Determining the Effects of a Food Carbon Footprint Training Tool on Consumer Knowledge, Transfer Intentions, and Environmental Self-Efficacy

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Introduction

- Tools to assess environmental (carbon) impact of food are limited and cumbersome
- Research is lacking that measures the impact of training people regarding the carbon impact (footprint) of foods

- We developed a web-based tool to assess the carbon footprint of food, a web-based training built around the tool, and a survey method to evaluate effectiveness

Background

- Consumers likely not to be aware of how their food choices impact the environment
- The environmental impact of food *production* varies considerably by food type
- *Supply chain* considerations are also important
  - How far food travels from producer to consumer
  - And what transport method is utilized
- Environmental impact is often measured by the amount of carbon dioxide (CO2) emitted

Kirkpatrick Training Evaluation Framework

- User Reactions
- User Learning
- User Behavior
- Outcomes

Hypotheses

- Using the training process and tool will significantly increase participants' post-training knowledge and environmental self-efficacy
- Participants will intend to use the knowledge they gained from the training and tool

Methods

- Pretest
  - Demographics, Knowledge, Environmental Self-efficacy
- Training
  - Carbonscope
  - Comparing food scenarios
- Post-test
  - Reactions, Knowledge, Env. Self-efficacy, Intentions to Use training

CarbonScope

- Interactive web-based software tool
  - www.cleanmetrics.net/carbonscope
- Users choose their location in the US, and then add food products from various US and overseas locations to a shopping cart
- Results show estimated carbon footprint and nutrition info for each product in the shopping cart

CARBONSCOPE

CarbonScope is an online tool that calculates the carbon footprints of a wide range of food products. It considers how the food was produced, processed, and transported to calculate the overall carbon footprint.

CarbonScope is based on the **best available data** (all peer-reviewed publications, including research papers, literature reviews, books, and encyclopedias) so it is an accurate decision-making tool for consumers. For more information, see the User Guide online.





ADDING ITEMS

Click on **ADD ITEM** to add foods to your shopping cart.

You can specify your **location** in the US

You can select your **food category**, a specific **product**, and a **quantity**.

You can specify the **source location** where the food comes from and **how** it was transported.

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CARBON FOOTPRINT

CLIMATE CHANGE

VIEW DEMO

LEARN ABOUT RESULTS

CarbonScope Calculations

- Calculates carbon footprints of a wide variety of food products
  - Meats, seafood, grains, vegetables, fruits, some processed foods
- Considers production, processing, packaging, storage, and transport up to a delivery point such as a retail store

CarbonScope Results

- Results can range from highly accurate analysis to quick estimates depending on the data content
- Current demo version includes production data for about 114 of food products
- Also includes energy and emissions analysis in food distribution networks

PLANT-BASED versus ANIMAL-BASED FOODS: RESULTS

What do you notice about the carbon footprints for the plant-based foods compared to animal-based foods?

Your US location:
Pacific (CA, OR, WA)

Number of Items: 6
Total Carbon Footprint: 18.63 Kg-CO2
Total Food Energy: 4050.56 Kcals
Total Proteins: 349.63 g

	Product	Qty	Units	Source	Transport	Dist	CO2	T-CO2	FoodEnergy	Proteins
Select	Orange	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	0.14	0.10	208.65	3.18
Select	Cucumber	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	0.13	0.10	68.04	2.95
Select	Oats	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	0.24	0.10	1764.47	76.61
Select	Beef - factory-farmed, frozen	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	14.99	0.10	1034.19	78.79
Select	Chicken, frozen	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	0.82	0.10	539.77	97.02
Select	Tilapia - farmed, frozen	1.00	lbs	Pacific (CA, OR, WA)	Road	1235.00	2.31	0.10	435.45	91.08

Delete Selected Item Delete ALL Items

Note: CO2 = total carbon dioxide (eqviv.) in Kg; T-CO2 = carbon dioxide from transport in Kg; Transport = transport mode for longest segment ('road' for other segments); Dist = total distance in miles; Food Energy in Kcals; Food Proteins in g.

CarbonScope Data Sources

- Data sources for energy use in food production include work by leading researchers:
  - David Pimentel (Cornell University)
  - Annika Carlsson-Kanyama (Royal Institute of Technology, Sweden)
  - Peter Tyedmers (Dalhousie University)
- Additional data sources include:
  - Energy in World Agriculture series (Elsevier)
  - Encyclopedia of Energy series (Elsevier)

Training Methods

- Short training designed using Adobe Captivate
- Training walks participants through various food scenarios using CarbonScope
- Specific learning goals are emphasized
  - Repetition
  - Hands on
  - What to notice
  - Summaries

FACTORY-FARMED versus WILD-CAUGHT SEAFOOD

Much seafood is raised commercially in fish farms. Let's compare **factory-farmed** seafood to **wild-caught** seafood.

If you want to follow along using CarbonScope add the following food items to your shopping cart:

1 pound factory salmon (seafood)

1 pound factory lobster (seafood)

1 pound of wild-caught salmon (seafood)

1 pound of wild-caught lobster (seafood)

Other info:

Food within: blank
Location: Pacific
Source location: Pacific
Transport mode: Truck

Survey Methods

- Participants: PSU students
- Pre- and post-training questions that capture:
  - Learning gains
  - Changes in environmental self-efficacy
    - The extent to which people believe that their individual behaviors can impact the environment
- Post-training questions that capture:
  - User reactions
    - To improve the training and tool
  - Intentions to transfer training
    - Use or apply the knowledge gained

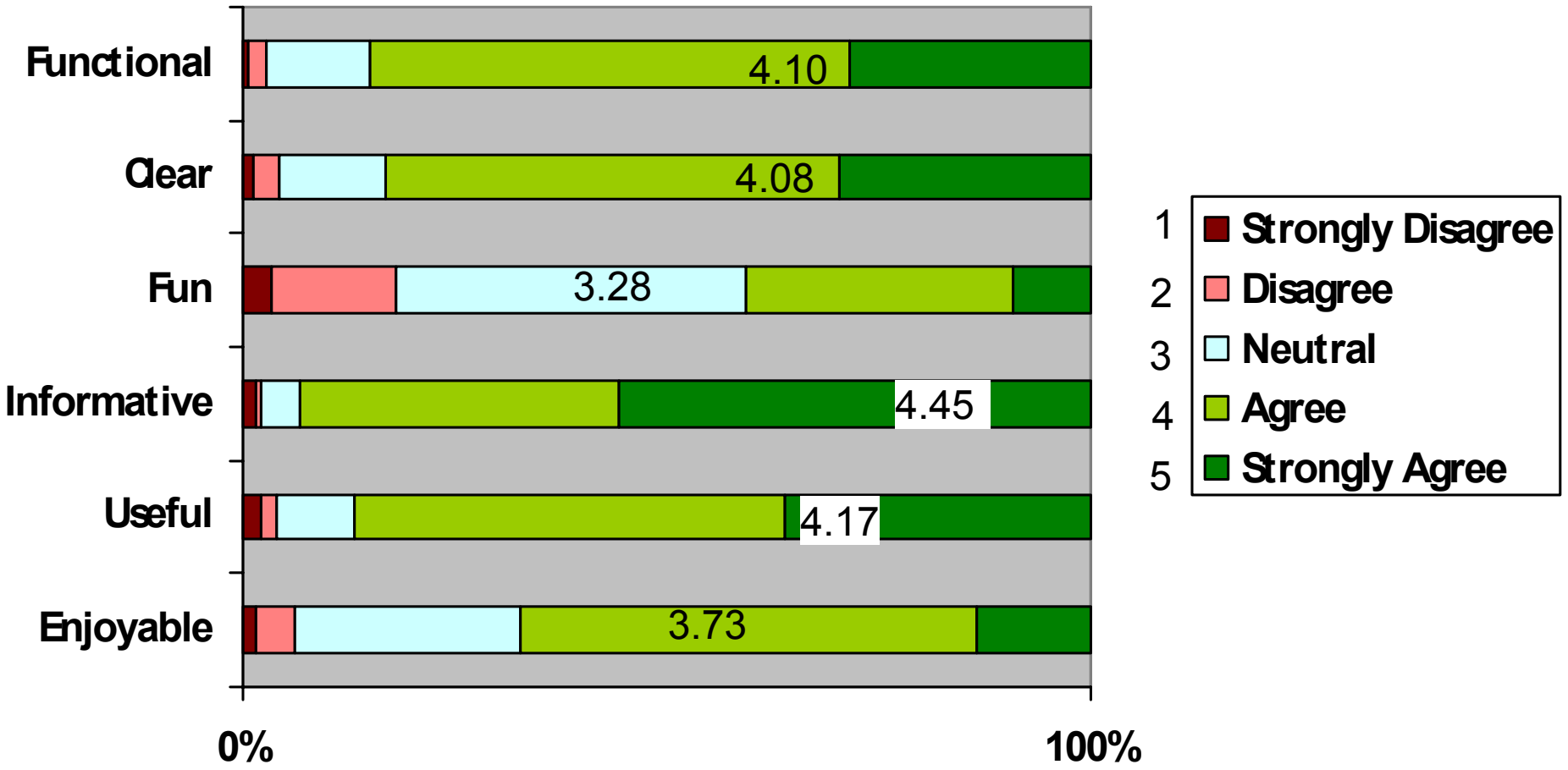
Results

- Pilot phase data gathering started 10/16/07 and will end 11/11/07
- Snapshot of the data collected through 10/30/07 is presented herein

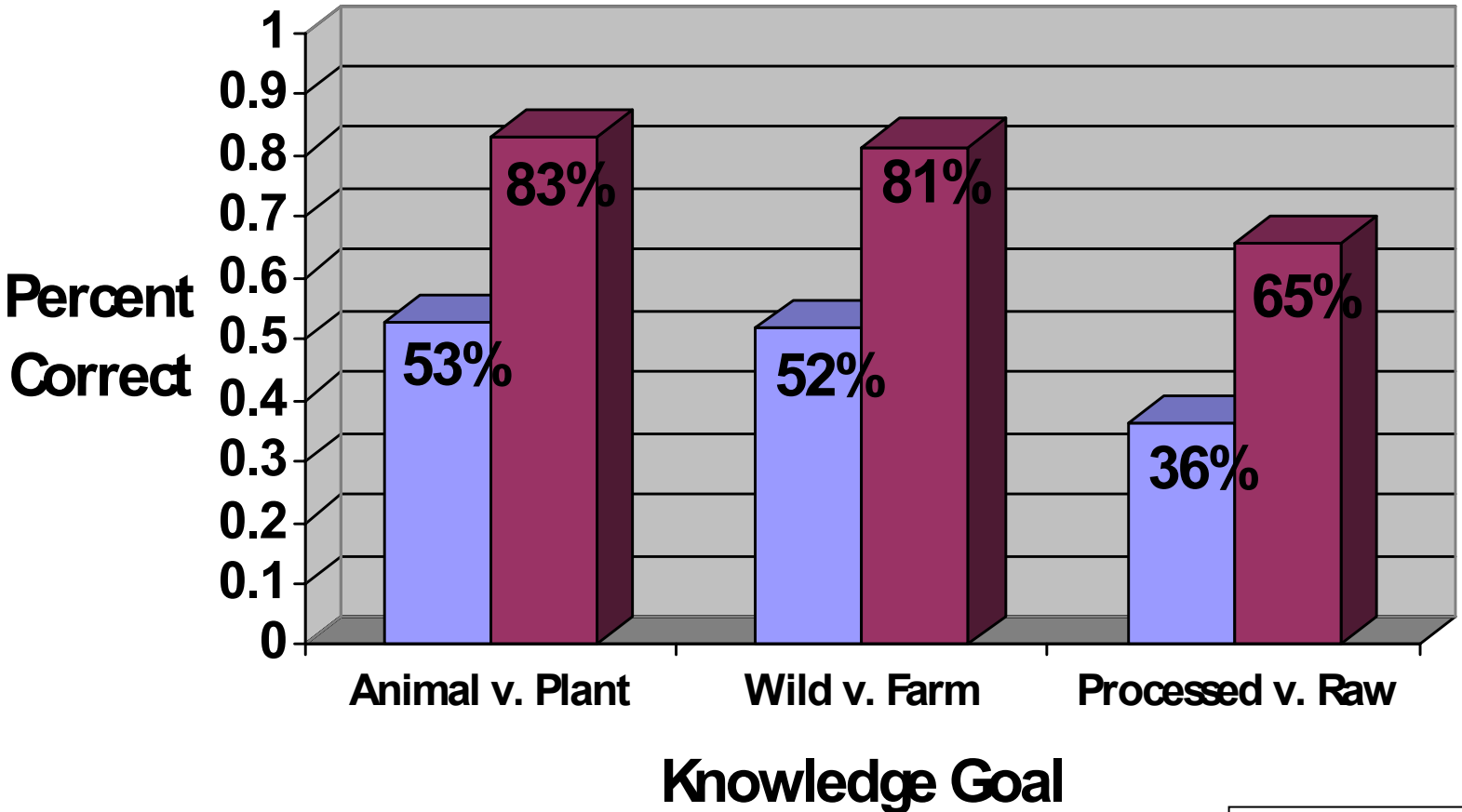
Sample Characteristics

- 268 students and faculty from public university in the Pacific Northwest region of the U.S.
- Ages: 16-50 years old (Mean=24.75, S.D.=6.81)
- 71.7% female
- 76.9% Caucasian, 11.9% Asian, 1.5% African American, 3.4% Other, 3% Hispanic, 2.6% Multi-racial/ethnic, .7% Native American/Pacific Islander
- 10.5% vegetarian
- .8% vegan

Evaluation: Reactions

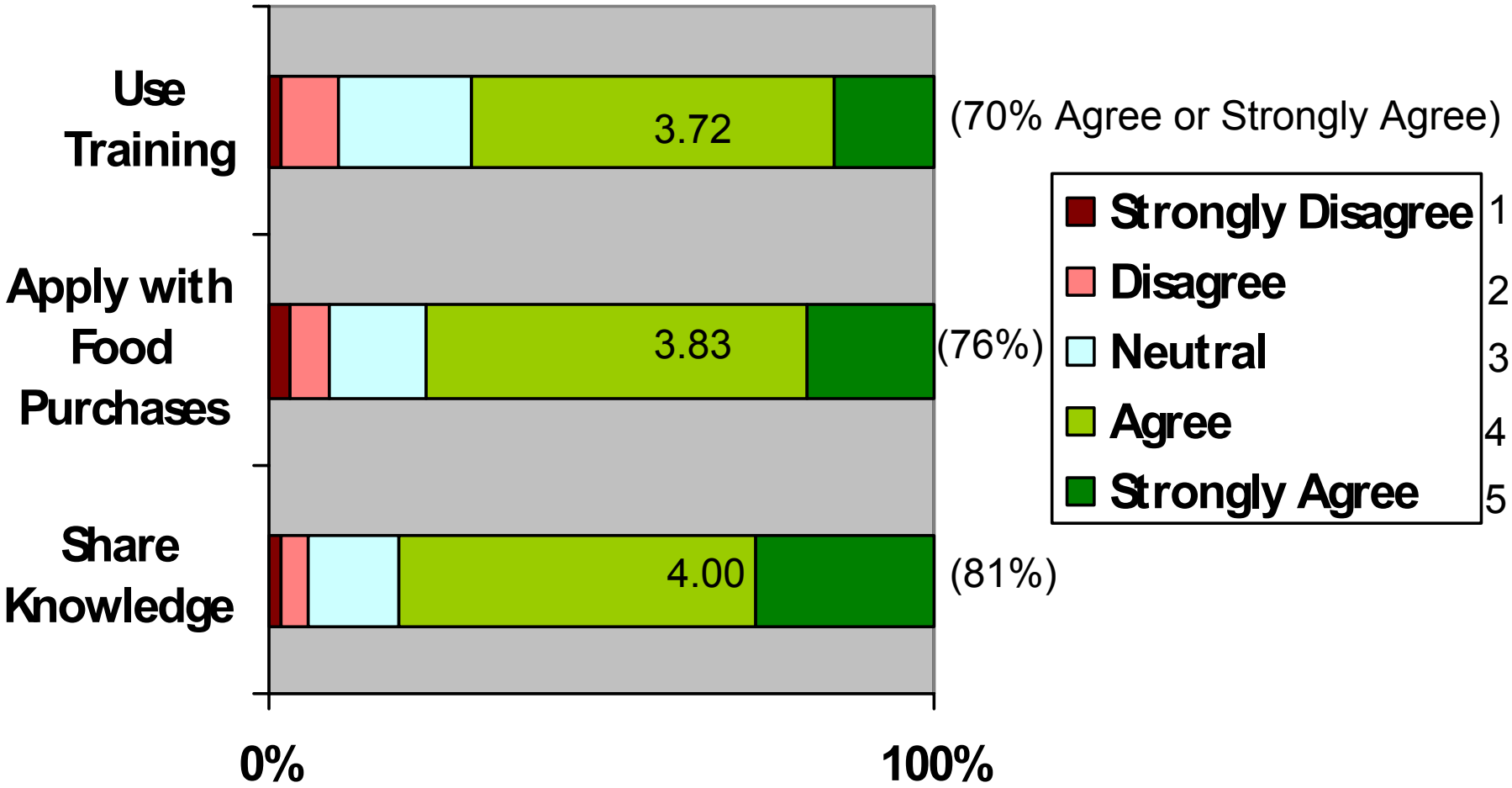


Evaluation: Learning

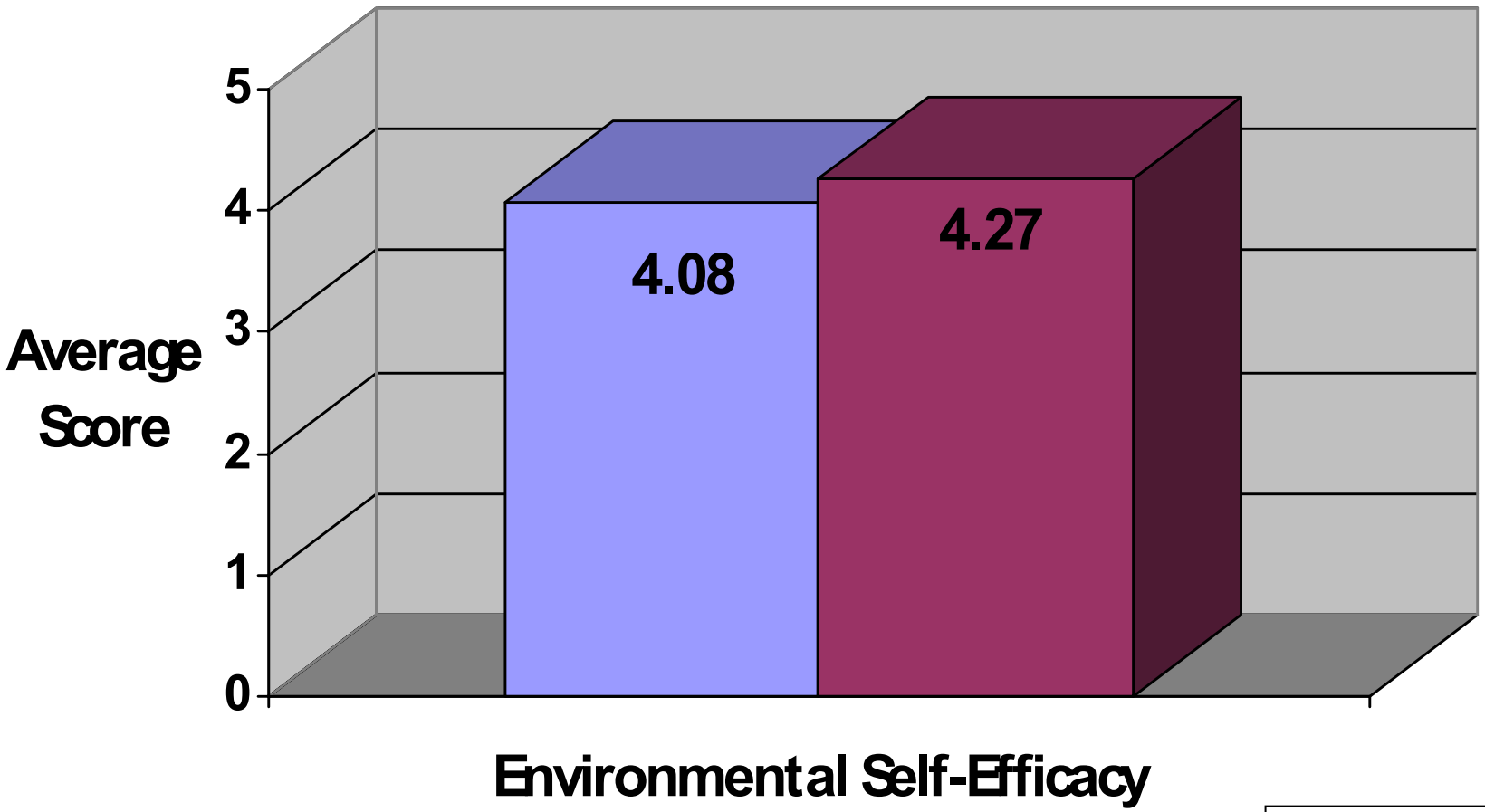


Paired Sample T-test
P<.001 in each case

Evaluation: Behavior (I intend to…)



Evaluation: Outcomes



Paired Sample T-test, $p < .001$

Discussion

- Participants generally reacted well to the training
- Participants offered constructive suggestions
- Effective tool for learning carbon impact of foods
- Participants intend to use the training
- Participants left with stronger beliefs that their actions impact the environment
  - Perception of the instrumentality of their food choices

→Promising approach to teach and motivate people to consider environmental impact when selecting foods

Contributions

- CarbonScope
  - Applies supply chain sustainability analysis to food
  - Includes energy requirements and environmental impact, of both production and supply chain
- Specific content information regarding the CO2 footprints of a variety of foods & supply chains
- Training process to teach carbon impact of food
- Explicit measurement of the impact of the training and tool
  - Knowledge gains
  - Behavior intentions
  - Outcomes (change in beliefs)

Study Limitations

- Generalizability of results?
  - 72% female, 77% Caucasian
- Potential biases:
  - Sample bias: University sample, “environmentally conscious” student body
  - Response bias: environmentally-concerned people are more likely to participate
  - Acquiescence bias: tendency to agree with survey items
- Access to information: requires computer literacy, proficiency in English
- Follow-up questionnaire was directly after training
  - How long will knowledge be retained? Real attitude change?
- Behavioral *Intentions* measured, but will people actually change their behaviors?

Future Plans

- CarbonScope:
  - More foods: beverages, processed foods, …
  - Finer grain distance calculations
  - More accurate farm production figures
  - Recipes
- Food carbon training:
  - Nutritional considerations — Fun factor
- Grant proposal to expand the study
  - Build on preliminary results
  - Broader, larger study population
  - Richer training process

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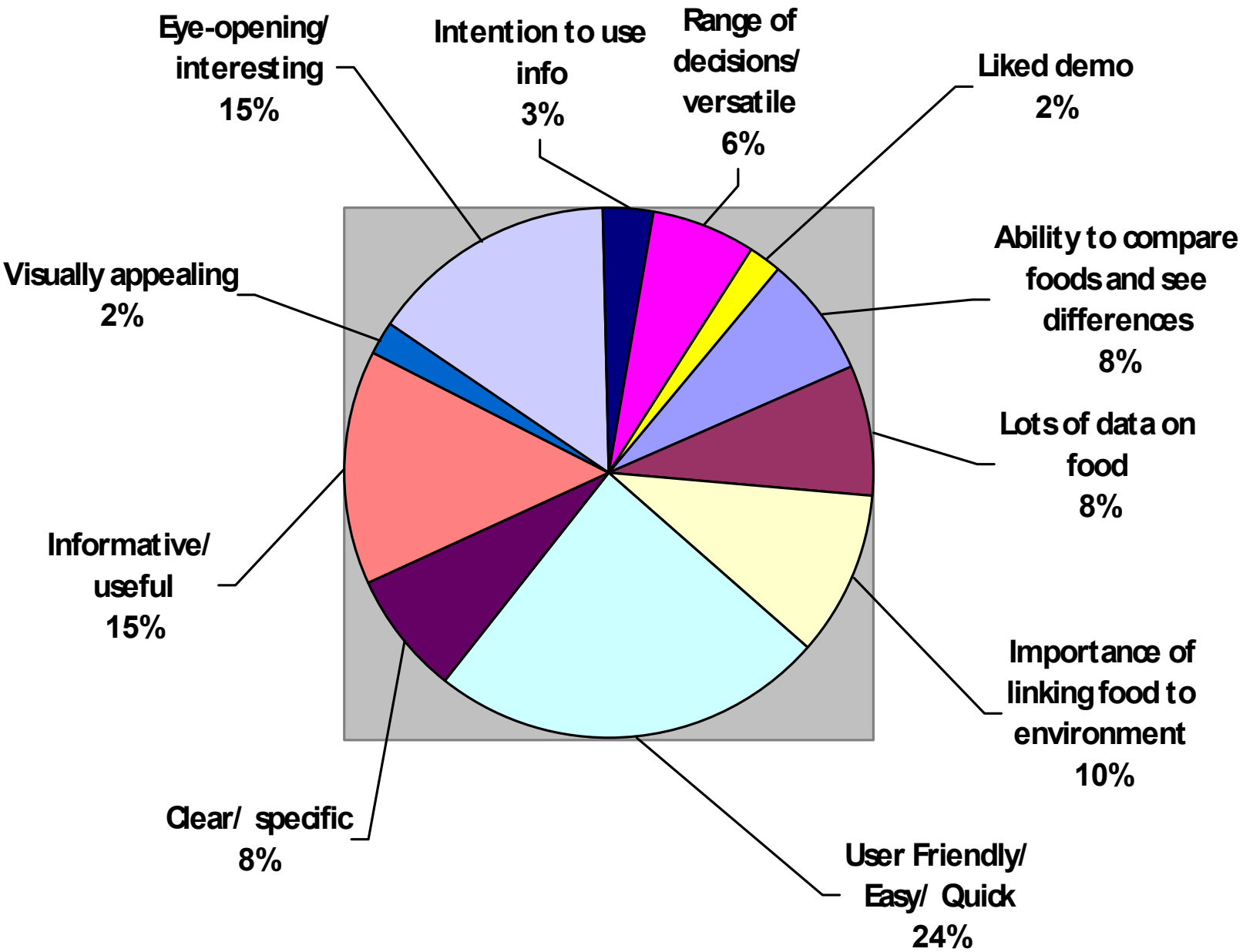
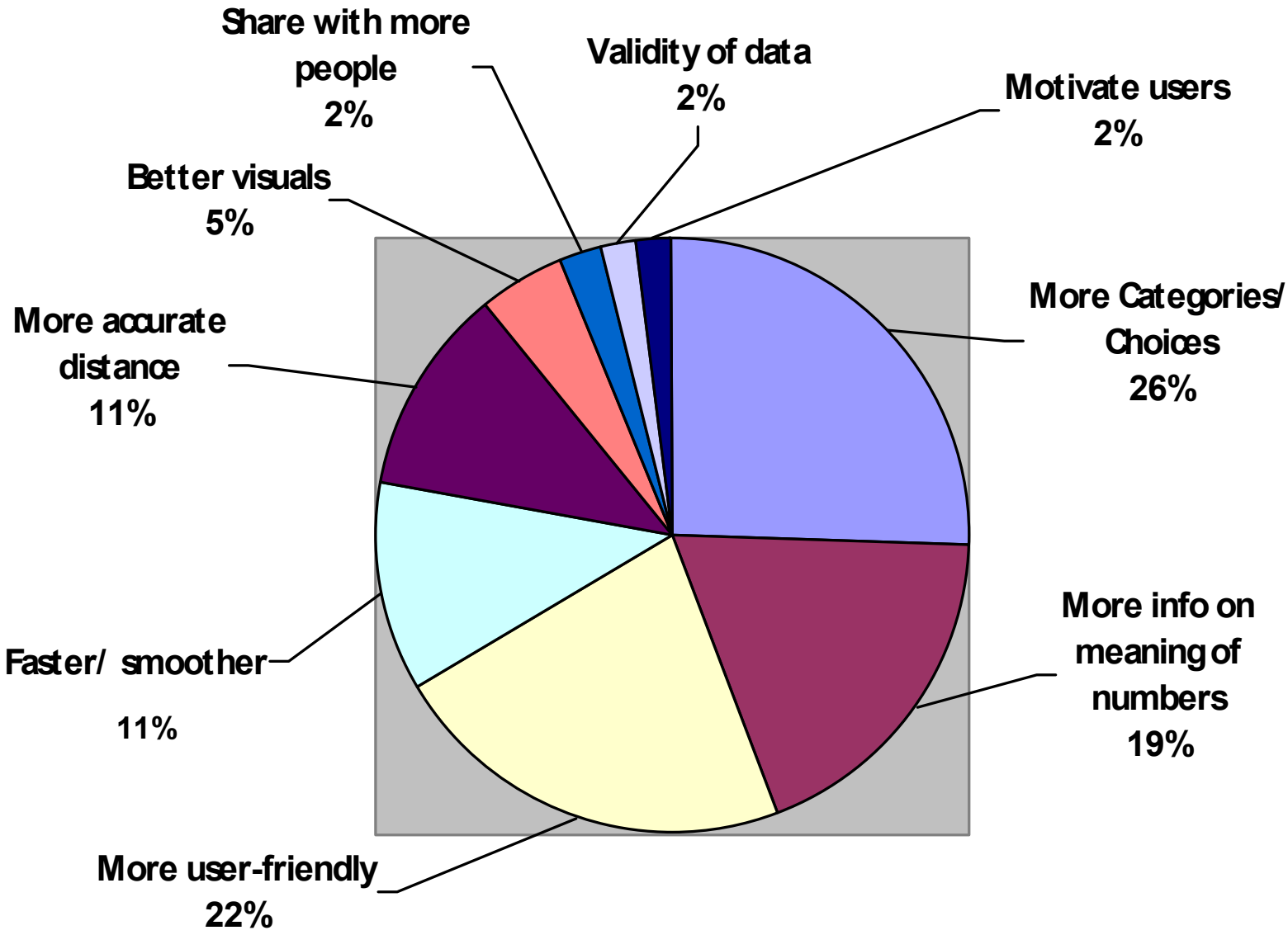
Participants' Qualitative Reactions/Suggestions

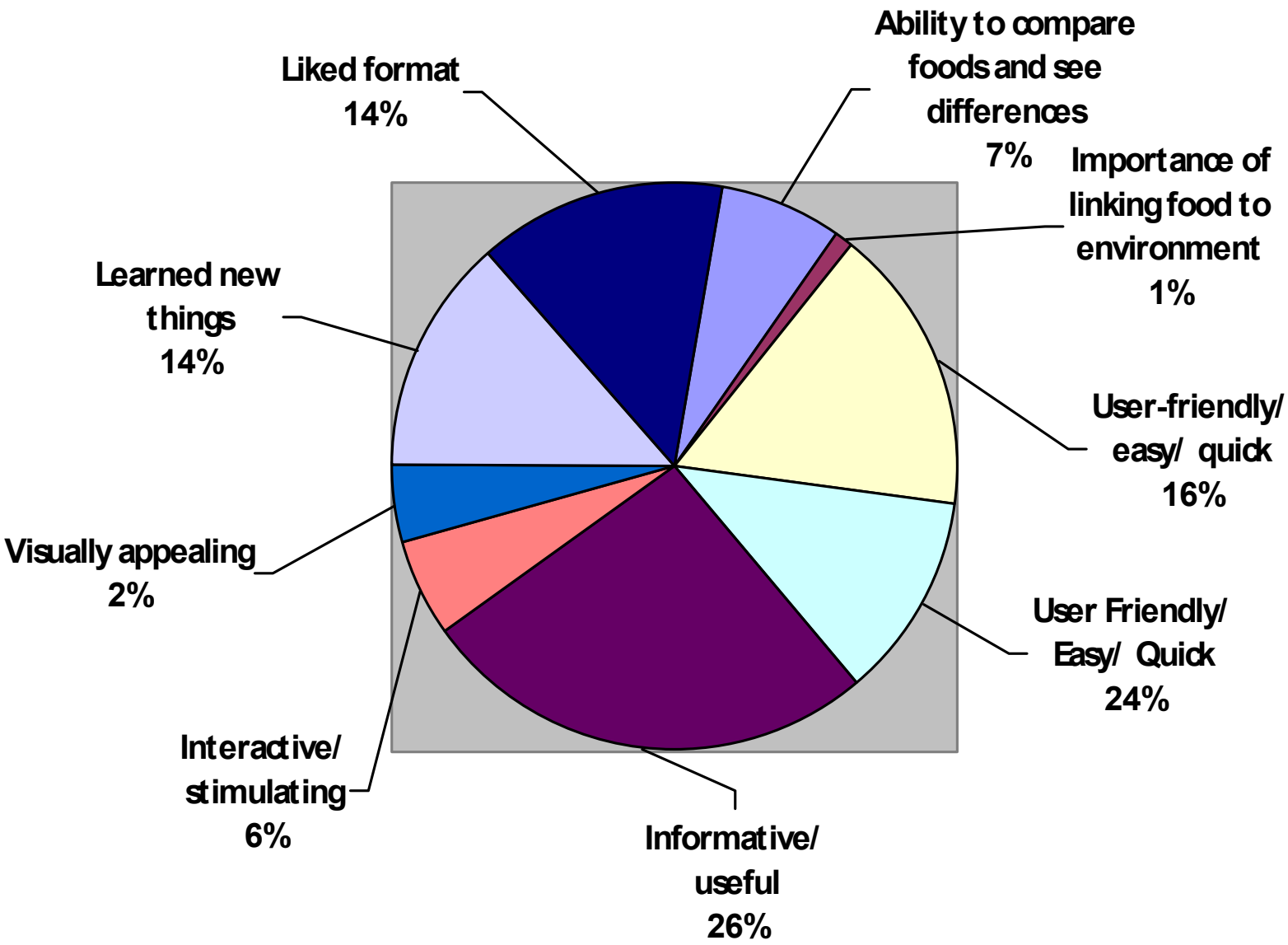
Liked about CarbonScope



CarbonScope Suggestions



Liked about Training



Training Suggestions