Research

Planning and Evaluating Science Video Programs Using Communication Science

Joseph Cone and Kirsten Winters

Abstract

Science-based videos could be of greater benefit to viewers if video producers understand what decisions and actions these audiences may be considering that can be affected by the videos. Such understanding may be developed through interviews, focus groups, and surveys, which should provide guidance for elements of both the style and content of the video production. The success of the videos in assisting viewers' understanding and decision making should then be evaluated, for example through surveys, as described here. Following such a process may increase the effectiveness of such videos, thereby also improving the return on the producer's investment in personnel, time, and other resources. For example, the results of climate change video evaluations presented here do indicate that members of the populations for whom the videos were intended rated them highly, obtained information they considered useful from the videos and were influenced to act on the concerns they had relating to the science topic (climate change risks).

Keywords

video, evaluation, decision-making, communication, climate change

Introduction

For nearly a century, video has proven a useful medium for informational purposes, although perhaps not as much as Thomas Edison enthused in 1922: "I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks" (Cuban, 1986, p. 9). Certainly, video is widely deployed today as a vehicle for sharing knowledge and experiences (YouTube, for example), while so-called "educational" videos for public audiences have long been used by "boundary organizations" (Guston, 2001) such as Cooperative Extension (Tribbia & Moser, 2008).

A research study is presented here of the development and evaluation of two viewer-centered video projects addressing a pervasive environmental issue in which learning and other outcomes were measured relatively inexpensively. The videos we produced were developed with university Sea Grant and Extension colleagues in Oregon (Cone, 2010) and Maine (Cone, 2009), explicitly for use with coastal populations considering and planning for the effects of climate change. To be sure, climate change may turn out to be the defining issue of the 21st century, affecting all aspects of life on Earth, as U.N. Secretary General Ban Ki-moon and others have argued (U.N. Dept. of Public Information, 2011). Many communities will feel the effects of a changing climate. Those effects have already begun, and despite much-publicized disputes over global warming (Leiserowitz, Maibach, Roser-Renouf, Smith, & Dawson, 2010) our experience (Borberg, Cone, Jodice, Harte,

& Corcoran, 2009) is that people confronting risks are less likely to care about debates than about getting help with pressing, local decisions.

In this way, climate change is a leading, current example of a common consideration in much university outreach and engagement: the need to help citizens in their understanding of and decision-making about often complex, controversial issues in which science knowledge can play a valuable role. Over the last decade, the paradigm of Extension has been gradually shifting from the historic model of transmission of information to a model of two-way interaction and engagement with an affected community (Kellogg Commission, 2001; National Sea Grant Extension Review Panel, 2000), through which a jointly developed understanding and plan for assistance can arise (Conway, 2006), and decisions can be made by community members. The video project presented here shows how other boundary and outreach organizations can embrace this same collaborative shift. The principal research question of this project was, if communication materials (videos) were grounded in research on what target audiences would like to know for their purposes, and who they would like to hear from, would audience members evaluate the resulting video favorably?

Literature Review

It is useful to distinguish between types of "educational" videos, based on whose knowledge is privileged by the video and what notion of learning they manifest. At one end of a continuum are "instructional" videos that privilege a subject-matter expert who presents information that the producers believe the viewer needs and will absorb. This traditional "transmission-absorption" model of education has been critiqued by a range of scholars of public science communication in recent years, including those from science education (Falk, 2005), decision research (Fischhoff, 2007) and communication research (Nisbet & Scheufele, 2009). Summarizing, Falk (2005) argues that contemporary understanding finds learning not as a "linear and predictable accumulation of knowledge . . . a process of filling-up identically empty minds as they moved past on the educational assembly line" but instead an "always highly idiosyncratic" process "determined first and foremost by the individual's prior knowledge, interests and motivations" (p. 269).

In contrast to "instructional" approaches that privilege the producers and seek to transmit their information are viewer-centered approaches, where understanding the "prior knowledge, interests and motivations" of these intended viewers drives the video content. The shift from a top-down, producer-driven model of communication to one that takes participants into fuller account has happened over the past two decades in several fields of science communication, including risk communication, health communication and science education (Trench & Bucchi, 2010). One type of educational video program that may result from this shift in perspective is participant-centered documentary, in which a number of speakers are seen to have pieces of knowledge about the subject, and learning, as well as other effects, arise from the viewer assembling these pieces into a meaningful whole.

The instructional adequacy of video programs is the frequent purpose of evaluation (for example, Beaudin & Quick, 1996; Krink & Gustafson, 1986), although some scholarship also addresses viewers' learning (for example, Fortner, 1985) or decision-making (Downs et al., 2004). Larger studies increasingly appear to be of videos designed to affect personal health choices in clinical settings (Aronson, Plass, & Bania, 2012; Wang et al., 2008; Wilkins et al., 2006).

Our videos were a product of a risk communication framework (M. G. Morgan, Fischhoff, Bostrom, & Atman, 2002), and its strategy, which has four critical steps: 1) gather information

about risks from subject experts and focus on facts critical to intended audiences; 2) elicit the audience's beliefs and understanding about the risks and their values relating to communicating about them; 3) develop communications that address these audience concerns and aid in their decision making ; 4) evaluate the communication. An overview of these steps develops over three sections: a formative phase to identify critical issues; a production phase that involved members of the intended user communities in the video productions; and an evaluation phase that relied on a post-test of viewers—focusing mostly on the evaluation and culminating phase of the project. Findings for the first two sections are included in the methods overview in order to provide background into the development of the project and the evaluation.

Finally, whereas traditional educational videos about science place top priority on accuracy, and thus often showcase scientists regardless of whether they are engaging to the audience (Olson, 2009), a substantial body of research (glossed in Cialdini, 2006) underscores the potential value of "likeable" messengers on camera. In general, likeable people draw attention to a topic when the viewer is not yet motivated to attend or when the topic represents a cognitive challenge (Petty, Cacioppo, & Schumann, 1983; Reinhard & Messner, 2009).

Methods

Formative Phase

Prior to video planning and production, front-end research was conducted, beginning with drafting a preliminary "expert model" of the coastal climate change risks, based on scientific and technical reports. Then, following Morgan et al. (2002), this model was tested against lay perceptions of the risks associated with coastal climate change through a combination of interviews, focus groups, and online surveys with our coastal populations of interest. It should be noted that these inquiries were intended to not only serve the development of video programs but also were designed, as part of a larger project, to facilitate direct contact with coastal populations through climate planning workshops.

Members of the target audiences (mainly coastal management professionals and property owners) were surveyed in Oregon (N=300) and Maine (N=548) in 2008. Findings from this survey research revealed that coastal populations in Oregon and Maine 1) were indeed concerned about the risks and local effects of climate change, 2) believed they would be personally affected, and 3) were looking for specific information about how they would be affected and 4) what they could do about it (Borberg et al., 2009; Center for Research and Evaluation, 2008). Specifically, Oregon survey participants were asked an open-ended question to identify coastal climate risks , and the most common risk-theme among 833 responses was effects of climate change on coastal processes, including sea level rise and shoreline erosion (32% of all responses). Maine survey respondents were similar, identifying coastal erosion (35.9% of responses) or sea level rise (25.7%) as significant or very significant problems.

In addition, some information sources were valued more highly than others (Oregon) or trusted more than others (Maine). In Oregon, Oregon State University (N=190) and Oregon Sea Grant (N=187) were valued first and fourth, respectively, out of 13 information sources (Borberg et al, 2009). In Maine, "colleges and universities" were trusted most (N=242) as a source of climate information, while Maine Sea Grant/Cooperative Extension was third of seven listed (N=135) (Center for Research and Evaluation, 2008).

Production Phase

Videos were designed to address these risk concerns and communication-source preferences. The Oregon and Maine DVDs were divided into five segments each that highlighted specific interests of the intended viewers, such as "shoreline effects of climate change" (Oregon) and "what individuals and communities can do to protect themselves" (Maine). Next, in producing both state videos, individuals from academic institutions were selected for on-camera roles based on whether they might be considered valuable or trusted by viewers, according to earlier surveys. Carefully selected were on-camera "hosts" who would be likeable and unbiased in narrating and guiding the viewer through the topic under discussion and the interviews of climate experts. In addition, reasoning from classic research on salesmen-prospect relationships which shows that the more "alike" the salesman is perceived to be, the more likely is the sale (Evans, 1963), in Maine, the video production team was at particular pains to select a host that would be perceived as similar in age, education, and sensitivity to local concerns as were the key viewers, namely shoreline property owners. (A well-known, informal, but knowledgeable coastal Extension agent was selected as host.) An added reason for wanting to not erect unnecessary barriers to information acceptance was that in the Maine survey nearly one-third of coastal property owners said they were not "well-informed" about the effects of climate change (Center for Research and Evaluation, 2008), while in the Oregon survey respondents had on average only one-fourth of the information they considered necessary on a list of 14 climate topics (Borberg et al., 2009).

Evaluation Phase

Consistent with the Morgan et al. risk communication framework, we planned post-viewing evaluations of the videos to determine their effectiveness, conducting three separate surveys of known viewers of the videos: two online with Oregon viewers, and one in the context of a Maine workshop. Since the Maine workshop sample was modest though it involved everyone at the event (N=22), this report concentrates on the results of the Oregon surveys (N=95).

Questions in the Oregon surveys measured the relationship between respondents' reactions (dependent variable) to the presented information and the presenter of the information (independent variables). They also measured the value of the information to the respondent with regards to climate change-related decision making. Decision making commonly is divided into three broad stages: 1) defining the problem by assembling information and addressing values; 2) evaluating potential solutions; and 3) making the decision (Wilson & Arvai, 2011). Thus, one question asked whether the video

- Presented topics that interest me [stage1]
- Provided information that is valuable to me [stage 1]
- Addressed concerns that I have [stage 1]
- Made me aware of new concerns [stage 1]
- Helped me understand decisions I might make [stage 2]
- Made me likely to act on my concerns [stage 3]

Using Surveymonkey.com, we conducted first an online survey of recipients of the DVD, *Preparing for Coastal Climate Change: What Oregonians are Asking* (Cone, 2009) during five weeks in April-May 2010. Recognizing that the response rate for online surveys can vary due to several

causes, including lack of topic salience for respondents or a lack of familiarity with the surveying organization (Fan & Yan, 2010), we attempted to limit those factors by the convenience sample we chose. It was composed of two groups that had previously involved in the earlier phase of the research project: coastal decision-makers who had responded to the 2008 survey on climate change (Borberg et al., 2009) and customers for Oregon Sea Grant outreach materials who had responded to a 2009 survey (combined N=332). This sample population was invited to view one or more of the video segments online and then take an online survey containing 15 questions, seven of which focused on the videos; the remaining questions were demographic. Educators who had received a copy of the DVD version of the video in the context of a Sea Grant workshop or other event were also surveyed. In addition to the 15 questions referred to earlier, five more questions on climate change views were included in the survey. This survey was conducted during eight weeks in April-June 2011, which was three or more months after the potential respondents had obtained the DVD. The Oregon video program contained five video segments that viewers may watch individually, in any combination, or in order: "Introduction to Oregon coast climate change"; "Predicting the climate", "Shoreline effects of climate change"; "Broader coastal and ocean effects"; and "What is the government doing?" We evaluated these five individually and together, as an overall rating for the entire program (whether online or on DVD).

Findings

While not all respondents answered all questions, most (*n*=64) scored the video segments they watched, rating them highly for presenting "topics that interest" them (97% agreed or strongly agreed) and providing "information that is valuable" to them (83% agreement). As mentioned earlier, we were interested in how the overall rating of the videos related to these variables of interest and value. Only respondents who watched two or more of the five segments were counted in this "overall" rating label. The mean rating (*n*=57) for the videos was 3.5 (scale: 1=poor, 2=fair, 3=good, 4=very good, and 5=excellent). We also were interested in (1) whether use of the risk communication method would produce a more valuable communication product; (2) whether the choice of video host was perceived as 'likeable' to the viewer; and (3) whether videos might influence behavioral intentions, as theory lays them out.

First, was our use of the risk communication method effective? The recommended front-end research indicated shoreline effects was very likely a topic of importance to viewers. Indeed, respondents to the video survey question (*n*=54) rated shoreline erosion as the potential climate risk of greatest concern (87% of respondents). Consistent with this perception, all or part of the shoreline segment was watched by 82% of respondents (57 of 69). And of these, most rated the segment as very good or excellent (61%). Also, in response to general questions about the entire video program, those watching the shoreline segment agreed that the program provided valuable information (80%), and that it addressed their concerns (75%). In contrast, viewers rated "climate effects on community infrastructure such as roads and buildings" as least concerning of those topics addressed in the videos, and fewer viewers watched the related segment (75%: 52 of 69), giving it a lower overall rating (only 48% very good or excellent).

Did the viewers perceive the choice of video hosts as likeable? The general-audience respondents (*n*=69) indicated very high agreement across all video segments to "the host in this video seemed likeable"; 85% agreed or strongly agreed. Also, overall ratings of the segments were positively correlated with the host's likability ($r=.595$, $p<.01$), though the correlation was even stronger with viewer assessment of the host's knowledge ($r=.729$, $p<.01$).

But did the videos have any influence on behavioral intentions? Well-established psychological models, such as the integrative model of behavioral prediction (Fishbein & Yzer, 2003), posit that a behavior change will not happen without first an intention to change, and that while communication can influence intention (Fishbein, Hennessy, Yzer, & Douglas, 2003) any single communication is unlikely to cause behavior change on its own. So, it was not surprising that respondents only slightly agreed that the videos they watched "made [them] likely to act on [their] concerns" (mean=3.5; scale 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree).

A very similar pattern was found in the survey responses to the DVD produced for Maine coastal residents. As part of a workshop there in 2009, property owners were shown a video segment in which a homeowner presented research-based construction methods for coastal properties. Again, respondents (n=22) agreed that "this section provided useful information for" them (4.3 on scale of 1 (low)¬–5 (high)); that "this section changed [their] attitudes positively about coastal building approaches to withstand climate change effects" (4.0), and that the video "made [them] likely to act on [their] concerns" (4.2).

Educators in the 2011 Oregon survey rated the DVD they received similarly to other survey respondents. Overall videos ratings for the aggregated responses was 3.6 or very good-to-good (scale:1=poor, 2=fair, 3=good, 4=v. good, and 5=excellent). Additionally, these Oregon educators reported that the DVD was of interest and value (89% agreed or strongly agreed in both cases), and that the video addressed their concerns. As with the other Oregon survey, educator-respondents were slightly moved to "act on concerns" after watching the video (identically 3.5 on the 1-5 scale (low-high). Also, 84% of Oregon teacher respondents agreed with the idea of sharing information with others, and 68% of these educators had in fact shared video information with students.

Limitations

There are limitations with the data. A higher response rate, as well as knowing how non-respondents differed from respondents, would have increased the richness and general applicability of the results. Also, the sample population was chosen based on convenience. And while it can be argued that the method was not a classic pretest-posttest design (see Shadish, Cook & Campbell, 2002), the overall project was not designed to conduct an experiment about video results, but rather to use the video as a component of a broader risk communication strategy. Additionally, some elements of the survey instrument merit further consideration. For example, more development of the Likert scale questions measuring phase of decision making was needed in order to increase the reliability and validity of the questions. That 84% of Oregon teacher respondents agreed with the idea of sharing information with others and that 68% of these educators had in fact shared video information with students are compelling findings related to phase of decision making, but a closer look is needed at the reliability of the measurement as well as at other factors beyond viewing the video that would influence such behavior.

Currently, much video content addressing scientific subjects focuses on explaining the science (e.g., "NOVA" on PBS) or on generating mere audience "awareness" of an issue (e.g., "Frontline" programming on PBS), so, in this project, a more purposeful tack was directed toward specific users by conducting pre-production research with them. It should be noted, however, that the time needed to conduct our surveys and analyze data was, indeed, a limiting factor. In the context of the Sea Grant organization and its communication needs, conducting evaluations takes time from producing materials, which usually is considered a priority. Such will be a common constraint in institutional communication offices like those of Sea Grant and Extension.

In spite of these limitations, what was accomplished and learned are worth sharing, because evaluating the effects of communication products, particularly "educational" videos, is not routine and can contribute to higher quality media content.

Discussion

This project was grounded in a key tenet of communication science, that "empirical study is absolutely essential to the development of effective communication" (M. G. Morgan, et al., 2008, p. 28). We wanted to know whether videos with science content would be rated highly if we identified the topic-related risks and concerns of our target audiences and presented information addressing those risks in a way they would find congenial to their values (Kahan, 2010). And, since ultimately we would want to inform their decisions and actions, would they indicate such? As the results of post-viewing surveys indicate, the answer to all these questions was in the affirmative, to differing degrees. This finding shows that our front-end research, which directed the content of the shoreline segment, may have led to increased viewership of that particular segment but also increased the value to viewers of the program simply because the audience considered the topic important. Finally, an observation: While the correlation between video ratings and host likeability supported the "likeable host" tactic, the stronger correlation between ratings and host knowledge might be anticipated from viewers who were engaged in the information content and thereby actively processing it (Petty et al., 1983).

Would this method be recommended for video evaluation to other organizations? From the standpoint of capital, both financial and human, needed for a similar study: yes, this practice of evaluation would be recommended. In this largely grant-funded project, Sea Grant had the time, money, and people (although not the requirement) to conduct both front-end research and summative evaluation of the videos (Diamond, 1999), a comparative luxury that, regrettably, not all similar video projects can afford. Even so, overall budgets for the entire productions were comparatively very modest: less than $50,000 for Oregon and less than $100,000 for Maine, both costing less than $2,500 per minute of final production (an amount within an appropriate range, considering the production quality of the videos—both of which won peer awards). All costs for the summative evaluations—the three post-viewing surveys—accounted for about $2,000 each in Oregon and Maine. One advantage of online surveys is the elimination of implementation costs associated with mail or telephone surveys.

For those wanting to use this method for video production and evaluation, it is important to note a few lessons learned. For example, motivating participants through email to respond to an online survey is somewhat difficult. Despite convenience samples composed of individuals with some degree of likely interest in the materials and topics under discussion, a 25% combined response rate for our two Oregon surveys (the general population and the educators) is disappointing, even though such a rate is consistent with the widespread experience that Internet surveys often have lower response rates than traditional methods such as postal mail (Lesser, Yang, & Newton, 2011). In that context, a 25% response is not unusual. Incentives were offered to prospective respondents in the form of both cash discounts and free offers on educational products available from us. There is evidence that "free" incentives may matter to respondents more than discounts, as our response count in the 2010 survey jumped from six respondents to more than 60 once the option of a free DVD was added to the follow-up invitation two weeks after the first.

Another challenge with online surveys is conducting interviews with non-respondents to

determine their reasons. One would want to know whether those motivated to respond are unique in some way that somehow affects their responses to the survey questions. However, if potential respondents have, effectively, ignored three e-mailed requests to participate in a survey, it's tricky to get an answer via email why that is so.

Still, 95 total respondents (between the two surveys) dwarf the handful of responses we typically obtain from voluntary postpaid response cards contained in our DVD packaging. Our surveys provide vastly more data than we otherwise usually obtain about video products, making this summative evaluation process, in our minds, distinctly valuable.

Endnotes

Communications were not to be limited to the video products, even though we planned 1) targeted distribution of hundreds of DVDs, 2) television (Maine), and 3) online broadcast of the video content. In addition, we planned Extension workshops with local communities, which, in some instances were to be shown portions of a video.

This question was placed before others that named risks so as to avoid priming the participants.

Climate Variability and Coastal Community Resilience: Testing a National Model of State-based Outreach, funded by the NOAA Climate Program Office (SARP). NOAA Grant Number NA07OAR4310408.

About the Author

Joseph Cone leads the communication research and production activities of Oregon Sea Grant, working closely with Extension, learning, and research colleagues. Kirsten Winters is a doctoral student at Oregon State University in Environmental Science who has worked with Cone on projects helping communities and individuals understand and prepare for climate change.

References

Aronson, I. D., Plass, J. L., & Bania, T. C. (2012). Optimizing educational video through comparative trials in clinical environments. *Educational Technology Research and Development,* 60(3), 469-482. doi: 10.1007/s11423-011-9231-4

Beaudin, B. P., & Quick, D. (1996). Instructional video evaluation instrument. *Journal of Extension*, 34(3).

Borberg, J., Cone, J., Jodice, L., Harte, M., & Corcoran, P. (2009). An Analysis of a Survey of Oregon Coast Decision Makers Regarding Climate Change. Corvallis, Ore.: Oregon Sea Grant.

Center for Research and Evaluation, U. o. M. (2008). Sea Grant Project Fall 2007 Focus Groups & Spring 2008 Surveys: Comparative Analysis (pp. 41). Orono, Maine: Center for Research and Evaluation.

Cialdini, R. B. (2006). Influence: *The Psychology of Persuasion* (Revised ed.). New York: Collins.

Cone, J. (Writer). (2009). Building a Resilient Coast: Maine Confronts Climate Change [DVD]. Corvallis, Ore.: Oregon Sea Grant.

Cone, J. (Writer). (2010). Preparing for Coastal Climate Change: What Oregonians are Asking [DVD]. Corvallis, Ore.: Oregon Sea Grant.

Conway, F. (2006). Sharing Knowledge, Power, and Respect: Keys in Bringing Communities Together. *Journal of Higher Education Outreach and Engagemen*t, 11(1), 133-143.

Diamond, J. (1999). P*ractical Evaluation Guide: Tools for Museums and Other Informal Educational Settings:* Rowman Altamira.

Downs, J. S., Murray, P. J., Bruine de Bruin, W., Penrose, J., Palmgren, C., & Fischhoff, B. (2004). Interactive video behavioral intervention to reduce adolescent females' STD risk: a randomized controlled trial. *Social Science & Medicine*, 59(8), 1561-1572.

Evans, F. B. (1963). Selling as a Dyadic Relationship – A New Approach. *American Behavioral* Scientist, 6(9), 76-79. doi: 10.1177/000276426300600922

Fan, W., & Yan, Z. (2010). Factors affecting response rates of the web survey: A systematic review. *Computers in Human Behavior,* 26(2), 132-139. doi: 10.1016/j.chb.2009.10.015

Fischhoff, B. (2007). Nonpersuasive communication about matters of greatest urgency: climate change. *Environmental Science & Technology A-Page Magazine,* 41(21), 7204-7208.

Fishbein, M., Hennessy, M., Yzer, M., & Douglas, J. (2003). Can we explain why some people do and some people do not act on their intentions? . *Psychology, Health & Medicine*, 8(1), 3-18.

Fishbein, M., & Yzer, M. C. (2003). Using Theory to Design Effective Health Behavior Interventions. *Communication Theory*, 13(2), 164-183.

Fortner, R. W. (1985). Relative effectiveness of classroom and documentary film presentations on marine mammals. *Journal of Research in Science Teaching*, 22(2), 115-126. doi: 10.1002/tea.3660220203

Guston, D. H. (2001). Boundary Organizations in Environmental Policy and Science: An Introduction. *Science, Technology, & Human Values,* 26(4), 399-408.

Kahan, D. (2010). Fixing the communications failure. *Nature,* 463(7279), 296-297.

Kellogg Commission. (2001). Returning to our Roots: Executive Summaries of the Reports of the Kellogg Commission on the Future of State and Land-Grant Universities. Washington, D.C.: National Association of State Universities and Land-Grant Colleges.

Krink, F. G., & Gustafson, K. L. (1986). *Instructional technology: A systematic approach to education.* New York: Holt, Rinehart, & Winston.

Leiserowitz, A. A., Maibach, E. W., Roser-Renouf, C., Smith, N., & Dawson, E. (2010). Climategate, Public Opinion, and the Loss of Trust. New Haven: Yale University.

Lesser, V., Yang, D., & Newton, L. (2011). Assessing Hunters' Opinions Based on a Mail and a Mixed-Mode Survey. *Human Dimensions of Wildlife,* 16(3), 164-173. doi: 10.1080/10871209.2011.542554

Morgan, M. G., et al. (2008). Best Practice Approaches for Characterizing, Communicating and *Incorporating Scientific Uncertainty in Climate Decision Making*. U.S. Climate Change Science Program.

Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). *Risk communication: a mental models approach* New York: Cambridge University Press.

National Sea Grant Extension Review Panel. (2000). *A Mandate to Engage Coastal Users: A Review of the National Sea Grant College Extension Program.* Corvallis, Oregon: Oregon Sea Grant.

Nisbet, M. C., & Scheufele, D. A. (2009). What's next for science communication? Promising directions and lingering distractions. *Am J Bot*, 96(10), 1767-1778. doi: 10.3732/ajb.0900041

Olson, R. (2009). Don't Be Such a Scientist: *Talking Substance in an Age of Style*. Washington, D. C.: Island Press.

Petty, R. E., Cacioppo, J. T., & Schumann, D. (1983). Central and Peripheral Routes to Advertising Effectiveness: The Moderating Role of Involvement. *Journal of Consumer Research*, 10(2), 135-146.

Reinhard, M.-A., & Messner, M. (2009). The effects of source likeability and need for cognition on advertising effectiveness under explicit persuasion. *Journal of Consumer Behaviour,* 8(4), 179-191. doi: 10.1002/cb.282

Shadish, W.R., Cook, T.D., & Campbell, D.T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. New York: Houghton Mifflin Company.

Trench, B., & Bucchi, M. (2010). Science communication, an emerging discipline. *Journal of Science Communication*, 9(3).

Tribbia, J., & Moser, S. C. (2008). More than information: what coastal managers need to plan for climate change. *Environmental Science & Policy,* 11(4), 315-328.

U.N. Dept. of Public Information. (2011). With Environmental Refugees Reshaping Human Geography, Security Council Has Unique Duty to Mobilize Action to Confront Climate Change Threat, Says Secretary-General Retrieved 10/26/11, 2011, from http://www.un.org/News/Press/docs/2011/sgsm13712.doc.htm

Wang, J. H., Liang, W., Schwartz, M. D., Lee, M. M., Kreling, B., & Mandelblatt, J. S. (2008). Development and Evaluation of a Culturally Tailored Educational Video: Changing Breast Cancer–Related Behaviors in Chinese Women. *Health Education & Behavior*, 35(6), 806-820. doi: 10.1177/1090198106296768

Wilkins, E. G., Lowery, J. C., Copeland, L. A., Goldfarb, S. L., Wren, P. A., & Janz, N. K. (2006). Impact of an educational video on patient decision making in early breast cancer treatment. [Research Support, Non-U.S. Gov't]. *Med Decis Making*, 26(6), 589-598. doi: 10.1177/0272989X06295355

Wilson, R. S., & Arvai, J. L. (2011). Structured Decision Making. Corvallis, Ore.: Oregon Sea Grant.