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An Unexplored Direction in Solid Waste Reduction: Household Textiles and Clothing Recycling

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Abstract: *"Nearly 100% of all household textiles and apparel can be recycled" was the thesis for a recycling education program for Extension professionals attending a state meeting. Positive encouragement resulted in six additional presentations and pre-test/post-tests. One group received a follow-up survey after 3 1/2 months. After the educational sessions, awareness and perceived importance increased, and donating unwanted clothing to churches or charities became the preferred option, while discarding in the trash became the least desirable option. Extension professionals can engage consumers in a unique area of waste management. The resulting Extension fact sheet lends curriculum support.*

Introduction and Review of Literature

Educating consumer about ways to reduce solid waste may have a trickle up effect on corporations and government. In the last 22 years, the *Journal of Extension* has published two articles on recycling education designed to prevent pollution and reduce solid waste (Blaine, Mascarella, & Davis, 2001; Hammer, 1990).

Reducing solid waste includes properly disposing of unwanted household textiles and apparel. Consumers should not place unwanted textiles or apparel in the garbage because almost 100% of it can be recycled (Stall-Meadows & Peek, 2010; Textile Recycling, 2012). Yet solid waste disposal occurs with about half of the discarded textiles and apparel in the United States (Environmental Protection Agency [EPA], 2008). Researchers have stressed the importance of identifying ways to reduce the post-consumer textile and apparel waste being sent to landfills (Domina & Koch, 1997, 2002; Hawley, 2006a; Hawley, 2006b; Koch & Domina, 1999). Consumer education is a key to reducing waste (Koch & Domina, 1999; Morgan & Birtwistle, 2009). "There is a general lack of knowledge of how and where clothing is disposed of" (Morgan & Birtwistle, 2009, p. 196). Frame and Newton (2007) suggested the government and sustainable advocates work toward promoting proper textile disposal in order to reduce municipal solid waste.

Following these recommendations, the lead researcher toured a donation processing center and developed an educational seminar addressing textile and clothing recycling. The purpose of the study reported here was to determine the effects and success of a recycling education presentation immediately following the event and after a time lapse of 3 1/2 months.

Consumer Recycling of Waste

Consumers generally know to donate unwanted good quality clothing and household textiles to charities, give them to friends and family, or sell them at garage sales or in consignment shops. They are most likely to donate if the item is too small, only slightly worn, no longer desired, or out of fashion. American consumers donate approximately one-half of their discarded clothing to charities (EPA, 2008). Charities sell the donated items to fund operations or give the used household textiles and clothing to the needy. The lead researcher toured a donation processing center and saw dozens of donated comforters and bedspreads awaiting free distribution to local homeless people. Most of the donated clothing was sold in the charity's thrift store, but some may be shipped for foreign assistance.

While serving the needy and reducing solid waste are key benefits of donating textiles and apparel, the process of recycling also creates jobs for citizens. According to the Secondary Materials and Recycled Textiles Association (SMART), more than 500 recycling businesses employ about 17,000 workers in the U.S., and many of these workers are unskilled, handicapped, or marginalized (EPA, 2008; Textile Recycling, 2012). Additionally, the number of used merchandise stores totaled almost 18,000 (U.S. Census Bureau, 2002).

Unnecessary Solid Waste

Consumers may also give away apparel, sell it at garage sales or consignment shops, or use it as cleaning rags (Hawley, 2006a; Koch & Domina, 1997; EPA, 2008).

Unfortunately, an abundance of textiles are deposited in landfills and account for about 5.2% of a landfill's contents (Consumers & Green Advocates, 2012; EPA, 2008).

Every ounce of household clothing and textile items can be recycled in some way (Council for Textile Recycling, 1997; Hawley, 2006a). This supports the McDonough and Braungart (2002) Cradle to Cradle model of zero waste. According to the EPA website, "If all available means of reuse and recycling are utilized, the remaining solid waste that needs to be disposed of can be as low as 5%" (EPA, 2008). If the remaining 95% of textile solid waste can potentially be recycled and reused, it is near the sustainability ideal of the Cradle to Cradle model (McDonough & Braungart, 2002). When waste products are recycled into new products, they are cycled back through the economy and create new jobs for workers. With few exceptions, recycled textiles become valuable commodities in other markets, yet consumers lack awareness of the value of donating all unusable household items, regardless of the product's condition.

Based on the review of literature and the donation processing center tour, two research questions were developed. As a result of the educational session on recycling textiles and apparel:

1. What increase in knowledge occurred?
2. What changes in planned disposal behaviors occurred?

The next section describes the pre-test/post-test evaluation used to assess consumers' textile and apparel recycling knowledge and planned behaviors before and after a one-time educational session.

Methods

The six separate, but comparable sessions consisted of a 1-hour discussion of a textile and apparel recycling fact sheet and an electronic presentation rich in photographs. A total of 135 adults and eight children attended the Sustainability in Textiles and Apparel educational sessions. Only adults participated in the study, and 126 completed the pre-test and post-test surveys (96% female; 4% male). No other demographic data were collected. The six groups were: 1) attendees at a state FCS association meeting (N=19); 2) the first session at a county free fair (N=13); 3) the second session at the fair (N=11); 4) a senior level university class (N=60); 5) a university residence hall meeting (N=6); and 6) a church women's group (N=17). This methodology and instrument complied with the university's institutional review board.

The researchers administered a pre-test before each educational session and a post-test immediately following the session (Figure 1). Extension specialists have used variations on pre-test/post-test surveys to measure the impact of one-time, short duration workshops (Nielsen, 2011). The researchers administered a follow-up survey to group 4, the same class of university students (N=53), about 31/2 months after the initial educational session.

Figure 1.

Questions from Pre-test and Post-test

<p>On a scale of 1-10, how aware are you of the benefits of clothing and textile recycling? (One means you are not aware of any benefits, while ten means you are very aware of the benefits).</p>									
Not aware of any benefits			Aware of some benefits				Very aware of benefits		
1	2	3	4	5	6	7	8	9	10
<p>On a scale of 1-10, how important is clothing and textile recycling to you? (One means it is not at all important, while ten means it is extremely important).</p>									
Unimportant			Somewhat important to you				Extremely important		
1	2	3	4	5	6	7	8	9	10
<p>Insert the number beside the method, with 1 representing the most common method of disposing of this type of clothing, 2 representing the second greatest method, and so forth. Rank only the methods that apply.</p>									
<p>What do/will you do with your good condition clothing when you no longer want it?</p>					<p><input type="checkbox"/> Keep it at my home/make rags <input type="checkbox"/> Donate it to local church or charity <input type="checkbox"/> Throw it in the trash <input type="checkbox"/> Sell it <input type="checkbox"/> Give it to friends or family <input type="checkbox"/> Other (please list): _____</p>				
<p>What do/will you do with your worn out clothing when you no longer want it?</p>					<p><input type="checkbox"/> Keep it at my home/make rags <input type="checkbox"/> Donate it to local church or charity <input type="checkbox"/> Throw it in the trash <input type="checkbox"/> Sell it <input type="checkbox"/> Give it to friends or family <input type="checkbox"/> Other (please list): _____</p>				
<p>What do/will you do with your clothing that is too stained or faded to wear when you no longer want it?</p>					<p><input type="checkbox"/> Keep it at my home/make rags <input type="checkbox"/> Donate it to local church or charity <input type="checkbox"/> Throw it in the trash <input type="checkbox"/> Sell it <input type="checkbox"/> Give it to friends or family <input type="checkbox"/> Other (please list): _____</p>				
<p>What do/will you do with your clothing that is torn or has holes in it when you no longer want it?</p>					<p><input type="checkbox"/> Keep it at my home/make rags <input type="checkbox"/> Donate it to local church or charity <input type="checkbox"/> Throw it in the trash <input type="checkbox"/> Sell it <input type="checkbox"/> Give it to friends or family <input type="checkbox"/> Other (please list): _____</p>				

It is likely that by virtue of their attendance, some of the participants had an increased level of interest in sustainability. Although inferences to the larger population may not be

made from the statistics, a quantitative review of the data follows in the next section.

Results

Pre-test/Post-test Survey Data

To assess change in the participants' level of understanding of textiles and apparel recycling, the pre-test scores were subtracted from the post-test scores. A two-tailed dependent *t*-test (alpha level .05) was used to determine that there were significant improvements from the participants' pre-test or baseline levels to their post-test levels.

Table 1.

Questions 1 and 2 Summary and Paired Samples T-test, Pre-Test, and Post-Test (N=126)

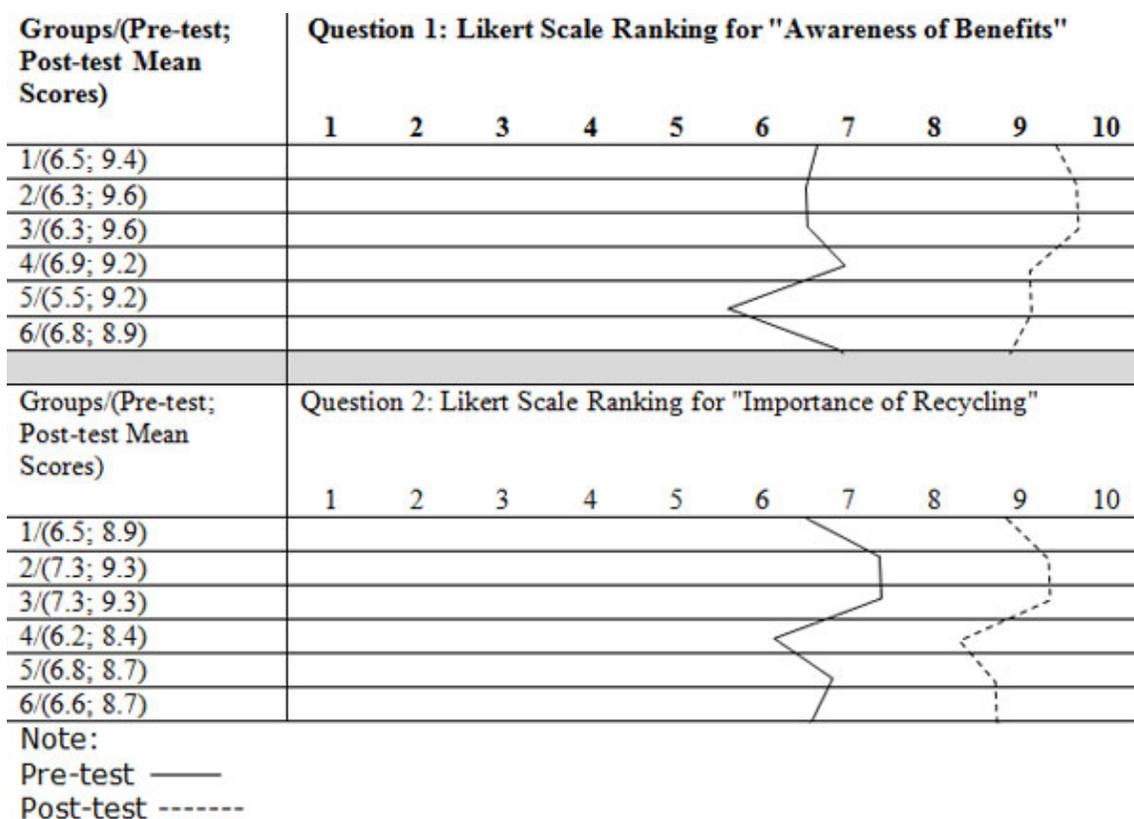
Questions	Mean Score	Standard Deviation	<i>t</i> -value	Two-tailed <i>p</i> -value	Standard Error of Difference
Pre-test Question 1	6.04	2.22	15.3699	≤.0001*	0.208
Post-test Question 1	9.24	0.96			
Pre-test Question 2	6.04	2.08	12.8717	≤.0001*	0.207
Post-test Question 2	8.70	1.18			
Note: * Significant at the .05 level					

Table 2 graphically illustrates the mean scores for the individual groups for the following questions:

1. On a scale of 1-10, how aware are you of the benefits of clothing and textile recycling? (One means you are not aware of any benefits, while ten means you are very aware of the benefits of clothing and textiles recycling.)
2. On a scale of 1-10, how important is clothing and textile recycling to you? (One means it is not at all important to you, while ten means it is extremely important to you.)

Table 2.

Mean Scores by Individual Groups from Pre-Test/Post-Test Questions 1 and 2



The survey asked what participants would do with clothing if it was: 1) in good condition, 2) worn out, 3) stained and faded, or 4) with holes and tears. The choices for disposal and the mean response for each choice are presented in Tables 3-6. Note: In the tables below, the higher mean response scores represent a lower preference. A lower mean score represents a greater likelihood to choose that particular disposal method. For example, a mean of 1.56 indicates the disposal method was more preferred than a mean of 1.84.

The data in Table 3 show that the current (pre-test) and planned (post-test) behaviors for disposing of unwanted, good condition clothing changed minimally after the educational sessions. Participants may have better understood the secondary market value of clothing that is in good condition and were least likely to trash these items.

Table 3.

Mean Scores for All Respondents Regarding Good Condition Clothing

Question: "What would you do with				
---	--	--	--	--

unwanted good condition clothing?"	Pre-test Mean Responses	Post-test Mean Responses	Post-test Rank	Increased/decreased likelihood of using disposal method
-Keep it at my home	2.97	3.75	5	Decreased
-Donate: church/charity	1.84	1.56	1	Increased
-Throw it in the trash	4.53	5.01	6	Decreased
-Sell it	2.95	2.33	3	Increased
-Give to friends/family	1.91	2.11	2	Decreased
-Make rags	4.58	3.64	4	Increased
Note: N=126				

The data in Table 4 show that the current and planned behaviors for disposing of unwanted worn out clothing. The ranking of "sell it" and "throw it in the trash" changed substantially after the presentations. These data indicate that the participants understood when the presenter stressed that almost 100% of unwanted textiles and apparel can be recycled.

Table 4.
Mean Scores for All Respondents Regarding Worn Out Clothing

Question: "What would you do with unwanted worn out clothing?"	Pre-test Mean Responses	Post-test Mean Responses	Post-test Rank	Increased/decreased likelihood of using disposal method
-Keep it at home	3.16	3.55	5	Decreased
-Donate: church/charity	1.75	1.22	1	Increased

-Throw it in the trash	2.36	4.90	6	Decreased
-Sell it	3.50	2.70	4	Increased
-Give to friends/family	2.91	2.39	3	Increased
-Make rags	2.55	2.38	2	Increased
Note: N=126				

The data in Table 5 show the current and planned behaviors for disposing of unwanted stained or faded clothing. Prior to the educational sessions, the participants may have lacked awareness that even stained or faded clothing can still have economic value to others.

Table 5.

Mean Scores for All Respondents Regarding Stained or Faded Clothing

Question: "What would you do with an unwanted stained/faded t-shirt?"	Pre-test Mean Responses	Post-test Mean Responses	Post-test Rank	Increased/decreased likelihood of using disposal method
-Keep it at my home	2.53	3.33	5	Decreased
-Donate: church/charity	2.06	1.12	1	Increased
-Throw it in the trash	2.04	4.62	6	Decreased
-Sell it	3.98	2.83	4	Increased
-Give to friends/family	3.39	2.66	2	Increased
-Make rags	2.33	2.68	3	Decreased
Note: N=126				

The data in Table 6 show a comparison of the current and planned behaviors for

disposing of unwanted clothing with tears or holes. The post-test scores showed that the participants were least likely to throw damaged clothing in the trash, while before the presentation, it was the most likely method selected. The presenter stressed the alternative uses for clothing that was too damaged to be resold in a charity shop.

Table 5.

Mean Scores for All Respondents Regarding Torn or Holey Clothing

Question: "What would you do with an unwanted t- shirt with tears/holes? "	Pre-test Mean Responses	Post-test Mean Responses	Post- test Rank	Increased/decreased likelihood of using disposal method
-Keep it at my home	2.42	3.29	5	Decreased
-Donate: church/charity	2.31	1.16	1	Increased
-Throw it in the trash	1.77	4.77	6	Decreased
-Sell it	4.18	2.98	4	Increased
-Give to friends/family	3.42	2.61	3	Increased
-Make rags	2.44	2.11	2	Increased
Note: N=126				

The "tears or holes" question resulted in the greatest variance of scores from the pre-test to the post-test. The option, "throw it in the trash" moved to last place, while "donate to church or charity" moved to first place after the educational presentation. These findings suggest that the participants understood the program emphasis: avoiding solid waste disposal and donating to charities.

Follow-up Survey Data

The researchers investigated retained knowledge about textile and apparel recycling after 3 1/2 months by administering a follow up survey to the original group of university

students (N=53) because of their continued accessibility. Means and independent samples t-tests were calculated. Table 7 shows mean score comparisons for questions 1 and 2 for all participants on the three questionnaires.

Table 7.

Questions 1 and 2 Means: Pre-test, Post-test and Follow-Up Survey

Questions	Mean Score Pre-test N=126	Mean Score Post-test N=126	Mean Score Follow-Up Survey N=53
Q1 (awareness of benefits)	6.04	9.24	7.96
Q2 (perceived importance)	6.04	8.70	7.53

Table 8 shows the follow-up survey mean scores compared to the pre-test and post-test mean scores. An independent samples t-test analysis with an alpha level set at .05 identified significant differences between scores after 3 1/2 months. First, the pre-test scores were subtracted from the follow-up scores; then the follow-up scores were subtracted from the post-test scores. Scores for questions 1 and 2 on the follow-up survey were lower than the post-test scores, but were still significantly higher than the pre-test scores. Although the convenience population and its small size prevent generalizability, these data suggest information retention.

Table 8.

Independent Samples T-Test for University Student Participants, August and November 2010

Question	Mean Difference	t- value	Df	Two- tailed p- value	Standard Error of Difference
Follow Up - Pre-test Q1	2.44	7.2665	110	≤.0001*	0.335
Follow Up - Pre-test Q2	1.36	3.8216	110	≤.0002*	0.357
Post-test -					

Follow Up Q1	1.23	4.7202	110	$\leq .0001^*$	0.262
Post-test - Follow Up Q2	.86	3.1085	110	$\leq .0024^*$	0.278
Note: * Significant at the .05 level.					

Conclusion and Implications

The unmet need for education on textiles and apparel recycling became apparent when the lead researcher presented a pilot workshop with pre-test and post-test to Extension professionals. They rated the topic as valuable; something they "need to know" (Loveridge, 1998). The feedback helped improve instrument readability and function, but the pilot workshop data were not included in the study reported here.

After the six educational sessions, donating to church or charity became the preferred disposal option, and throwing in the trash became the least desirable option. Consumers may exhibit greater sustainability if they consciously evaluate the consequences of their actions. The study demonstrated that consumer education positively influenced attitudes toward recycling. More exposure to textile and apparel recycling (beyond a single seminar) is needed to strengthen participants' perceived importance of the issue. Extension professionals and other outreach educators can offer multiple educational presentations, establish community programs that promote recycling, seek media coverage of recycling activities, or schedule a tour through a donation processing center. The researchers encouraged participants, many of whom were educators, to disseminate the sustainable information and opportunities to their constituents. Based on this research, a fact sheet was developed for the Oklahoma Cooperative Extension Services to provide educators with materials to disseminate and to encourage proper disposition of unwanted household textiles and apparel. The fact sheet is available at: <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-7411/T-4318web.pdf>.

The study reported here enhance the knowledge of Extension professionals in several ways:

- It provides a creative and unique programming aspect under the umbrella of solid waste reduction.
- It deals with the timely topic of sustainability, which is a current focus of organizations.
- It offers a pre-test-post-test survey technique to assess success of a recycling program about textiles and apparel.

- It increases awareness about this important topic among the journal readers.
- It offers a published fact sheet to help professionals develop curriculum.
- The first author offers access to the PowerPoint presentation to aid educators in teaching the subject matter.

The limitations for the study reported here included the available populations and the relatively small population for the follow-up survey. However, the substantial number of participants ranging from young to older adults provided a good cross section of consumers, so additional sessions may produce similar results.

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