Educating Young Drivers in the Pacific Northwest on Driver Distraction

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ABSTRACT

This paper summarizes the outcome of an outreach project that examined the perception of distracted driving among high school and university students in the Pacific Northwest. The primary objective of the project was to identify secondary tasks that young drivers consider distracting and determine their self-reported engagement in those tasks while driving. An interactive demonstration was developed and administered to 2,378 drivers, from high schools and universities from four states Alaska, Idaho, Oregon, and Washington. The drivers responded to a pre- and post-survey administered immediately before and either immediately after or two weeks after the demonstration. The purpose of the survey was to measure the degree to which the interactive demonstration improved young drivers' perspectives regarding the hazards of distracted driving. Results were statistically significant for all type of distractions (manual, visual, and cognitive) at the combined high school and university student data. Indicating that as a result of the interactive demonstration, younger drivers were more likely to correctly identify different types of distracted driving.

INTRODUCTION

Many studies have identified the impact of driver distraction on road safety (1, 2, 3, 4, 5, 6). There are many types of driver distractions that involve a combination of manual, visual, auditory and cognitive components. Each can negatively impact drivers in terms of their ability to maintain lane position, speed, and eyes on the road (7, 8).

Younger drivers are particularly likely to engage in unsafe activities while distracted (9). They are shown to be more likely to be severely injured when involved in a crash when using a mobile device, talking to passengers, or otherwise engaged in other in-vehicle sources (10). There is a growing body of research that suggests that feedback can help mitigate young drivers' unsafe behavior so they can learn over time (11, 12). That is, younger drivers are not necessarily risk seekers, are unaware of the risks associated with certain behaviors. Gender is examined in the study presented in this paper given observed differences in past studies (13). Females tend to use cell phones more often while driving than males, and males look away from the road while driving when talking to other passengers in the vehicle (14, 15)

The effectiveness of feedback to young drivers is largely dependent on the context in which the information is provided, which can vary from real time (as the safety critical event occurs) to weeks or months after the distracting activity occurs (16). It was reported that although the majority of teenage drivers consider texting a distraction activity, they still text while driving (17). For young drivers who may not have encountered many unsafe distracting tasks, education in an interactive setting can be of great value in many ways. It can ensure that information is retained and processed (18), and can provide long-term safety benefits if integrated with other driver education programs (19). Surveys can be particularly helpful in capturing self-identified behavior that may not otherwise be observed (20).

Young drivers are more likely influenced by peers; information on unsafe driving behavior provided in a group setting could reap benefits that may not otherwise be realized if the information was available in isolation. Peer pressure therefore can have a positive impact when there is a model as well as positive reinforcement of good driving (21). In a group setting, interactive lecturing can also help increase attention and motivation among young drivers (22). Studies have shown that once students receive an effective lecture, their inherent enthusiasm and motivation for learning expands, clarifying and facilitate the acquisition of new information (23, 24)

This paper describes coordinated efforts across five universities to identify young drivers' perceptions of driver distractions in the Pacific Northwest and the effectiveness of an interactive demonstration designed to improve awareness of distraction among younger drivers. Hurwitz et al. (25) had previously developed and administered an interactive demonstration to 1,400 high school teenage drivers (14 to 18 years old) in Washington, Idaho, and Oregon. Results from 1,006 usable responses suggest that interactive demonstrations can positively increase their awareness of distracted driving. This study expands the number of participants and geographical areas in the region to include college students. The collaboration with ten high schools, five universities, and four states helps identify the broader implications of driver distraction among younger drivers.

2 METHODOLOGY

2.1 Study Population

Participants in this study were recruited from high schools and universities in Anchorage, AK, Corvallis, OR, Seattle and Pullman, WA, and Moscow, ID. Approximately 2,500 participants took part in the interactive demonstrations, and 2,378 returned the survey: 1008 were high school students (mean age=16.98, sd=1.31) and 1378 were university student (mean age=21.44, sd=5.68). There were 49% (n=494) males and 46.3% (n=467) females in the high schools. At the universities, there were 59.5% (n=814) male and 36.7% (n=503) female. High school participants reported driving an average of 4.71 days per week with a standard deviation of 2.50, and an average of 5.82 days per week for the university students with a 1.80 standard deviation. Years of driving experience for the high school students ranged from 0.37 years in Moscow (UI), to 0.74 years in Anchorage (Wasilla-UAA), to 0.77 years in Pullman (PHS-WSU), to 0.86 years in West Salem High School (WSHS), and 0.94 years in North Salem High School (NSHS). However, years of driving experience for university students ranged from 2.21 years in UW, to 2.98 years in Corvallis, to 3.68 years in WSU, to 4.39 years in Moscow (UI), and 6.03 years in Anchorage (UAA).

Participants were not individually compensated for their participation. However, a raffle for a $50 gift card was used to link pre- and post- survey responses, and ultimately thank the participants for their participation. Summary data for the university and high school participants are provided in Tables 1 to 4. The study was reviewed and approved by the Institutional Review Board (IRB) at each participating institution.

TABLE 1: University Participant Demographics

	OSU n (%)	UAA n (%)	UW n (%)	WSU n (%)	U of I n (%)	Combined n (%)
Total	188 (13.7)	678 (49.4)	177 (12.9)	98 (7.15)	229 (16.7)	1370 (100)
Grade Level						
Freshman	132 (70.2)	221 (32.6)	149 (84.2)	6 (6.12)	57 (24.9)	565 (23.8)
Sophomore	29 (15.4)	173 (25.5)	1 (0.56)	60 (61.2)	81 (35.4)	344 (14.5)
Junior	16 (8.51)	141 (20.8)	2 (1.13)	24 (24.5)	36 (15.7)	219 (9.21)
Senior	1 (0.05)	116 (17.1)	0 (0)	6 (6.12)	55 (24.0)	178 (7.49)
Type of License						
None	7 (3.72)	12 (1.8)	6 (3.40)	3 (3.06)	5 (2.2)	33 (1.39)
Permit	6 (3.19)	43 (6.3)	10 (5.65)	4 (4.08)	0 (0)	63 (2.65)
Provisional	44 (23.4)	15 (2.2)	19 (10.7)	13 (13.3)	0 (0)	91 (3.83)
Full	120 (63.8)	577 (85.1)	118 (66.7)	76 (77.6)	224 (97.8)	1115 (46.89)

TABLE 2: High School Participant Demographics

	NSHS n (%)	WSHS n (%)	Wasilla HS n (%)	Pullman HS n (%)	U of I HS Data n (%)	Combined n (%)
Total	350 (34.7)	140 (13.9)	35 (3.47)	112 (11.1)	371 (36.8)	1008 (100)
Grade Level						
Freshman	0 (0)	1 (0.71)	0 (0)	0 (0)	109 (29.4)	110 (10.9)
Sophomore	3 (0.86)	0 (0)	0 (0)	0 (0)	143 (38.5)	146 (14.5)
Junior	156 (44.6)	56 (40.0)	24 (68.6)	78 (69.6)	57 (15.4)	371 (36.8)
Senior	159 (45.4)	69 (49.3)	11 (31.4)	34 (30.4)	59 (15.9)	332 (32.9)
Type of License						
None	82 (23.4)	29 (20.7)	2 (5.71)	12 (10.7)	53 (14.3)	178 (17.7)
Permit	98 (28.0)	37 (26.4)	4 (11.4)	23 (20.5)	59 (15.9)	221 (21.9)
Provisional	46 (13.1)	23 (16.4)	3 (8.57)	51 (45.5)	97 (26.1)	220 (21.8)
Full	59 (16.9)	27 (19.3)	26 (74.3)	24 (21.4)	156 (42.0)	292 (29.0)

TABLE 3: University Participant Driving Experience

	OSU n (%)	UAA n (%)	UW n (%)	WSU n (%)	U of I n (%)	Combined n (%)
Drivers Education Training						
Yes	85 (45.2)	293 (45.8)	129 (72.9)	84 (85.7)	203 (88.6)	794 (58.0)
No	83 (44.1)	317 (49.5)	15 (8.47)	10 (10.2)	26 (11.4)	451 (32.9)
Not Yet	7 (3.72)	30 (4.7)	6 (3.39)	2 (2.04)	0 (0)	45 (3.28)
Crashes						
Yes	75 (39.9)	344 (53.0)	43 (24.3)	33 (33.7)	78 (34.1)	573 (41.8)
No	102 (54.3)	305 (47.0)	134 (75.7)	63 (64.3)	151 (65.9)	755 (55.1)
Moving Violations						
Yes	56 (29.8)	191 (30.4)	17 (9.60)	31 (31.6)	146 (63.8)	441 (32.2)
No	122 (64.9)	437 (69.6)	160 (90.4)	64 (65.3)	83 (36.2)	866 (63.2)

TABLE 4: High School Participant Driving Experience

	NSHS n (%)	WSHS n (%)	Wasilla HS n (%)	Pullman HS n (%)	U of I HS Data n (%)	Combined n (%)
Drivers Education Training						
Yes	26 (7.43)	29 (20.7)	8 (22.9)	88 (78.6)	322 (86.8)	473 (46.9)
No	175 (50.0)	63 (45.0)	22 (62.9)	11 (9.82)	12 (3.24)	283 (28.1)
Not Yet	69 (19.7)	15 (10.7)	4 (11.4)	10 (8.93)	28 (7.55)	126 (12.5)
Crashes						
Yes	73 (20.1)	14 (10.0)	13 (37.1)	34 (30.4)	114 (30.7)	248 (24.6)
No	236 (67.4)	107 (76.4)	22 (62.9)	76 (67.9)	219 (59.0)	660 (65.5)
Moving Violations						
Yes	9 (2.57)	1 (7.14)	3 (8.57)	3 (2.68)	173 (46.6)	189 (18.8)
No	296 (84.6)	121 (86.4)	32 (91.4)	107 (95.5)	198 (53.4)	754 (74.8)

2.2 Pre- and Post-Survey Content

A four-page pre-survey and one-page post-survey were used at each school. The pre- and post-surveys asked students to rate (on a seven point Likert scale) how distracting they perceived specific activities to be while driving. Data on general demographics such as gender, year in school, age, etc. and information on driving habits was collected through a series of self-reported questions including both distracting activities and tickets or warnings issued. Internal Consistency Method was conducted as an index of reliability (Cronbach's alpha 0.83) with good reliability.

Additionally, the pre-survey asked more specific questions about driving history and experience, license type and training, driving frequency and duration, and how often and when they and/or their parent engage in specific secondary tasks. The pre-survey took approximately 10-15 minutes to complete, while the post-survey took approximately 5-10 minutes.

2.3 Interactive Demonstration Content

The interactive demonstration was designed so that students with different learning styles would be exposed to a variety of evidence suggesting that many secondary tasks performed while driving result in distractions that significantly impair driving performance. Evidence included research outcomes, videos of naturalistic driving, static images, hands on demonstrations, and the use of inductive and deductive reasoning through extensive questioning. To promote a more interactive classroom environment, preplanned questions were used throughout the demonstration and two activities were included. One activity involved all student participants and the other activity involved several students at the front of the classroom. Table 5 presents the topics, the types of evidence presented, and the intended outcomes of the demonstration.

TABLE 5: Demonstration Components

Topics	Evidence Presented	Intended Outcome
What is transportation Engineering and human factors?	Figures and photos describing transportation engineering and human factors.	Students can describe different aspects of transportation engineering and human factors.
What constitutes distracted driving?	Video clips and photos of a bus driver engaged in multiple simultaneous distractions.	Students can identify distraction and its motor, cognitive, visual and audible components.
What is the impact of distracted driving?	Video clips of naturalistic texting, application of makeup, and tuning radio resulting in crashes. Research results of distraction of driver performance. Activities on attention and cognitive load.	Students are provided evidence of association between distracted driving and crashes is presented.
How do we quantify driver behavior?	Photos of instrumented vehicles, driving simulators, and data collection systems.	Students exposed to engineering research facilities.
How can we mitigate distracted driving?	Research results and photos from feedback studies.	Students exposed to how engineers solve problems.

An instructor's guide was developed to ensure consistency among all presenters. These notes included summaries of the major points to be communicated, the amount of time to be spent, and the expected student outcomes for each slide. A video recorded demonstration was also provided.

3 DATA ANALYSIS AND RESULTS

The analysis sought to examine a) the impact of the interactive demonstration, b) the effect of when the post-survey was conducted, c) difference in distracted activities between the high school and the university students and their level of involvement, and the d) role of gender, if any.

3.1 Interactive Demonstration

To visualize the impact of the demonstration on driver perceptions regarding the distraction of certain secondary activities, Likert scale graphs with the pre- and post-surveys were developed. Shifts in the percentages can provide evidence on student perceptions towards distraction. A paired t-test was conducted on data collected at each high school and university individually.

Figures 1 and 2 show the responses for the pre- and post-survey question, "which of the following activities you think is a distraction while driving," collected from predominantly freshmen at WSU and predominantly juniors and seniors at NSHS. The data from these locations is consistent with observations from other locations (26). Each distraction activity includes two rows of data, before (pre-survey) and after (post-survey). Again, these are based on a seven-point Likert scale from 1 (for no perceived distraction) to 7 (for highly distracting). Shifts towards the right in responses for each activity between the before and after data demonstrate an increase in the perceived level of distraction.

A variety of insights can be observed from Figures 1 and 2. The percent of neutral responses decreased after the interactive demonstration for nearly every activity. For example:

- Neutral responses for the, “other complex thinking” activity changed from 29% in the before survey to 16% in the post survey; a 13% reduction at WSU.
- For the percent of responses disagreeing that a secondary task is distracting decreased after the demonstration. Of the 14 activities considered, 9 had lower percent disagreements at WSU (p-value<0.05) and 14 had lower percent disagreement at NSHS (p-value<0.001).
- The percent of responses agreeing that a secondary task is distracting increased after the demonstration. This was consistent for all activities at WSU and NSHS.
- Daydreaming and other “complex thinking”, both of which can be considered cognitive distractions, showed larger pre- and post-survey shifts, 12 and 14 percent, respectively, than those activities associated with mobile devices.
- Tuning the radio, changing climate settings, and inserting/using CDs showed larger pre/post shifts than those associated with mobile devices.

The data observed in the responses from WSU and NSHS were similar with the other demonstration sites (26).

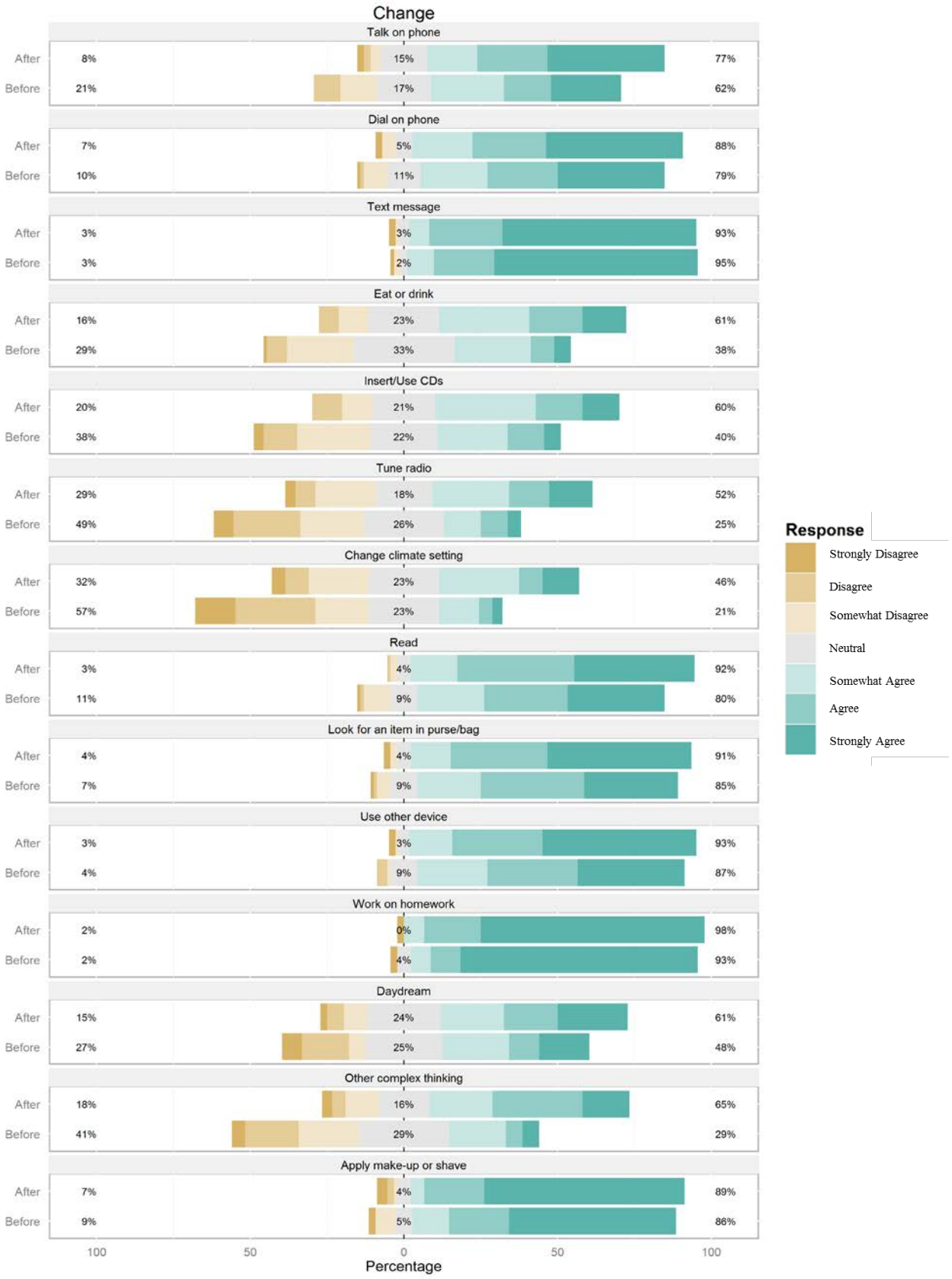

FIGURE 2: Responses to Distracting Activities in Pre- and Post-Survey at WSU

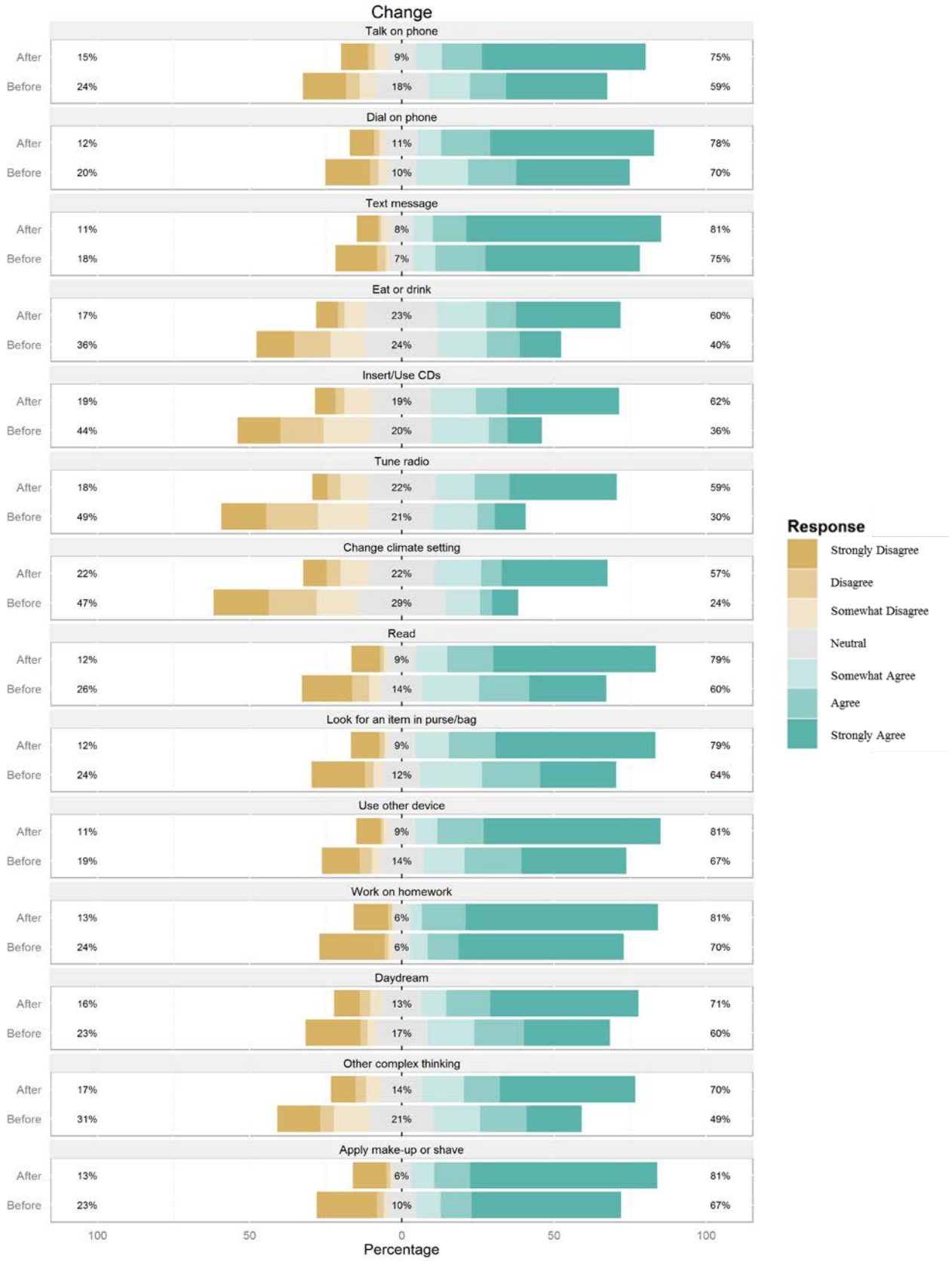

FIGURE 3: Responses to Distracting Activities in Pre- and Post-Survey at NSHS

Perceptions on driver distraction before and after the interactive demonstration for all high school and university students were examined using paired t-tests (Table 6). There were significant differences observed for 13 out of the 14 distracting activities ($p<0.05$); no differences were observed for "work on homework". This suggests that the interactive demonstration had a positive impact, and made drivers more aware of the distraction potential of many secondary tasks while driving for both high school and college students.

TABLE 6: Paired t-test result between the pre-post surveys of the student responses

Activities	High School		University	
	p-value	Mean of differences	p-value	Mean of differences
Talk on a mobile phone	<0.001	-0.484	<0.001	-0.401
Dial a mobile phone	<0.001	-0.428	<0.001	-0.262
Text message	<0.001	-0.277	<0.001	-0.213
Eat or drink	<0.001	-0.604	<0.001	-0.426
Insert/Use CDs or DVDs	<0.001	-0.686	<0.001	-0.509
Tune the radio	<0.001	-0.594	<0.001	-0.507
Change the climate setting (heat, air conditioning)	<0.001	-0.593	<0.001	-0.547
Read (map, printed directions, book, etc.)	<0.001	-0.567	<0.001	-0.329
Look for an item in wallet/purse/backpack	<0.001	-0.346	<0.001	-0.273
Use a device brought into the vehicle	<0.001	-0.286	<0.001	-0.203
Work on homework	0.002	-0.215	0.111	-0.093
Daydream	<0.001	-0.337	<0.001	-0.347
Think about something complex	<0.001	-0.533	<0.001	-0.520
Apply make-up or shave	<0.001	-0.316	<0.001	-0.194

3.4 Impact of Survey Latency on Participant Response

One pre-survey and one post-survey was collected at each school except for the OSU sample which had both an immediate post-survey and a two-week post-survey after the interactive demonstration. The two week interval was chosen because it has been found that drivers tend to poorly recall a dangerous driving situation after two weeks (16). The post-survey data was collected twice at OSU to evaluate how the responses of students changed over time. Figure 3 shows that participant agreement that the secondary activity, "Day dream" was a distraction was 60% before the demonstration, and 77% immediately after (p-value < 0.05), and 62% two weeks after 62% (p-value = 0.14). This pattern suggests that there was a meaningful impact immediately after the demonstration but the impact did not sustain two weeks after the demonstration, although it was still 2% higher than the baseline condition. Table 7 summarizes the outcome of the paired t-test on the OSU sample directly after the presentation, and two week after.

TABLE 7: Paired t-test result between the pre-post and two-week post survey results

Activities	OSU			
	Immediately after		Two weeks after	
	p-value	Mean of differences	p-value	Mean of differences
Talk on a mobile phone	<0.001	-0.903	0.004	-0.351
Dial a mobile phone	<0.001	-0.576	0.084	-0.218
Text message	0.002	-0.196	0.208	0.154
Eat or drink	<0.001	-0.971	<0.001	-0.533
Insert/Use CDs or DVDs	<0.001	-1.056	<0.001	-0.551
Tune the radio	<0.001	-1.282	<0.001	-0.564
Change the climate setting (heat, air conditioning)	<0.001	-1.282	<0.001	-0.545
Read (map, printed directions, book, etc.)	<0.001	-0.681	<0.001	-0.472
Look for an item in wallet/purse/backpack	<0.001	-0.687	0.14	-0.187
Use a device brought into the vehicle (mobile phone, iPad, laptop, etc)	<0.001	-0.581	0.563	-0.078
Work on homework	<0.001	-0.454	0.268	-0.157
Daydream	<0.001	-0.559	0.477	-0.097
Think about something difficult (complex problem, relationship, argument, etc.)	<0.001	-1.142	<0.001	-0.527
Apply make-up or shave	<0.001	-0.502	0.201	-0.167

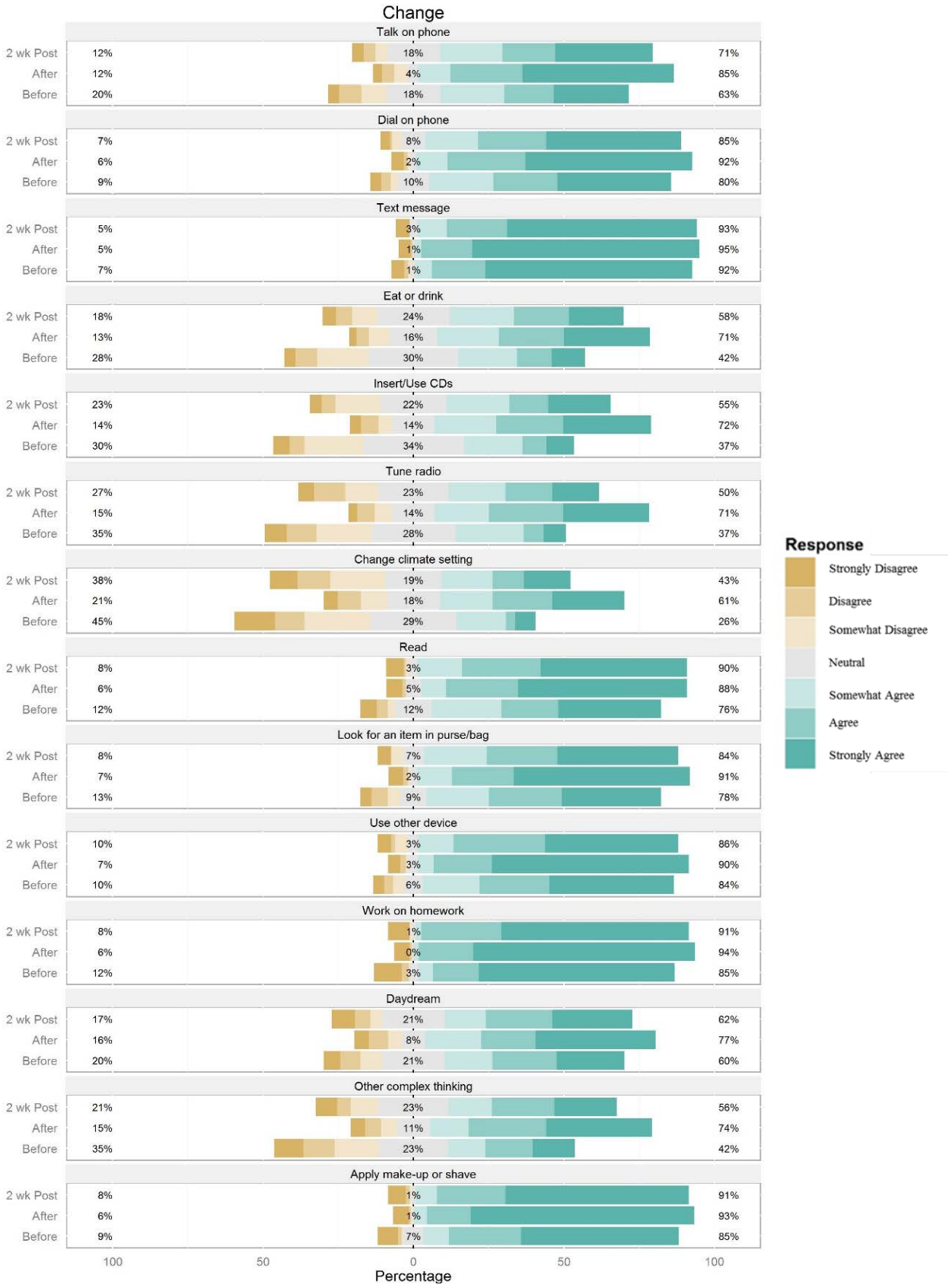

FIGURE 4: Responses to Distracting Activities in Pre- and Post-Survey at OSU

3.5 Distracting Activities

Students were asked to list other secondary tasks in which they commonly engaged while driving (Figure 4). Approximately 40% of the university and 24% of the high school participants indicated additional secondary tasks. It was found that almost 36% of university and 26% of high school respondents changed clothes or shoes while driving, followed by interacting with passengers, and singing and dancing. Other activities during driving included a variety of personal grooming tasks, experiencing road rage, and steering the vehicle (driving) with their knees.

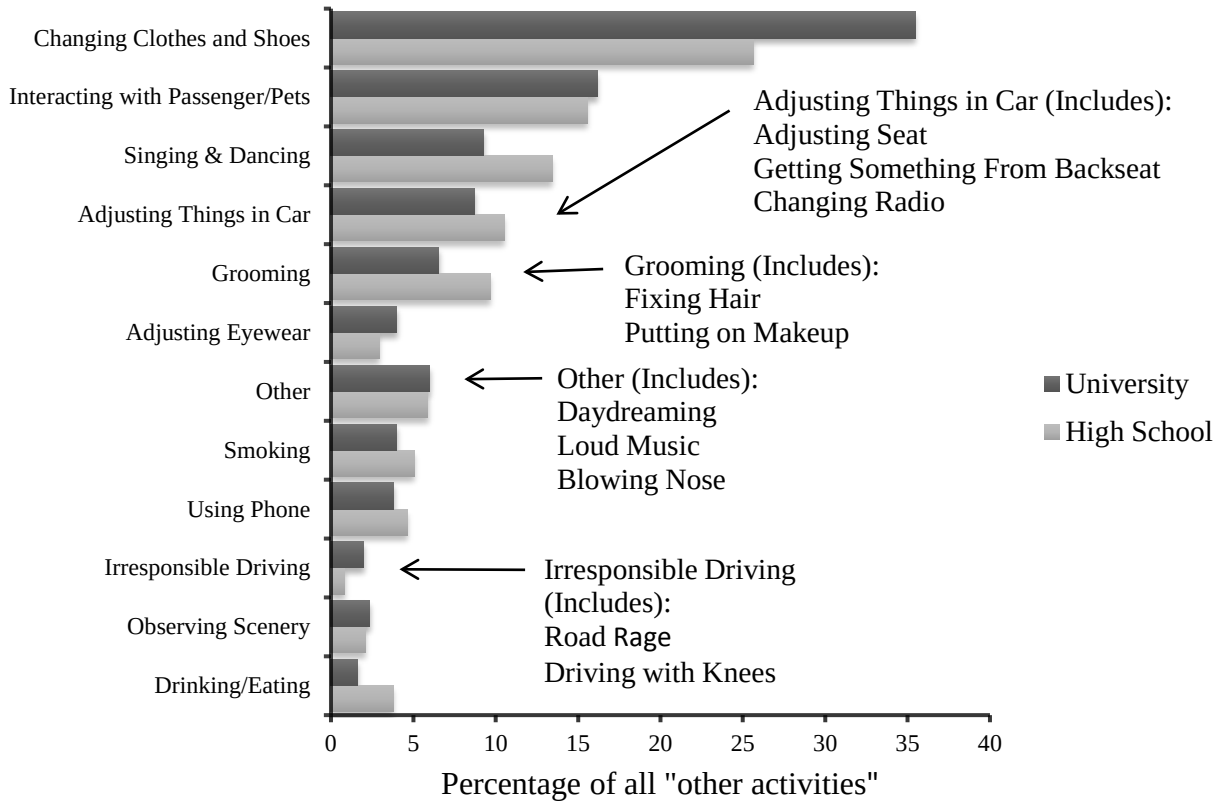

FIGURE 4: Other Distracting Activities during Driving

3.6 Level of Involvement in Secondary Activities for High School and College Students

Differences between high school and university students' self-reported frequency of involvement in secondary tasks while driving was also investigated. University students appear to be involved in distraction inducing activities more often while driving. Visual inspection of Figure 5 demonstrates that university students self-reported higher frequencies of secondary tasks while driving than high school students. A Likert scale ranging from never involving in distraction activity (1) to always being distracted (7) was used. For example, university student responses for the "talk on phone" activity shows a higher percentage (17%) of occurrence while driving than high school students (10%). This finding is consistent with previous studies (27) that suggests that as drivers with more experience are more inclined to engage in secondary tasks.

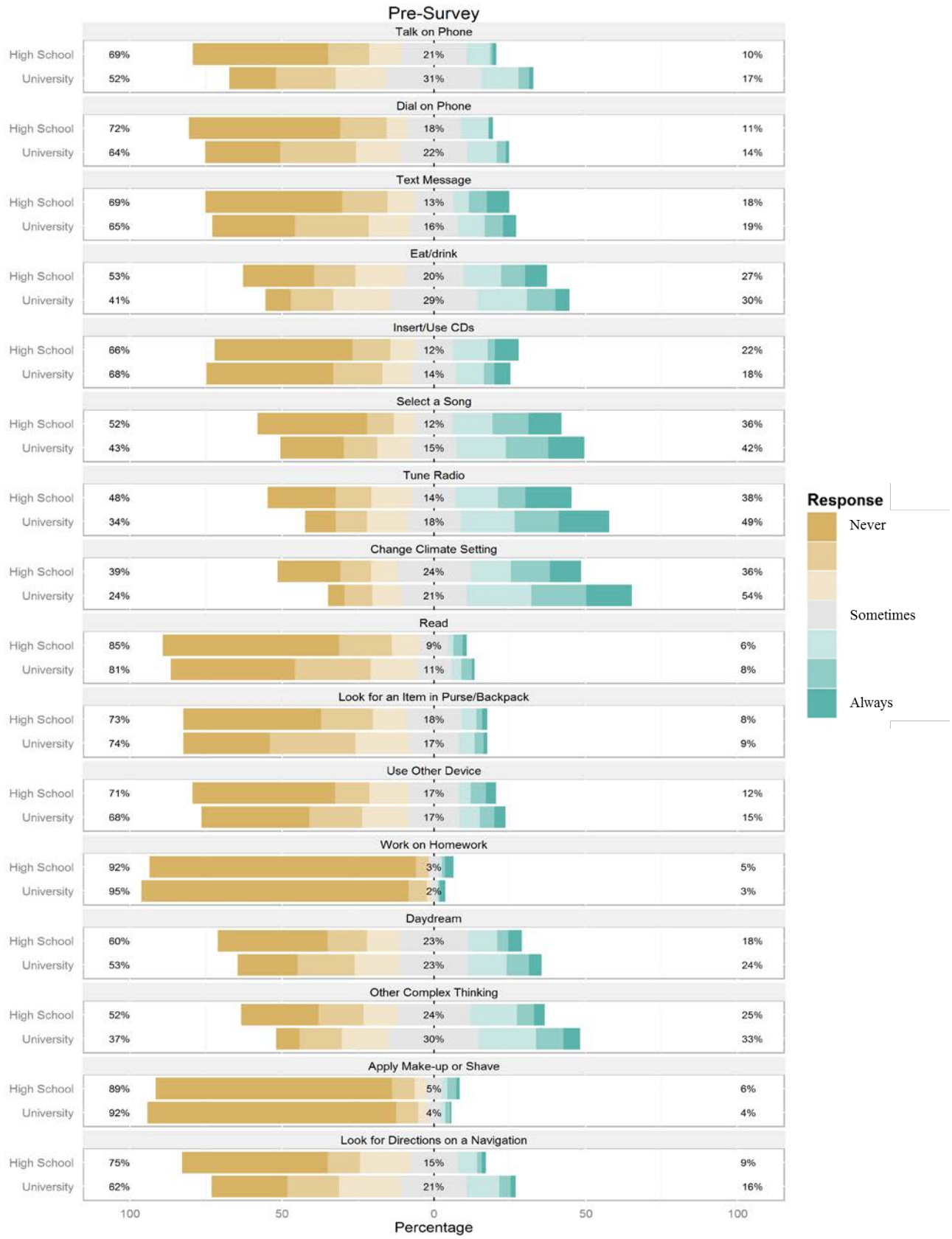

FIGURE 6: Reported Frequency of Distraction for High School (HS) & College Students (C)

3.7 Impact of Gender

Gender differences were examined using the question "which of the following do you think is a distraction while driving." The response variable ranged from +6 (much greater distraction) to -6 (much less distraction), while 0 indicated no change in perception. Scores were calculated by subtracting the pre-survey responses from post-survey responses for each student. Scores were then divided into three categorical dependent variables (positive, neutral, and negative) for data analysis. Accounting for the ordinal nature of the data, an ordered probit model was used to estimate the influence of gender on the effectiveness of the interactive demonstration (Table 8). The explanatory gender variable was coded as 1 for "female" and 0 for "male." The activities, eat or drink, insert/use CDs, and think about something difficult showed significant differences in perception among high school students, while change the climate, look for an item, and daydream were significant at the university level. There were differences in the perception of talk on a mobile phone, dial a mobile phone, text message, and day dream for both the high school and university data. This suggests that there were notable gender differences in the effect of the presentation. The positive estimate results indicate that females are more likely to perceive that an activity is distracting after the interactive demonstration than males. However, two of the activities (look for an item and work on homework) at the university level have a negative estimate, which indicates that males were more likely than females to consider these a distraction after the presentation.

TABLE 8: The impact of females' perceptions of distraction activities compared to males

Activities	High School		University	
	Estimate	**P-value**	**Estimate**	**P-Value**
Talk on a mobile phone	**0.312**	**0.001**	**0.215**	**0.003**
Dial a mobile phone	**0.398**	**<0.001**	**0.125**	**0.092**
Text message	**0.392**	**<0.001**	**0.136**	**0.073**
Eat or drink	**0.200**	**0.039**	0.073	0.325
Insert/Use CDs or DVDs	**0.294**	**0.003**	0.111	0.137
Tune the radio	0.106	0.282	-0.004	0.951
Change the climate setting (heat, air conditioning)	0.147	0.133	**0.173**	**0.021**
Read (map, printed directions, book, etc.)	0.133	0.176	-0.074	0.314
Look for an item in wallet/purse/backpack	0.053	0.590	**-0.168**	**0.022**
Use a device brought into the vehicle (mobile phone, iPad, laptop, etc)	0.020	0.832	0.025	0.735
Work on homework	-0.055	0.583	**-0.199**	**0.010**
Daydream	**0.275**	**0.004**	**0.222**	**0.002**
Think about something difficult (complex problem, relationship, argument, etc.)	**0.296**	**0.002**	0.070	0.330
Apply make-up or shave	0.131	0.192	-0.060	0.380

*The significance level is 0.10

Moreover, gender was also considered in the open ended question, "what other secondary tasks do you do while driving" (Figure 6). Most responses were consistent between male and

female respondents. However, it was nearly twice as common for a female to mention in the open ended question that personal grooming such as fixing hair and makeup took place while driving.

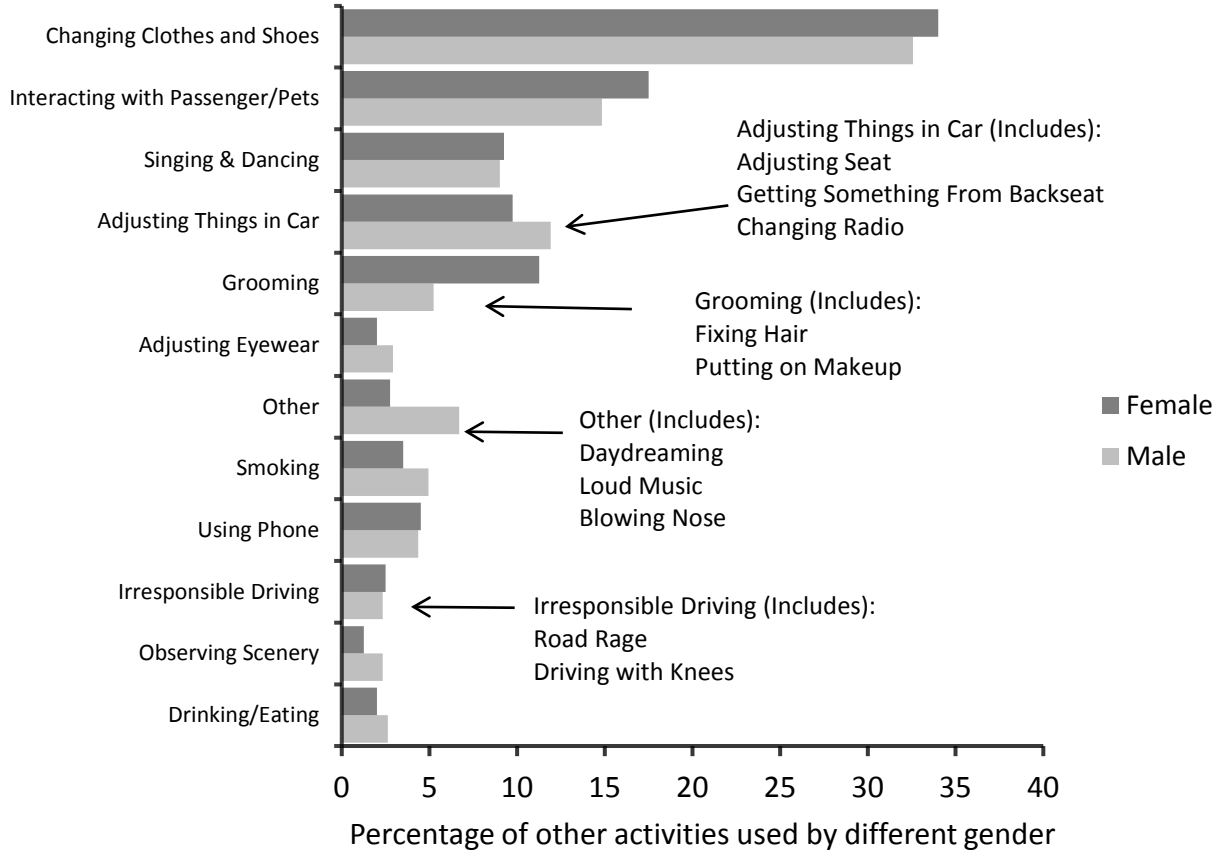

FIGURE 6: Male VS Female Responses for the Secondary Activities to all Students

CONCLUSIONS AND RECOMMENDATIONS

The paper presented the results of a coordinated effort across five universities in four states to examine perceptions of driver distractions among young drivers in the Pacific Northwest. The study was designed to examine the effectiveness of an interactive demonstration on driver distraction as an educational intervention for young drivers: high school and university students. Prior to participating in the interactive demonstration, a pre-survey administered to participants solicited questions about activities they performed while driving, their driving habits and vehicle operating patterns, activities they think constitute distraction to the driving task, and their demographics. After participating in the distracted driving interactive demonstration, a post-survey was provided for students to self-report questions regarding activities performed while driving and activities they think constitute distraction to the driving task.

The pre-and post-survey data showed that the percentage of neutral responses decreased after the interactive demonstration for nearly every activity. This suggests that the interactive demonstration generated a positive influence on young drivers' perceptions of distraction associated with involvement in secondary tasks while driving. The result of visual inspection was also confirmed by paired t-tests conducted on the aggregated high school and university student data.

The impact of the interactive demonstration was also clear in the post-survey data collected two weeks after the demonstration. Before the demonstration, participant agreement that the secondary activity, "Day dream" was a distraction was 60%, immediately after it was 77% (p-value < 0.001), and two weeks after it was 62% (p-value = 0.14). This pattern suggests that there was a meaningful impact immediately after the demonstration that, however, declined two weeks after the demonstration, although it was still 2% higher than the baseline condition.

Students reported doing quite a few things in their vehicle while driving. The results of the pre-survey show that almost 36% of university respondents and 26% of high school respondents changed clothes or shoes while driving. Interacting with passengers, singing and dancing, a variety of personal grooming tasks, and experiencing road rage were also commonly listed as secondary tasks while driving. There were considerable differences between high school and university students' self-reported frequency of involvement in secondary tasks while driving. This may be due to the incremental increase in university students' driving experience, resulting in a greater degree of multitasking comfort while driving.

There were notable differences in the amount of shift in perceptions resulting from the interactive demonstration. More specifically, females tend to shift more in agreement after the presentation compared to males. In the open-ended question, female respondents indicated personal grooming (such as fixing hair and makeup) twice as frequently as men.

The results of this study should be regarded with caution. A major study limitation is the fact that perceptions are not actions, and it is unclear how the perception will translate to real world behavior even though a strong correlation was observed between (27). Additionally, as the post-survey data was collected immediately after the interactive demonstration or two weeks after, it is unclear what the long-term impact will be. Hence, additional testing would be useful to capture the changes in behavior over time given such intervention programs. In general, interactive demonstrations on the impact of driver distraction can have a positive influence on young drivers.

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