startled when they receive an alert). Finally, parents can be oriented to the location and purpose of the post hoc monitoring tools (e.g., graphs, coaching notes) so that they understand what is available to them and may be more likely to use the tools.

2. **Real-Time Feedback**

Many parents in this analysis said that the real-time feedback improved their teen's driving safety. All of the triggers, with the exception of fast start and lane crossing, received at least a 4 out of 5 safety rating on average from parents. A few parents in this analysis characterized the real-time feedback as a coaching tool that raised their teen's awareness of risky behaviors and allowed them to learn and adjust their driving behavior. Including real-time feedback as part of monitoring systems for teens allows teens to receive real-time input on risky behaviors when they are driving independently so that they can continue to learn and make adjustments. Making improvements to certain triggers (e.g., pegging the speeding trigger to the speed limit) would improve the monitoring system's effectiveness as a coaching tool.

3. **Notification of Post Hoc Feedback**

In this study, parents were prompted by the e-mail notification to visit the website to view events. Several commented that they would visit it immediately after receiving a notification. Notifications appear to be quite effective at getting parents (at least those

that desire to see the information) to review events and information related to their teen's driving behavior. Monitoring systems should include an e-mail or other form of notification when feedback is available.

4. **Informative Post Hoc Non-Video Monitoring Tools**

- **Graphs:** The graphs provided via the Driver Coach system appeared to be a lost opportunity for providing feedback. Several parents had no opinion about the graphs, had never used them, or did not recall there even being graphs. A few parents indicated that the graphs would have been helpful if there had been more data points (events) for them to extrapolate meaningful information about their teen's driving behavior. Non-video monitoring systems should include tools that can help parents interpret information regarding their teen's driving behavior.
- **Coaching Notes:** While several parents did not find the coaching notes to be helpful, others found them to be a helpful starting point for discussion. Developers of monitoring systems may want to include coaching notes that provide up-to-date information parents can use to coach their teens as they learn to drive independently.
- **Comment Section:** While many parents in this study did not use the Comment section, all but one parent said a comment section should remain available. Developers of monitoring systems will need to consider if enough resources are available to review and respond to parent comments. If not, having a comment section that is not reviewed may frustrate parents. If a comment section is included, it should be noticeable or pointed out to parents during system orientation.

LESSONS LEARNED

Several lessons were learned during the qualitative analysis that can inform future studies.

1. The Importance of Interview Design

In retrospect, a few of the questions in the interview script could have been better worded. For example, a question about the website graphs asked participants if they found the graphs to be informative, confusing, no opinion, or never used. The question was problematic because it referenced more than one issue but only allowed for one response. For instance, a participant may have felt the graphs were informative but also confusing.

Also, during the exit interviews, several parents said they logged in to the website when the database indicated they had not. While this finding did not impact the focus on how parents used the real-time feedback and non-video monitoring tools, it is a reminder of the importance of interview design. Researchers should be careful to structure interview instruments in such a way that participants do not hesitate to be candid about the use or non-use of a system they are testing if that usage was not mandatory.

2. The Value of Video

During this analysis, the focus was on real-time feedback and non-video monitoring tools. The focus was not on the video portion of the website. Yet during the analysis of the transcripts, the analyst noticed some issues that emerged which dealt with how parents used the video in ways

that would be difficult, if not impossible, with non-video monitoring approaches. A full analysis of this issue was not conducted, yet the themes the analyst saw seem worth noting. There appears to be real value in video, and non-video monitoring tools that can address these issues in some manner would be beneficial.

- a) Verification: Some parents mentioned the use of the video from the Driver Coach system as a means of verifying if a trigger was accurate. Several parents said the video and accompanying data had led them to conclusions about the perceived accuracy or inaccuracy of the trigger.
 - Parent: “I would look at the on-line video where she had crossed over maybe the white line on the outside or the center line, a little bit was too close to it. I found those to be very accurate.”
- b) Confidence: Some parents used the video to get confirmation on their teen’s driving behavior. For example, if a parent saw something their teen was doing that was not safe, it reduced their confidence. One parent mentioned seeing his teen texting while driving and as a result removed driving privileges. Conversely, some parents would watch their teen drive and feel greater confidence in their teen if they saw that they were focused on the driving task.
 - Parent: “Yeah, it made me feel safer as a parent, you know what I mean, okay birds-eye view she is okay, she is aware.”
- c) Coaching: Some parents mentioned using the video to coach their teen on a specific event viewed in the video. This was a primary intention of the Driver Coach system, that parents would watch the video with their teen and coach them on how to handle driving situations more safely.
 - Parent: “Well it is like when she almost hit the deer, I mean it was good to be able to go back and see what happened and then to be able to coach if something could’ve been done differently or not.”

Parent use of the video and accompanying data for these reasons raises the issue of how can non-video feedback tools address parents’ desire to verify trigger accuracy, gain confidence in their teen, and coach their teen on specific scenarios? This is an area for consideration and future research.

In closing, this analysis has provided the research team and hopefully future developers with input that may be used to inform the development of future monitoring and feedback systems. It may also inform the development of data collection tools (e.g., interview instruments) for future studies that include components about parental involvement and usage of monitoring tools.

FUTURE RESEARCH

While results of this study provided takeaways for developers of monitoring systems that provide real-time and non-video monitoring tools, the research team identified two avenues for potential

future research: development of non-video-based graphic tools and a comparison of parent involvement in video- versus non-video-based post hoc monitoring systems.

The first avenue for future research is the development of useful tools for non-video-based post hoc feedback. For instance, the research team could create an event summary table that could be included on a post hoc feedback website. If video feedback is not part of a monitoring system, parents would not be able to see the video clip or internal cab-related portions of the event summary (e.g., seat belt use, distractions, etc.). Yet some event summary information could be still be provided (e.g., vehicle speed, lateral and longitudinal acceleration values). Additional information could be gleaned in a manner that did not invade the teen's privacy if the system included a camera to collect a snapshot of the forward roadway at the moment the event is triggered. Such a snapshot could allow the parent to observe the context surrounding an event such as the lighting, weather, and possible location where the event occurred (e.g., near school).

Future research could also compare the usage of the Driver Coach website with a website that does not have video as part of the post hoc feedback to determine if the non-video feedback is used similarly to video feedback or not. Also, future research could be done on the interviews to determine how the parents were using the video portions of the website. A full review of the transcripts for video-related issues could be performed, as well as an examination of how those issues could potentially be addressed via non-video monitoring tools.

APPENDIX A. PARTICIPANT/PARENT E-MAIL

At the start of the study's feedback period, the following e-mail was sent to the parent participant (and teen, if applicable) that contained instructions, credentials, and a link to the VTTI-developed participant website.

Participant/Parent Name,

We have reached your teen's self-reported licensure date of DATE.

As a reminder, the Driver Coach system will provide an alert on the following driving behaviors, capturing approximately 15 seconds of video surrounding the event and securely uploading to a VTTI server:

- Lane Departure Warning
- Swerve
- Hard Braking
- Hard Cornering
- Sudden Acceleration
- Excessive Speed

The alert the system provides consists of:

- audio (tone + speech description of triggered behavior)
- visual (blinking light on system)

Below, please find the link to the Participant website, where you and your teen will be able to login and review video/data of captured driving events. Your site login credentials are attached to this email.

Participant Page: <https://LINK>

The Feedback website continues to be a work-in-progress, thus you will see significant changes in both appearance and functionality in the coming months. We appreciate your understanding and patience as we work to implement these improvements. Thank you for your continued participation in this important research study.

Please let us know if you have any questions or concerns.

Thank you,

APPENDIX B. PARENT VISITS AND TEEN C/NC RATES

The following tables includes the C/NC rates and login information for each participant included in this interview analysis. The first table is parents of teens with C/NCs and the second table is parents of teens without C/NCs.

Parents of teens with C/NCs.

Parent	Parent Visits	Teen CNC
1	23	1
2	17	3
3	15	2
4	11	2
5	8	1
6	7	3
7	7	1
8	5	1
9	4	1
10	4	2
11	3	1
Number (N)	11	11
Average (Mean)	9.5	1.6
Standard Deviation	6.39	0.81
Min	3	1
Max	23	3

Parents of teens without C/NCs.

Parent	Parent Visits	Teen CNC
1	45	0
2	27	0
3	19	0
4	17	0
5	14	0
6	13	0
7	11	0
8	10	0
9	9	0
10	7	0
11	6	0
Number (N)	11	
Average (Mean)	16.2	
Standard Deviation	11.29	
Min	6	
Max	45	

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