

Relative Effects of Visualized and Verbal Presentation Methods in Communicating Environmental Information Among Stakeholders: Okavango Delta, Botswana

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The present study examined the relative effectiveness of 2 public instructional communication methods in improving selected predictors of knowledge-sharing behaviors among communities in the Okavango Delta, Botswana. A total of 120 subjects took part in a quasiexperimental study, with 2 experimental treatments: (a) visualized PowerPoint presentation and (b) verbal presentation with no visual aids. The results showed that neither method was more effective than the other. However, significant differential effects of method by grouping factor, position, were found among belief and intention measures. The study concluded that neither method was more effective, but recommended use of integrated public instructional communication methods.

Communication of information about environmental conservation is essential for sustainable development. However, scientists have failed to generate meaningful dialogue with lay-audience groups; such as policy makers and local communities, regarding environmental conservation issues (Rhoads, Wilson, Urban, & Herricks, 1999; Siepen & Westrup, 2002). Experts present environmental information in a

complex way, making it difficult for nontechnical audiences to understand (Heong & Escalada, 2005). This presents communication challenges that constrain the much-needed dialogue and social change in the public sphere. Contemporary approaches of demonstrating and explaining environmental scenarios using models and indicators may exacerbate this problem (D. E. Zimmerman, Akerelrea, Smith, & O'Keefe, 2006). In addition, preventative innovations, such as environmental conservation, are complex and uncertain, with the delayed benefits accruing from them compounding the problem of effectively communicating what often seems to the public as abstract esoteric arguments (Rogers, 2003). These communication challenges underscore the need to explore

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effective environmental conservation information communication strategies, with a view to understanding how they contribute to the sustainable adoption of environmental conservation innovations.

Advances in information and communications technologies, specifically presentation software, have presented opportunities to improve diffusion of innovations in the public sphere, as a result of their potential of enhancing information delivery (Lundgren & McMakin, 2004; Meitner, Gandy, & Sheppard, 2005; D. E. Zimmerman et al., 2006). The studies suggests that the use of computer-aided visuals in environmental management is ideal for communicating complex scientific and environmental information, as they facilitate visualization of otherwise abstract phenomena for ease of understanding.

Against this backdrop, the present study explored the relative utility of using visuals and verbal instructional communication methods in impacting the predictors of knowledge sharing behaviors. In comparing the two instructional communication methods, it was hypothesized that visualized public instructional communication method will lead to higher improvement in subjects' knowledge, attitudes, beliefs, and intentions than the traditional verbal method. The study results are expected to offer some directions to practitioners in environmental communication and education on effective means of promoting responsible environmental behaviors for sustainable development.

THEORETICAL FRAMEWORK

The study is guided by the theory of reasoned action (TRA; Ajzen, 1991) and the responsible environmental behavior model (REB; Hines, Hungerford, & Tomera, 1986). The theories seek to explain and predict behaviors that facilitate social change. The TRA posit intention as the lone determinant of behavior, while intention is a product of subjective norms and

attitudes. Subjective norms are influenced by normative beliefs while attitudes are a function of behavioral beliefs. The REB postulates that an individual's behavior is influenced by two factors: intention and situational factors. Intention is a product of cognitive (knowledge) and affective (attitude, locus of control, and personal responsibility) factors.

The behavior explored by the present study is knowledge sharing behavior—with respect to environmental conservation knowledge—viewed as an action taken by an individual to disseminate acquired knowledge to other members (Hsu, Ju, Yen, & Chang, 2007; Ryu, Ho, & Han, 2003). The choice of the study constructs was informed by the specific behavior of interest explored and the literature. Research has shown that knowledge is necessary for initiating and informing decision-making, though inadequate in predicting behaviors (Burger, 2005; Frick, Kaiser, & Wilson, 2004; Kaiser & Fuhrer, 2003). However, knowledge becomes an important factor in this study because of the nature of the behavior examined—knowledge sharing. Examination of the potential effect of knowledge in fostering knowledge sharing behaviors has not been addressed in the knowledge sharing literature. This is so because knowledge sharing studies relied mostly on TRA/TBP models, which do not posit knowledge as a factor in explaining human behavior. Various scholars have demonstrated the role played by attitudes, beliefs, and intention on human behavior (Hines, Hungerford, & Tomera, 1986; Kuo & Young, 2008). Others have shown that these factors can be improved through effective instructional communication approaches and methods such as using visuals (Ajzen, 1985; Kennedy, 1994; Meitner et al., 2005; D. E. Zimmerman et al., 2006).

The studies relied on either REB or TRA-based research models, with none explicitly combining the two frameworks. Whilst so, studies have suggested that the explanatory power of the TRA and REB can be improved by integrating other theories to either of these two theories (Kuo & Young, 2008; Osbaldiston, 2004; Trumbo & O'Keefe, 2005). This study

integrated the two frameworks by incorporating requisite constructs deficient from each to develop an integrated research model. The study used the knowledge construct of the REB, belief from the TRA, and attitude and intention posited by both theories. By bringing together the affective and cognitive factors of human behavior, the research model presents a pragmatic theoretical guidance of exploring the contribution of knowledge in the promotion of environmental knowledge diffusion.

LITERATURE REVIEW

Research on visualization versus traditional instructional methods abounds in education, though biased to student samples (e.g., Amare, 2006; Large, 1996). Other studies from health have explored the potential of using visuals to enhance communication (Filippatou & Pumfrey, 1996; Houts, Doak, Doak, & Loscalzo, 2006). In natural resources management, a pioneer study by D. E. Zimmerman et al. (2006) found that rural adults benefited significantly from visualized presentations than students and urban residents. They recommended future research to focus on adult audiences and concluded that visualized presentations could enhance lay publics' understanding of complex ecological information.

Oo, Sutteerawathana, and Minato (2010) compared different information dissemination methods used by agencies to reach rural publics. The study identified weaknesses in the methods used, thereby rendering information diffusion interventions ineffective. They argued that the conventional environmental education strategies used by agencies were inappropriate in informal and rural settings. This may be so because the interventions are mostly informed by studies conducted in developing world (Greco, 2005; Lee, 2008), thereby risking the applicability of the findings to environments outside developed world. The present study fills this gap and replicates D. E. Zimmerman et al.'s (2006) study by comparing the

relative utility of two public instructional communication methods on an adult rural population engaged in environmental management programs.

METHODOLOGY

Study Setting and Sampling

The study was conducted in the Ngamiland District in northwestern Botswana (Figure 1). The key ecological feature in Ngamiland is the Okavango Delta, a pristine natural wetland in southern Africa (Mendelsohn & Obeid, 2004). The delta is home to multiethnic groups with a population of about 125,000 people (Central Statistics Office, 2002). More than 95% of the people depend directly or indirectly on the natural resources found in the wetland for livelihoods (Mbaiwa, 2002).

The population of the 13 villages (Figure 1) that participated in the study ranged between 157 and 4,389 inhabitants (Central Statistics Office, 2002). The district houses a majority of local communities engaged in community-based natural resources management (CBNRM) projects, initiated by government for collaborative natural resources management. The study sample comprised leaders of these CBNRM organizations.

The sampling frame comprised registrants on the Ngamiland District CBNRM Forum. From the list of 21 registrants, 13 CBNRM Board of Trustees groups were randomly sampled. Because the CBNRM Board members were preexisting groups, it was not possible to randomly select the subjects. Only groups (individual boards), wherein subjects were members, were randomly selected thereby making the sampling a probability cluster sample (Ary, Jacobs, Razavier, & Sorensen, 2009). In a cluster sampling technique, the unit of sampling is a "naturally" occurring group of individuals. The technique fits the study because it was feasible to select groups of individuals rather

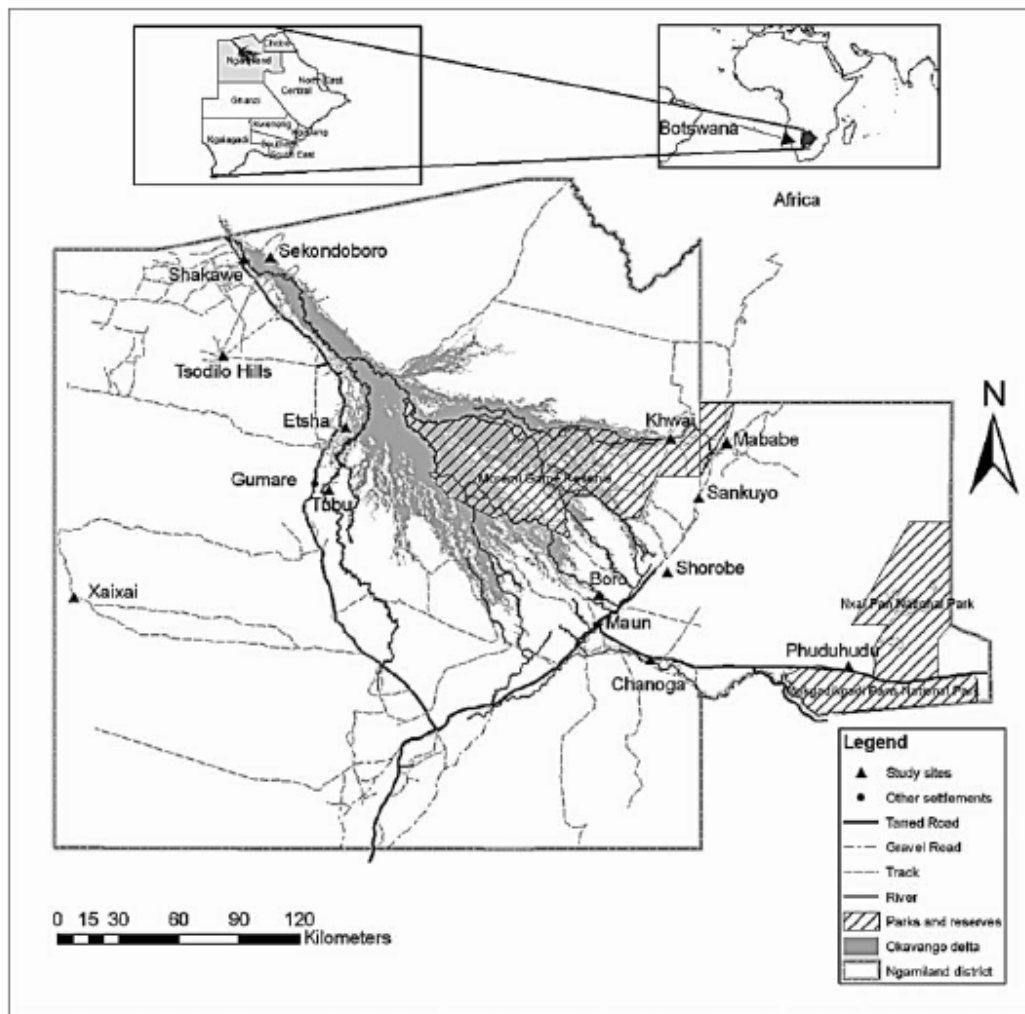


Fig. 1. Study Area Map.

than individuals from the accessible population. Although the sampling technique was random cluster sampling, the sample is a convenience one.

Participants

A total of 120 subjects participated in the study. The sample was predominantly male (71.7%), with subjects' mean age of 35.95 years. Forty-three percent of the subjects held executive positions in the Board of Trustees. The

rest are additional members (39.2%) and ex-officio members (17.5%). The demographic characteristics of the subjects are shown in Table 1.

Research Design

The study used a quasiexperimental counter-balanced design. The design was appropriate because subjects were within intact groups. Random assignment of subjects was not feasible as the target group were existing groups (Ary

Table 1
Sociodemographic Characteristics of Study Subjects

Variable		<i>N</i>	<i>M (SD)</i>	%	<i>n</i>
Gender	Male			71.7	86
	Female			28.3	34
Education		120	2.53 (.77)		
	None			11.7	14
	Primary			28.3	34
	Secondary			55.0	66
	Tertiary			5.0	6
Ethnicity	Motawana			5.0	6
	Moyei			26.7	32
	Mosarwa			27.5	33
	Mombukushu			25.0	30
	Moherero			5.8	7
	Others			10.0	12
	Position	Chairperson			10.8
	Vice chairperson			9.2	11
	Secretary/vice			15.8	19
	Treasurer			7.5	9
	Additional member			39.2	47
	Ex-officio			17.5	21
Age (years)		120	35.95 (13.02)		

et al., 2009; Gersten, Baker, & Lloyd, 2000). The quasiexperimental counterbalanced design allows subjects to participate in the two treatments, thereby addressing several internal validity concerns. The design is strong in reducing threats to internal validity (Ary et al., 2009; Shadish, Cook, & Campbell, 2002). Because all subjects receive the two experimental treatments, they act as their own controls and make comparisons between treatments feasible (Cook & Campbell, 1979). In counterbalanced design, the sequence of treatment administration is reversed across groups, thereby rotating any preexisting differences between the groups.

The selection of the first experimental treatment—traditional-verbal presentation, was done randomly, and was administered to the first group followed by the visualized presentation, and the order was counterbalanced accordingly for the subsequent groups. The approach eliminates the confounding of order and carryover effects (Ary et al., 2009; Cook & Campbell, 1979). In addition, the design enabled the study to be conducted in a natural setting of the subjects.

Data Collection Instrument

Data was gathered using a retrospective pretest instrument (Allen & Nimon, 2007; Hill & Betz, 2005). The construct questions were determined using the TRA and REB studies and adapting portions of existing studies pertaining to the specific domain and subject area (e.g., Bock, Zmud, Kim, & Lee, 2005; Hamilton, 1991; Hines et al., 1986; Marcinkowski, 1988). The instrument also captured the subjects' demographic variables. Knowledge was assessed using a 12-item scale adapted from instruments used by several scholars to assess perceived level of knowledge (e.g., Cottrell & Graefe, 1997; Hwang, Kim, & Jeng, 2000; Marcinkowski, 1988). Subjects were asked to rate their perceived level of knowledge retrospectively using a 5-point Likert scale ranging from 1 (*very low*) to 5 (*very high*). For example, subjects were asked to rate their knowledge of "wildfires or waste management as an environmental problem in Botswana." Subjects' attitudes and beliefs towards knowledge sharing were tapped using 3-item bipolar adjectives. The subjects were asked to

respond to affective bipolar items such as “sharing knowledge with other people is...,” “very good...very bad,” “very enjoyable...very unenjoyable,” while instrumental adjectives were covered by “very beneficial...very harmful,” “very important...very unimportant.” Subjects’ intention to share knowledge was measured using a 5-point Likert scale ranging from 1 (*highly unlikely*) to 5 (*highly likely*). The 6-item scale asked subjects to indicate the likelihood of engaging in specified knowledge sharing activities such as sharing “knowledge acquired with CBO/Board members.”

The internal consistency reliabilities of the different scales making the retrospective pretest instrument were examined, using Cronbach’s alpha. Table 2 shows that almost all the reliability coefficients exceeded the minimum recommended value of .70, signifying adequate scale reliability.

Procedure and Data Analysis

Each subject participated in two experimental treatments during a half-day workshop organized in the respective villages. The visualized communication method was a PowerPoint containing photos as visuals combined with non-heavy bulleted text slides. The topic addressed through the visualized presentation was waste management. The visuals used were selected based on simplicity, cultural, and contextual relevance. All the photographs were taken within Ngamiland district and portrayed local waste management issues and scenes.

Another presentation, signifying a traditional communication method, was given verbally and dealt with fire management issues. Presentations were all made in local Setswana language.

To maintain consistency, all the presentations were given by the researcher talking from a script with bulleted points. To reduce the experimenter effect, research protocols such as standardizing instructions, methods, and treatment administration procedures were developed (de Vaus, 2001) and used. Each presentation was comparable and identical in terms of format, content, concepts, complexity, and length, and dealt with a specific environmental issue in the Okavango delta. Panel of experts reviewed the message and presentation stimuli, and were also pretested for manipulation check. After each presentation, which took about 40 min, subjects completed a retrospective pretest questionnaire.

The pilot study, undertaken prior to the full study, accorded the research team an opportunity to examine, evaluate, reflect, and provide feedback on the instrument items. It also assessed the intervention delivery styles, presentation timing, and nonverbal cues. The measure was taken to deal with any possible experimenter effects (Ary et al., 2009). The inconsistencies noted were addressed accordingly to ensure uniformity throughout the full study.

Data was analyzed using doubly multivariate repeated measures analysis of covariance (ANCOVA; Tabachnick & Fidell, 2001) to determine the effects of the intervention. ANCOVA was primarily useful as the research

Table 2
Cronbach’s Alpha Coefficients for Constructs of the Retrospective Pretest Instrument

Construct	Reliability			
	Traditional verbal presentation		Visualized presentation	
	Posttest	Pretest	Posttest	Pretest
Knowledge	.91	.90	.90	.96
Beliefs	.79	.97	.76	.88
Attitudes	.85	.88	.80	.93
Intention	.94	.92	.65	.91

design was quasiexperimental. The design provided statistical adjustment of preexperimental nonequivalence based on pretest, that is, the covariate on the outcome to estimate the treatment effect (Colliver & Markwell, 2006; Oakes & Feldman, 2001). Other covariates from subjects' demographics were factored in the ANCOVA model based on relevant literature (e.g., Ajzen & Fischhoff, 1980; D. E. Zimmerman et al., 2006). The assumptions underlying the statistical analysis were tested and were tenable.

RESULTS

Experimental Treatment Effect

The main effect of the treatment was examined using doubly repeated measures ANCOVA, controlling for the pretest scores, education, age, and familiarity. The analysis tested the differences between the two experimental variables means of the visualized and the traditional verbal public instructional communication methods to the overall dependent variables. Table 3 presents the descriptive statistics, showing mean scores for dependent variables across the two communication methods. The test indicated no significant effect of method, Wilks's lambda = .996, $F(4, 103) = .11$, $p = .98$, suggesting that the mean groups' scores for dependent variables did not significantly differ between the two methods (see Table 3). The finding implied that neither of the two public instructional communication methods was better than the other in terms of effectiveness in improving knowledge, beliefs, attitudes, and intent.

Effect of Method by Position

The effect of method on the dependent variables was further explored by grouping factor position, using a one-way mixed between-within repeated measures ANCOVA. The between-

Table 3
Descriptive Statistics for Dependent Variables for Verbal and Visualized Presentations

Variable	N	Verbal		Visual	
		M	SD	M	SD
Knowledge	117	4.30	.48	4.32	.59
Belief	117	4.56	.58	4.58	.54
Attitude	117	4.79	.48	4.81	.40
Intention	117	4.63	.51	4.55	.57

subjects factor was position (executive, ex-officio, and additional member), while the within-subjects factor was the method. The between-subject factor was explored on the basis of findings from past studies that it could influence knowledge sharing behaviors (e.g., Michailova & Husted, 2003). Table 4 shows the mean scores for dependent variables for the three positional groups for the two methods.

There was no significant interaction between method of public communication and position, Wilks's lambda = .98, $F(8, 204) = .32$, $p = .96$. There was a significant main effect of position between groups for the full model, Wilks's lambda = .84, $F(8, 204) = 2.31$, $p = .02$, $\eta^2 = 0.08$. Further assessment revealed that among the four dependent variables, belief and intention showed statistically significant differences, $F(2, 105) = 4.37$, $p = .01$, and $F(2, 105) = 4.32$, $p = .02$, $\eta^2 = 0.08$ respectively (see Table 5). This suggested that subjects' belief and intention mean scores differed by position across the three positions, while for the other individual dependent variables, there was no difference among the group mean scores.

Post hoc analysis using Bonferroni criterion revealed a nonsignificant difference in groups rating scores for belief variable between executive committee members and ex-officio members ($p = 1.00$), but when compared to the additional members group (nonportfolio members) there was a significant difference ($p = .01$). Another significant difference was found between executive committee and additional members for the intention measure ($p = .02$). The rest of the comparisons did not yield any significant difference.

Table 4
Mean Scores Toward Public Communication Methods by Position

Variable	Method	Executive ^a		Member ^b		Ex-officio ^c	
		M	SD	M	SD	M	SD
Knowledge	A	4.37	.49	4.23	.49	4.29	.42
	B	4.44	.60	4.19	.53	4.32	.64
Belief	A	4.71	.51	4.41	.64	4.52	.55
	B	4.68	.41	4.45	.61	4.60	.61
Attitude	A	4.77	.59	4.77	.42	4.88	.22
	B	4.78	.50	4.79	.34	4.91	.15
Intention	A	4.75	.39	4.47	.60	4.66	.47
	B	4.65	.52	4.40	.67	4.66	.41

Note. A = verbal; B = visual.
^an = 51. ^bn = 45. ^cn = 21.

Evaluation of mean estimates (Table 6) showed that portfolio holders' (executive and ex-officio) group mean rating scores were significantly higher than that of additional members for belief and intention.

This suggested that portfolio-holding committee members have more favorable beliefs

towards knowledge sharing and demonstrated more likelihood to share the information acquired when compared to the additional members. However, it should be noted that the mean scores for the belief and intention measures for additional members were still high, as they ranged between 4.41–4.75.

Table 5
Multivariate Analysis for the Evaluation of the Effect of Method by Position

Source	Variable	df	F	η	p
Between subjects					
Position	Knowledge	2	2.00	.04	.14
	Belief	2	4.37*	.08	.01
	Attitude	2	2.11	.04	.13
	Intention	2	4.32*	.08	.02
S within-group error	Knowledge	105	(.41)		
	Belief	105	(.41)		
	Attitude	105	(.33)		
	Intention	105	(.40)		
Within subjects					
Method	Knowledge	1	.03	.000	.86
	Belief	1	.16	.002	.69
	Attitude	1	.48	.005	.49
	Intention	1	.12	.001	.73
Method × Position	Knowledge	2	.55	.010	.58
	Belief	2	.29	.005	.75
	Attitude	2	.08	.001	.93
	Intention	2	.30	.006	.74
Error	Knowledge	105	(.10)		
	Belief	105	(.20)		
	Attitude	105	(.04)		
	Intention	105	(.14)		

Note. Values in parentheses represent mean square errors. S = subjects.
p < .05.

Table 6
Estimated Marginal Means for Pairwise Comparisons for Position

Measure	Position	<i>M</i>	<i>SE</i>	95% CI	
				Lower limit	Upper limit
Knowledge	Executive	4.39	.07	4.26	4.52
	Member	4.20	.07	4.06	4.34
	Ex-officio	4.37	.10	4.16	4.57
Belief	Executive	4.70*	.07	4.57	4.83
	Member	4.41*	.07	4.27	4.55
	Ex-officio	4.60	.10	4.40	4.81
Attitude	Executive	4.75	.06	4.64	4.87
	Member	4.77	.06	4.65	4.90
	Ex-officio	4.97	.09	4.79	5.15
Intention	Executive	4.70*	.06	4.57	4.82
	Member	4.42*	.07	4.29	4.56
	Ex-officio	4.69	.10	4.49	4.90

* $p < .05$.

DISCUSSION

The study investigated the relative effectiveness of two public communication methods on the subjects' knowledge, belief, attitudes, and intention. It was hypothesized that a visualized public instructional communication method will lead to improvement in subjects' knowledge, attitudes, beliefs, and behavioral intentions more than the traditional verbal method.

The main hypothesis was not supported as the statistical tests revealed no significant difference in the effectiveness of the two public communication approaches, thereby concluding that neither of the two methods was better than the other in terms of improving subjects' knowledge, belief, attitudes, and intention to share the knowledge gained. The finding partly contradicts a closely related Colorado study's findings that rural mountain adults showed significantly higher knowledge gain scores in three of the four knowledge concepts examined (D. E. Zimmerman et al., 2006). However, for the same study, the researchers found that the urban resident adults did not differ significantly in knowledge scores between the two treatments. The findings for the urban residents conforms to the present study findings that neither visualized nor non-visualized knowledge mean scores were significantly dif-

ferent. Moreover, the study findings support claims by Large (1996) that adults may have less need for visuals. Based on the researcher's experience with traditional public meetings in Botswana, though it is very rare for adults in rural areas to take notes during the public deliberations, their recall of the deliberations, often expressed through comments and questions, is impressive. This observation points to the possibility that adults' absorbance capacity of verbal talks is high, and hence they have less need of visuals. Another distinction between the two studies is the type of the visuals used; D. E. Zimmerman's study used animated visuals, whereas the present study used still photographs only. Research has shown that design features such as the type of visual can affect the results (Large, 1996; Neto, 2006).

Although the study results indicated that neither of the two public communication methods was better than the other, an integrated public instructional strategy is still recommended for use by practitioners. This is necessary because natural resources/environmental issues often communicated to the stakeholders, mainly local communities, are becoming more complex and abstract, making the use of visuals potentially beneficial for their ability to aid appeal (D. E. Zimmerman et al., 2006). This recommendation is made against the backdrop

that failure to detect significance difference between the two public instructional communication methods may be attributed to several factors. First, the researcher is generally good in the command of the local language and public speaking with local communities. In fact, during feedback after the subjects completed the questionnaire, some noted that the researcher was good at articulating the issues, with or without visuals. This scenario also points to the possibility of the message source factor. Bright and Fishbein (1993) indicated that novelty or expectedness from a source perceived credible may bias the results, with recipients judging all methods' effectiveness based on the position and the credibility of the presenter. Future research should consider factoring in the potential effect of the source.

Second, since the majority of the subjects are not acculturated to visualized presentations, multitasking may have confounded the results. Again, some of the subjects noted that they struggled with simultaneously listening, reading the bullet points, and making sense of the visuals. This suggests that multitasking may have been a challenge within the study sample, thereby confounding the potential effectiveness of information visualization over the traditional verbal one.

Third, the level of abstractness of the subject matter addressed through the presentations may have had an effect. The two subjects matter presented in the present study—wildfires and waste management—may be less conceptual, as they are issues commonly faced by the subjects within their local environment. It remains to be seen whether the nonsignificance difference would still be found when presenting more abstract or imperceptible environmental and ecological issues. The significant difference finding on knowledge scores between the rural-mountain residents exposed to visualized presentations and those exposed to non-visualized treatment in the Colorado study (see D. E. Zimmerman et al., 2006) may in part be explained by the conceptual nature of the subject matter addressed through

the topic presented. Future studies should explore the effect of different communications approaches on environmental topics with differing levels of abstractness. The studies may help shed light on whether the effect of different communication approaches will differ in affecting subjects' cognitive and affective abilities based on level of abstractness.

The finding that Board members holding executive positions and ex-officio positions had more favorable beliefs towards knowledge sharing and demonstrated more likelihood to share information than additional members holding no portfolios points to the potential effects of positional hierarchy. It demonstrates that position holders in the Board had more favorable beliefs towards knowledge sharing and were more willing to share information than non-portfolio members. The finding is consistent with Michailova and Husted (2003), whose study found that hierarchy and positional power played a role in knowledge sharing behaviors in Russian firms. This finding points to the need to enhance the knowledge sharing capacities of the additional members. Usually, capacity building interventions prioritize portfolio members at the expense of additional members, thereby leaving the latter group behind. The difference has potential implication for practice in that an agency that intends to use board members is faced with a choice between using portfolio members and excluding nonportfolio holding members. The choice may compromise the much needed broad-based effects. It is, therefore, necessary that prior to using board members as agents of information diffusion, capacity needs assessments be undertaken for structures used as agents of information diffusion to identify requisite areas that need attention. In the case of the additional members, based on the results of this study, communication skills enhancement training and self-efficacy may be necessary to make their knowledge-sharing beliefs more favorable so as to build their confidence in public communication, thereby increasing the likelihood that they will share acquired knowledge with others.

CONCLUSIONS

The findings provide initial guidance on communication approaches and methods that can be employed in communicating environmental information to local communities in the Okavango delta region. Although results, in terms of effectiveness, did not show significant differences between the two methods of public instructional communication examined in this study, it is advisable to use integrated presentation methods for communicating environmental issues. Notwithstanding the lack of superior outcomes as hypothesized, other researchers have posited that use of visuals may still benefit recall and attention (Amare, 2006; Szabo & Hastings, 2000).

The study also provides guidance to environmental agencies regarding the choice of information diffusion agents. Choices may be informed by factors such as an individual's attitudes and belief toward knowledge-sharing and demonstrated intention to share acquired knowledge. This makes understanding of factors that promote knowledge-sharing among agents necessary. However, the study also recommends that agencies should undertake knowledge-sharing capacity needs assessments with a view to providing requisite capacity enhancement based on the needs. Apart from the immediate applicability of the findings to the Okavango delta environment, the study findings advance understanding and scholarly research on the response of adults to visuals, with focus in natural resources management, a scholarly field of research less studied.

The study findings should be interpreted in the light of the study limitations. First, self-reported scale measures were used instead of more objective measures. Second, the use of a retrospective pretest, although it addressed the problem of response shift bias, created challenges for meeting the ANCOVA design ideal that the covariate should be measured before the intervention. Third, the study used a convenient sample of CBNRM boards from one

district, representing one stakeholder. This limits the generalizability of the study findings beyond other stakeholder groups. Future studies should focus on other stakeholder groups, using objective measurements scales, traditional pretest–posttest design, and research designs with control groups. Future research should also explore the effect of different communications approaches on environmental topics with differing levels of abstractness. Last, although steps were taken to minimize the potential effect of the experimenter, the potential effect may not be completely ruled out. Future studies should therefore examine the potential effect of the communicator, by replicating the findings with different experimenters.

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