

Golden State Water Company Analysis Report

2010-2014

Prepared by David Liu

ddliu@uci.edu

Do Not Circulate

## ABSTRACT

The present study utilizes survey data collected through Discovery Cube Orange County that captures leak checking in association with the Golden State Water Company (GSWC) program. Participants were recruited from different GSWC programs across Orange County across four years from 2010-2014. The 2010-2011 year has  $n=1599$  surveys collected, 2011-2012 year has  $n=1689$  surveys collected, 2012-2013 year has  $n=589$  surveys collected, and the 2013-2014 year had  $n=536$  surveys collected. The current research questions are (1) What are some issues in installing showerheads and faucets that participants have and (2) What is the effect of checking leaks on fixing a leak for participants? Participants had trouble installing shower head and faucet heads across 7 themes and are because they have had no time to install the aerators/shower head, plan on installing later, never received the aerator/shower head, trouble installing the item, it costs lots of money to install, do not know how to use it or what it is, or are moving, remodeling, have no shower or no need for the item. There is a decreasing trend on the percent explained by the indirect effect as time goes on. Moreover, a large percent of the effect of checking a leak to fixing a leak is not because of finding a leak. There is something else that is helping participants from checking the leak to fixing the leak but it is not just because they found a leak. There is a decreasing trend on the actual number of people fixing leaks explained by indirect. Less and less people are fixing leaks because checking for leaks helped them find a leak. Recommendations for future analysis are included.

## GSWC Report 2010-2014

**Present Study**

The present study utilizes survey data collected through Discovery Cube Orange County that captures leak checking in association with the Golden State Water Company (GSWC) program. This study has no experimentation or randomization and therefore cannot state any causal claims of Discovery Cube or Golden State Water Company outreach programs.

The current research questions are:

RQ 1) What are some issues in installing showerheads and faucets that participants have?

RQ2) What is the effect of checking leaks on fixing a leak for participants?

*Data*

Participants were recruited from different GSWC programs across Orange County across four years from 2010-2014. The 2010-2011 year has  $n=1599$  surveys collected, 2011-2012 year has  $n=1689$  surveys collected, 2012-2013 year has  $n=589$  surveys collected, and the 2013-2014 year had  $n=536$  surveys collected. The data set may not be representative of all students who participated in GSWC because it did not draw from all GSWC participants as a whole.

**Methods and Analysis Plan**

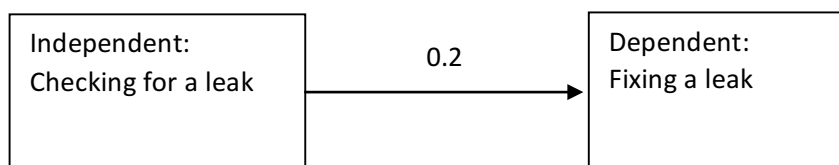
RQ1: I will be using qualitative methods and thematic analysis of the fill in the blank surveys from 2010-2011. During 2010-2011, participants had an option to fill in reasons why they had trouble installing showerheads and faucets.

RQ2: I will be using cross tabs and mediations models to understand the effect of checking leaks on fixing a leak for participants.

*Direct/Main Effect Model*

A direct effect is a model that shows what the direct effects between an independent and dependent variable (see Diagram A). The arrow shows the direction of the effect size and the number on top of the arrow is the effect size. Effect sizes are between -1 and +1. In Diagram A, the effect size of the independent variable on the dependent variable is 0.2. or in other words, the number of books read has a 0.2 effect size on SAT scores

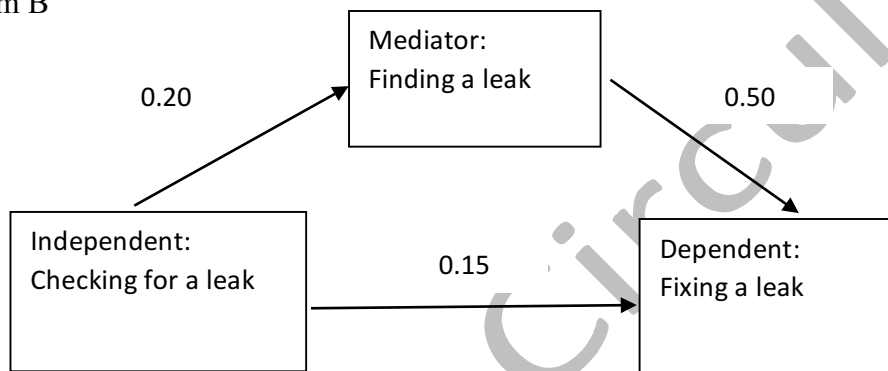
Diagram A



### Mediation Model

A mediation model shows the indirect effect of an independent variable and dependent variable (see Diagram B). It attempts to explain the underlying mechanism that occurs between the independent and dependent variable. That underlying mechanism or third explanatory variable is called a mediator variable. So in essence, the independent variable affects the mediator variable which affects the dependent variable. The total effect including the mediator variable is Direct Effect + Indirect Effect 1 x Indirect Effect 2. To calculate the total effect of the model we take the direct effect (0.15) and add it to the two indirect effects multiplied together ( $0.50 \times 0.20$ ). So the total effect of the checking a leak and fixing a leak accounting for the mediator is  $0.15 + (0.20 \times 0.50)$  is 0.25. The percent that is mediated by finding a leak is Indirect Effects divided by Total Effect, which is  $(0.20 \times 0.50) / 0.25$  or 40%. Finding a leak explains about 40% of the effect of number of checking for a leak on fixing a leak.

Diagram B



### Results

RQ1: The 2010-2011 GSWC survey allowed a fill in the blank free response for survey takers. Survey takers were allowed to fill in why they were not able to install the shower head or the faucet heads. Using inductive analysis and descriptive coding of the free response comments, the codes and sub-codes were created as well as operationalized (see Table 8 and 9 in Appendix). From there the sub codes from Table 8 and Table 9 were grouped together to form 7 themes (see Table 7 in Appendix) that cut across why survey takes had trouble installing shower head or faucet heads. Participants had trouble installing shower head and faucet heads because they:

1. Have had no time to install the aerators/shower head
2. Plan on installing later
3. Never received the aerator/shower head
4. Trouble Installing the item
5. It costs lots of money to install
6. I do not know how to use it or what it is
7. I am moving, remodeling, have no shower or no need for the item.

RQ2 On average the percent explained by the indirect effect is 23.73% for 2013-2014 (see Table 1), 32.39% for 2012-2013 (see Table 3), and 42.60% for 2011-2012 (see Table 5). There is a decreasing trend on the percent explained by the indirect effect as time goes on. Moreover, a large percent of the effect of checking a leak to fixing a leak is not because of finding a leak. There is something else that is helping participants from checking the leak to fixing the leak but it is not just because they found a leak. On average the actual number of people fixing leaks explained by the indirect is 35.59% for 2013-2014 (see Table 2), 43.33% for 2012-2013 (see Table 4), and 57.61% for 2011-2012 (see Table 6). There is a decreasing trend on the actual number of people fixing leaks explained by indirect. Less and less people are fixing leaks because checking for leaks helped them find a leak.

### **Plans for Future Research**

#### *Archiving Current and Future Programs*

Throughout the data preparation process, it was difficult to find the original surveys from 2010-2011 and 2011-2012. Due to the decreasing trend, the way the surveys were created from the earlier years may explained the higher percentages (survey layout, questions etc). Moreover, it is hard to be able to understand how the actual curriculum, presenters or materials from previous programs explain the higher percentages since there is no archives.

#### *Study Design*

It is recommended that there be a pre/post design administered with a comparable control group. Mediation models and cross tabs can be run to see if the program had any differences on fixing leaks or if merely just asking someone to check for leaks would help find a leak and fix a leak. The same survey would be administered to the comparable control group.

#### *Changes to Survey*

Below is the current item asking why participants have trouble installing showerheads, bathroom sink aerators and kitchen aerators (see Question 4 from current GSWC survey below)

Question 4. If you circled “No” above, choose one of the following reasons:

1. Already have high efficacy shower head(s)
2. Plan to install within the next two weeks
3. Plan to save for the future
4. Plan to give to a neighbor, family member or friend
5. Need help to install

The seven themes are grounded in the data from 2010-2011. The current GSWC reasons item do not reflect the seven themes that came across from the 2010-2011 survey. Based on the analysis from the 2010-2011 GSWC free response on why participants are having trouble installing, it is recommended that the answers for reasons for not installing to be changed. The current GSWC survey items for Question 4, 6, and 8 should be changed. The answer choices are recommended to be changed to:

1. Have had no time to install the aerators/shower head
2. Plan on installing later
3. Never received the aerator/shower head
4. Trouble Installing the item
5. It costs lots of money to install
6. I do not know how to use it or what it is
7. I am moving, remodeling, have no shower or no need for the item.

Do Not Circulate

### Appendix

**Table 1:** Effects of Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2013-2014

Area Checked	Direct Effect	Total Effect	Indirect Effect	Percent Explained by Indirect
Toilet Tablet 1	0.24	0.238	0.048	20.17%
Toilet Tablet 2	0.19	0.196	0.036	18.37%
Kitchen	0.14	0.192	0.052	27.08%
Bathroom 1	0.22	0.223	0.073	32.74%
Bathroom 2	0.2	0.256	0.056	21.88%
Bathroom 3	0.3	0.324	0.073	22.50%
Shower Tub 1	0.22	0.234	0.064	27.35%
Shower Tub 2	0.22	0.235	0.055	23.40%
Shower Tub 3	0.23	0.303	0.073	24.10%
Outdoor 1	0.23	0.303	0.073	24.10%
Outdoor 2	0.24	0.248	0.048	19.35%
Averages	0.221	0.250	0.059	23.73%
<i>N</i>	536			

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.  
Other areas asked to check for leaks.

**Table 2:** Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2013-2014

Area Checked	Total Response for Checked	Yes for Checked	Total Response for Leaks	Yes for Leaks	Total Response for Fixed	Yes for Fixed	Checked & Fixed a Leak	Check, found & fixed leak	Percentage Indirect (actual)
Toilet Tablet 1	449	274	442	66	272	87	55	19	34.55%
Toilet Tablet 2	362	184	341	48	220	65	32	13	40.63%
Kitchen	449	359	464	63	299	106	81	32	39.51%
Bathroom	485	356	455	79	284	100	79	36	45.57%
Bathroom 2	382	250	368	50	251	88	62	26	41.94%
Bathroom 3	318	197	300	35	227	77	57	21	36.84%
Shower 1	447	342	448	58	276	86	57	26	45.61%
Shower 2	335	226	339	28	230	64	58	15	25.86%
Shower 3	274	149	262	30	208	62	46	15	32.61%
Outdoor 1	426	263	405	38	262	71	52	13	25.00%
Outdoor 2	364	213	343	26	243	68	47	11	23.40%
Averages	390	256	379	47	252	79	57	21	35.59%
<i>N</i>	536								

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.

Other areas asked to check for leaks.

Percentage Indirect (actual) means the Checked, found, & fixed a leak (Indirect Effect) divided by Checked & Fixed a Leak (Direct effect). It is looking at the total number of people who checked and fixed a leak, to determine what percentage was because of finding a leak.



**Table 3:** Effects of Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2012-2013

Area Checked	Direct Effect	Total Effect	Indirect Effect	Percent Explained by Indirect
Toilet Tablet 1	0.19	0.194	0.064	32.99%
Toilet Tablet 2	0.24	0.254	0.054	21.26%
Kitchen	0.27	0.296	0.116	39.19%
Bathroom 1	0.23	0.237	0.097	40.93%
Bathroom 2	0.22	0.195	0.049	25.13%
Bathroom 3	0.21	0.149	0.084	56.38%
Shower Tub 1	0.17	0.175	0.065	37.14%
Shower Tub 2	0.19	0.177	0.047	26.55%
Shower Tub 3	0.22	0.226	0.046	20.35%
Outdoor 1	0.12	0.218	0.078	35.78%
Outdoor 2	0.2	0.252	0.052	20.63%
Averages	0.205	0.216	0.068	32.39%
<i>N</i>	589			

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.  
Other areas asked to check for leaks.

**Table 4:** Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2012-2013

Area Checked	Total Response for Checked	Yes for Checked	Total Response for Leaks	Yes for Leaks	Total Response for Fixed	Yes for Fixed	Checked & Fixed a Leak	Check, found & fixed leak	Percentage Indirect (actual)
Toilet Tablet 1	494	319	481	73	290	127	76	30	39.47%
Toilet Tablet 2	363	188	343	46	219	96	51	18	35.29%
Kitchen	535	397	402	91	280	125	99	51	51.15%
Bathroom	535	396	400	91	277	120	95	48	50.53%
Bathroom 2	405	275	297	56	220	81	60	25	41.67%
Bathroom 3	347	226	261	59	211	92	64	30	46.88%
Shower 1	519	368	379	77	271	105	79	36	45.57%
Shower 2	366	226	271	47	217	82	53	20	37.73%
Shower 3	314	181	240	41	198	74	47	19	40.42%
Outdoor 1	458	294	331	59	242	90	61	27	44.26%
Outdoor 2	379	219	264	49	211	74	48	21	43.75%
Averages	429	281	334	63	240	97	67	30	43.33%
<i>N</i>	589								

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.

Other areas asked to check for leaks.

Percentage Indirect (actual) means the Checked, found, & fixed a leak (Indirect Effect) divided by Checked & Fixed a Leak (Direct effect). It is looking at the total number of people who checked and fixed a leak, to determine what percentage was because of finding a leak.

**Table 5:** Effects of Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2011-2012

Area Checked	Direct Effect	Total Effect	Indirect Effect	Percent Explained by Indirect
Toilet Tablet 1	0.26	0.258	0.108	41.86%
Toilet Tablet 2	0.27	0.275	0.105	38.18%
Kitchen	0.32	0.248	0.108	43.55%
Bathroom 1	0.32	0.208	0.135	64.90%
Bathroom 2	0.29	0.225	0.115	51.11%
Bathroom 3	0.32	0.255	0.095	37.25%
Shower Tub 1	0.30	0.206	0.086	41.75%
Shower Tub 2	0.33	0.303	0.113	37.29%
Shower Tub 3	0.35	0.285	0.095	33.33%
Outdoor 1	0.38	0.119	0.054	45.38%
Outdoor 2	0.36	0.303	0.103	33.99%
Averages	0.32	0.244	0.102	42.60%
<i>N</i>	1689			

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.  
Other areas asked to check for leaks.

**Table 6:** Tablet Usage and Checking for Leaks to Find and Fix Leaks for 2011-2012

Area Checked	Total Response for Checked	Yes for Checked	Total Response for Leaks	Yes for Leaks	Total Response for Fixed	Yes for Fixed	Checked & Fixed a Leak	Check, found & fixed leak	Percentage Indirect (actual)
Toilet Tablet 1	1382	915	1347	287	717	361	245	144	58.78%
Toilet Tablet 2	1089	619	1018	195	360	160	97	53	54.64%
Kitchen	937	691	301	195	411	222	189	124	65.60%
Bathroom	925	670	299	200	406	223	189	125	66.14%
Bathroom 2	776	510	204	130	333	163	128	76	59.38%
Bathroom 3	663	412	165	98	308	150	111	58	52.25%
Shower 1	1478	1041	450	303	646	361	289	177	61.25%
Shower 2	1160	753	302	187	515	267	203	111	54.68%
Shower 3	962	567	253	156	467	248	176	87	49.43%
Outdoor 1	1388	900	399	260	623	345	281	162	57.65%
Outdoor 2	1167	715	312	198	522	283	217	117	53.92%
Averages	1084	708	459	201	483	253	193	112	57.61%
N	1689								

Notes. Toilet Table 1 and Toilet Table 2 asked the participant to use the tablets.

Other areas asked to check for leaks.

Percentage Indirect (actual) means the Checked, found, & fixed a leak (Indirect Effect) divided by Checked & Fixed a Leak (Direct effect). It is looking at the total number of people who checked and fixed a leak, to determine what percentage was because of finding a leak.

**Table 7.** Themes Emerged from Code Categories of Faucets and Showers 2010-2011 GSWC

Theme	Code Category from Faucets and Shower Comments 2010-2011
No Time	No time
Plan to Install	Procrastination
	Couldn't get to it
	Will get to it
Didn't receive	Don't have
	Never received
No need	Unnecessary
	Personal use
	Unneeded
Trouble Installing	Unsuccessful
	Didn't fit
	Need help
	Hardware
Financial	Financial
	Money
House issues	House issues
	No shower
Unfamiliar	Unfamiliar
	Personal
	Unaware

**Table 8.** Coding Framework for Shower Comments 2010-2011

Code Category	Sub-code	Definition	Example from Data
No time	No time	The survey-taker hasn't had time to install the shower head.	"Haven't had the time"
	Just received	The survey-taker has just received the shower head, so he or she hasn't had time to install it.	"I just received the shower head and has not had time to put it up just yet"
Unsuccessful	Attempted	The survey-taker attempted to install the new shower head, but ultimately failed.	"Couldn't get the shower head off"
	Need help	The survey-taker relies on a different person to help them install the shower head.	"Because I'm waiting for assistance for installation"
Unnecessary	No need	The survey-taker already has a shower head or found no need to replace it with a new one.	"Because we still have the ones of last year"
Procrastination	Plan to later	The survey-taker plans to install the shower head at a definite time in the near future.	"Planning to/No time yet but will"
	Put off	The survey-taker vaguely refers to a time in the future when they may or may not install the shower head.	"Not yet, but I will install soon!"
Unaware	Didn't know about it	The survey-taker is unaware of the new shower head.	"I don't know what it is"
	Conserve water	The survey-taker is unaware or misinformed of the uses of the shower head.	"Because we want to save water"
Didn't fit	Not compatible	The shower head was not compatible with the survey-taker's current shower holder.	"It wouldn't fit in it"
Personal Use	Didn't like it	The shower head did not match the survey-taker's personal preference.	"My wife didn't like it"
	Used differently	The survey-taker utilized the shower head for different, personal reasons.	"The Teacher said my daughter is doing an experiment with them"

Money	Low on budget	The survey-taker is not financially equipped to install the shower head.	"I don't have enough money to get or install it"
No shower	No shower	The survey-taker does not have a shower.	"We don't have shower"
Couldn't get to	Conflicted at the moment	The survey-taker is in a conflicted situation where installing the shower head is not possible.	"Shower is getting remodeled right now"
Never received	Never received	The survey-taker never received a shower head.	"My son left it at the computer lab"

**Table 9.** Coding Framework for Shower Comments 2010-2011

Code Category	Sub-Code	Definition	Example from Data
No time	No time	The survey-taker does not have enough time to install the faucet	“Haven’t had the time”
	Just received	The survey-taker has not had the chance to install the faucet	“Not yet, just received it”
Will get to it	Will install	The survey-taker plans on installing the faucet at a definite time in the near future	“Will install on Saturday”
	Not yet	The survey-taker is putting it off until later	“Not yet”
Unneeded	Already have	The survey-taker already has a water-efficient faucet	“Already have one installed”
	Don’t like	The survey-taker does not like the faucet	“Water flow was too low”
	Don’t want	The survey-taker does not want to install the faucet	“Because we didn’t want to”
Unfamiliar	Unaware	The survey-taker did not know that a water-efficient faucet exists	“Don’t know what that is”
	Unfamiliar	The survey-taker does not know enough about the purpose of the faucet	“Need more information”
Hardware	Incompatible	The new faucet is incompatible with the survey-taker’s faucets	“Not compatible with our faucets”
	Can’t remove	The survey-taker cannot remove their current faucet to replace it	“Old one is stuck”
	Doesn’t fit	The new faucet does not fit the survey-taker’s faucets	“Does not fit”
Need help	Difficult	The survey-taker does not know how to install the faucet	“Unknown how to put it on”
	Dependency	The survey-taker needs someone else’s help to install the faucet	“Waiting for my father to put it in. He is a plumber.”
Financial	Money	The survey-taker cannot afford to buy the faucet	“Because it’s a lot of money”
Don’t have	Didn’t receive	The survey-taker did not receive the faucet	“Do not have one”
	Lost	The survey-taker has misplaced the faucet	“My son left it at the computer lab”



Personal	Experiment	The survey-taker is using the faucet for an experiment	“Because my daughter is doing an experiment”
House issues	Moving	The survey-taker is moving	“Moving”
	Remodeling	The survey-taker is remodeling	“We are remodeling”
	Housing	The survey-taker does not own the home	“Live in an apartment”