Developing Water Leaders as Catalysts for Change: The Nebraska Water Leaders Academy

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Abstract: Managing water resources is increasingly complex and dynamic. Sustaining freshwater ecosystem services in the face of increasing challenges and emerging threats is a supreme leadership challenge. Leadership development program designers should look to social science theories and methods to prepare leaders to catalyze the change necessary to meet future challenges. This paper provides evidence that a new generation of water leaders is needed; and correspondingly, there is a need for new leadership development programs. The Nebraska Water Leaders Academy and its evaluation is presented as a case study of a successful program training leaders in social science-based skills in order to produce catalysts of change. The Academy is theoretically grounded in transformational leadership, champions of innovation, civic capacity, and entrepreneurial leadership. The Academy employs a process-based curriculum with developmental experiences that includes key components of assessment, challenge, and support. Formative assessment provides constructive feedback from participants and guides the development of future sessions and curriculum. Summative assessment is used to gauge participants' leadership knowledge, skills, and behaviors, and evaluate the instructional methods used in the Academy. Results of pre- and post-Academy assessments of participants from both the participants' and raters' perspectives indicate statistically significant increases in transformational leadership behaviors, champion of innovation behaviors, civic capacity, entrepreneurial leadership behavior, awareness of Nebraska water issues, and engagement with Nebraska water issues.

Keywords: *water management, leadership development, process-based curriculum, assessment, catalysts of change*

Managing water resources is extremely challenging. Considerations include resource variability, changeable weather patterns, and technological advances, as well as evolving socioeconomic, policy, and regulatory factors. Unprecedented additional challenges, however, are emerging from the processes of climate change, increasing weather variability, accelerating demand for freshwater, aging infrastructure, fiscal constraints, environmental degradation, and declining water tables and stream flows (Pittock et al. 2008; Pahl-Wostl et al. 2013; Cosgrove and Loucks 2015). Problems posed to water managers are complex, non-linear, full of uncertainty, and open-ended (e.g., Tosey and Robinson 2002; Higgs and Rowland 2005; Gilley et al. 2009; Faruqi 2012). Sustaining freshwater ecosystem services in the face of these emerging threats is widely recognized as a supreme leadership challenge facing society (Millenium Ecosystem Assessment 2005; Rockström et al. 2009; Pittock et al. 2013).

This paper demonstrates how social science theories and methods are used to train leaders to catalyze change and provides an example of evaluating success. First, the case is made for a new generation of water leaders. Evidence presented shows that new leaders with a dynamic skill set are needed to meet future water management challenges. Correspondingly, the demand for

novel and evolutionary leadership development programs is presented. Foremost, the Nebraska Water Leaders Academy and its evaluation is presented as an example of a successful program training leaders in social science-based skills in order to produce catalysts of change.

Background

The Need for New Water Leaders

Emerging water management challenges demand knowledgeable and skilled leaders with abilities beyond technical expertise (Morton and Brown 2011; Lincklaen Arriëns and When de Montalvo 2013; Burbach et al. 2015). They require leaders who can guide, manage, and facilitate the changes necessary to address them. The Resilience Alliance (2010) argues that in order to increase a natural system's "resilience to disturbance and its capacity to adapt to change" resource managers must take "into account social and ecological influences at multiple scales, incorporate continuous change, and acknowledge a level of uncertainty" (p. 4). Folke et al. (2010) contend that transformational change is necessary to enable resilience in social-ecological systems, and this "transformational change often involves shifts in social network configurations, patterns of interactions among actors including leadership and political and power relations, and associated organizational and institutional arrangements" (para. 15). McIntosh and Taylor (2013) assert that "leadership is needed to initiate and drive change, enable innovation (both incremental and radical), build shared visions for a more sustainable water future, and deliver these visions through aligning resources and building commitment to collective success" (p. 46). Exceptional leadership is critical to the success of change efforts (Higgs and Rowland 2005). Thus, building leadership capacity is required to drive the necessary change to meet future water management challenges (Redekop 2010; Brasier et al. 2011; Morton et al. 2011; Pahl-Wostl et al. 2011b; Taylor et al. 2012).

Future water leaders must be catalysts of change while also preparing others to deal with continuous challenges and opportunities. Leaders will also need to catalyze change in many ways. As catalysts, they will not only need to lead incremental and transitional changes that involve merely fine-tuning the status quo but rather they will also need to lead discontinuous changes or paradigm shifts that involve redefining values, purposes, attitudes, and beliefs. These types of changes will frequently require different organizational strategies, structures, and management practices as well as cultural shifts (e.g., Burke and Litwin 1992; Cacioppe 2000; Tosey and Robinson 2002; Gilley et al. 2009). Leaders will need to create new systems and then institutionalize the new approaches in response to changing conditions (Kotter 1995). Leaders will need to help others make sense of and give meaning to events during times of great change (Weick 1995; Winch and Maytorena 2009; Combe and Carrington 2015) by organizing and turning circumstances into understandable frameworks that provide springboards for action (Weick et al. 2005).

Entrepreneurial individuals are needed to keep up with societal changes and globalization that continues to evolve at an increasingly rapid pace (O'Connor and Fiol 2002; Neuborne 2003), and foster a global mindset in organizations and communities by supporting innovation, change, and risk-taking while also valuing social responsibility (Reimers-Hild and King 2009). Future water leaders will also need to be good problem solvers if they are going to be catalysts of change (Gordon and Berry 2006; Heifetz et al. 2009); and manage not only conflict that has always been a part of water management, but also conflict that arises in a fashion and form not seen before as a consequence of increasingly diverse societies (Day 2000; Day and Halpin 2004; Benn et al. 2006; Dunphy et al. 2007; Taylor 2009; Pahl-Wostl et al. 2011a). Indeed, future water leaders must navigate more holistic, multidisciplinary, and participatory approaches to water management and governance (UNDESA 2014; Singh et al. 2019).

The Need for New Water-related Leadership Development Programs

Water-related leadership development programs are needed that prepare participants to be catalysts of change and to lead others through change (Burbach et al. 2015; Pradhananga et al. 2019). Traditional models of leadership development may be inadequate to develop catalysts of change

(Rost 1993; Allen et al. 2006). Many leadership development models are based on executive and management "command and control" models (Dietz and Stern 2002) in which leaders work toward specific goals, arbitrate among competing interests, enhance leader-follower competency, or develop competitive advantage (Berry and Gordon 1993; McCallum and O'Connell 2008; Mabey 2013). According to Faruqi (2012), traditional environmental leadership frameworks reflect a "mechanistic view of nature-human relations" (p. 776) where "human and natural systems are viewed as separate from each other" (p. 777) and "leaders are viewed as controllers who are expected to direct followers toward prescribed and often predetermined future states through a planned and efficient change management process" (p 776).

Historically, the foundation of most environment-related leadership development programs is the knowledge or information deficit model (Bak 2001; Sturgis and Allum 2004). This model is based on the premise that increasing participant environmental and leadership knowledge will cause behavior change and development of new abilities and skills. Knowledge forms the foundation upon which leadership development programs influence change; and knowledge is necessary for environmental and leadership behavior change (Kollmus and Agyeman 2002; Schultz 2002; Kaiser and Fuhrer 2003; Monroe 2003). Moreover, different forms of environmental knowledge must be considered in order to effect pro-environmental behavior change (Kaiser and Fuhrer 2003; Diaz-Siefer et al. 2015). Likewise, knowledge is necessary for developing the ability to effect change in others, communities, or policy (Gordon and Berry 2006). However, research has shown that, while knowledge is often correlated to behavior, increasing knowledge alone does not typically result in lasting behavior change (Barling et al. 1996; Schultz 2002; Abrahamse et al. 2005; Steg and Vlek 2009; Yukl 2013). It is generally not enough to know what to do. One must also be motivated to change, have the ability and skill to sustain the behavior change, and practice (Beer et al. 2016). People need active engagement with the concepts in the context of their own lives, critical reflection, and reinforcement to 'set' the new behavior (Bandura 1977; Argyris and Schon 1978;

Mezirow 1997; Beer et al. 2016).

Likewise, developing effective leaders with the ability to catalyze change and influence others requires building a set of competencies more than a body of knowledge alone (Boyatzis 1982; Bandura 1986; Arthur et al. 2003). Knowledge-only programs often result in small, short-term change or minimal ability to influence others (Feser et al. 2017). Often, leadership development requires more than knowledge to change values, beliefs, and attitudes (Roberts 2008). Changing values, beliefs, and attitudes requires a long-term perspective and reinforcement that accounts for social and cultural influences (e.g., Lewin 1947; McKenzie-Mohr 2000; Clayton and Opotow 2003; Dietz et al. 2005).

Water-related leadership development programs may also be short, one-time workshops where participants learn about environmental issues and leadership skills; and participants may even be motivated to implement change (DeVenney 2009; Petrie 2013). If a program is long-term, participants may meet at a series of stand-alone workshops where environmental and/or leadership information is shared. In more advanced cases, earlier knowledge may be built upon. However, in none of these cases would they get "the ongoing follow-up to solidify new thinking and behaviors into new habits" (Petrie 2013, p. 4).

Leadership Development as a Process

Leadership development programs founded on a process-based curriculum with a systematic approach that consider the unique contextual needs of the individual are much more likely to cause lasting change in behavior or leadership abilities (e.g., Brown and Posner 2001; Byrne and Rees 2006; Whitney and D'Andrea 2007; Ritch and Mengel 2009; McCauley et al. 2010; Day et al. 2014). Leadership development requires a variety of developmental experiences, as well as the ability and opportunity to learn from those experiences (Newman et al. 2007; Popper and Mayseless 2007; Ely et al. 2010; McCauley et al. 2010). And as mentioned earlier, active engagement with leadership concepts and water issues in the context of participants' own lives, critical reflection, and reinforcement is necessary to set the new behaviors. The leader development process will

most likely succeed in instances where individuals have solid developmental experiences that provide robust opportunities to learn (Hughes et al. 2012). First-hand experiences that activate emotional circuits in the brain result in improved learning and retention of that learning as changed behavior (Brown and Brown 2012; Waller et al. 2014). In a meta-analysis of creativity training programs, Scott et al. (2004) found that well-designed programs typically induce gains in performance; moreover, more successful programs were likely to focus on development of cognitive skills and the heuristics involved in skill application, and use realistic exercises appropriate for the context.

As a process, developing leaders takes time and practice to cultivate new knowledge, skills, abilities, and lasting behavior change (McCauley et al. 2010; Day et al. 2014; Beer et al. 2016). Maxwell (1998) states, "leadership develops daily, not in a day" (p. 21). According to Maxwell, the process entails learning, application, and adjustment. Day and colleagues (Day et al. 2014; Day and Dragoni 2015) promote experiences, interventions, and interactions as part of the development process. McCauley et al. (2010) state that leadership development involves developmental experiences that include three key components: assessment, challenge, and support (Figure 1). Taylor and McIntosh (2012) and Addor et al. (2005) demonstrate how a process-based water leadership development program incorporates assessment, challenge, and support to create agents of change.

It is not safe to assume that current water-related leadership development programs are designed to produce the catalysts of change necessary to address emerging water management challenges.

Burbach et al. (2015), for instance, reviewed 30 water-related leadership development programs and found only four that used curriculum grounded in evidence-based theory and that used a variety of developmental experiences incorporating assessment, challenge, and support.

The Nebraska Water Leaders Academy

The Nebraska Water Leaders Academy (from here on referred to as the Academy) has operated since 2011. The Academy employs a process-based curriculum with developmental experiences and opportunities to learn from the experiences following the McCauley et al. (2010) model to develop Nebraska's future water leaders, cause lasting change in their leadership abilities, and provide them the skills and abilities to influence change in others.

The objectives of the Academy are:
- Develop scientific, social, and political knowledge about water and related natural resources.
- Provide training materials, professional presentations, and experiential learning activities that instill sound and accurate information about efficient, economic, and beneficial uses of Nebraska's water resources.
- Develop and enhance critical thinking and leadership skills through process-based educational activities.
- Encourage and assist participants toward active involvement in water policy issues at all levels.

Figure 1. The McCauley et al. (2010) model of leadership development.

- Integrate multi-disciplinary educational and leadership programs to provide life-long leaders in water resources management.
- Challenge traditional paradigms about water resources and facilitate creative solutions to water-resources issues.

The Nebraska State Irrigation Association and its Executive Director, Lee Orton, created the Academy and established the nonprofit Water Futures Partnership-Nebraska to support Academy funding. The Academy is a year-long program consisting of six two-day sessions. There are three curricular components of the Academy: leadership, policy/law, and natural resources. Dr. Mark Burbach and Dr. Connie Reimers-Hild developed the leadership component of the Academy with contributions from qualified faculty and staff at the University of Nebraska-Lincoln (UNL). The water policy/law and natural resource curriculum are addressed by leading experts in their respective fields from UNL; federal, state, and local agencies; non-government organizations; and other associations. Early to mid-career professionals from diverse fields with a desire to impact change are the target audience. As of January 2019, a total of 120 participants in eight classes (i.e., cohorts) from across Nebraska with a wide range of professional, geographic, and water resources backgrounds have completed the Academy.

Formal assessment is accomplished through pre- and post-Academy assessments of participants' knowledge, skills, and abilities associated with the foundational leadership theories – transformational leadership, champions of innovation, civic capacity, and entrepreneurial leadership – as well as their awareness of and engagement in water issues in Nebraska. The pre- and post-assessments ask participants and others to rate participants on their leadership knowledge, abilities, and skills. Reliable and validated instruments are used in the pre- and post-assessments. Assessment is also conducted as part of each Academy session's evaluation process. Participants are asked to gauge the change in their knowledge and skills on leadership topics from before and after each session. At the conclusion of each session, participants are also asked open-ended questions about their experience with the material covered.

Challenge comes in the form of discussions in which participants are asked to respectfully challenge material covered by instructors; and in return, instructors challenge participants' paradigms. Participants are also asked to respectfully challenge each other's reasoning. Role play, scenarios, and games are used to challenge participants' assumptions or put themselves in another's shoes. Participants also have homework assignments and work on a team project.

Support starts with providing a safe and secure learning environment in which participants feel free to speak and share ideas (Beer et al. 2016). When it comes to sharing personal thoughts and opinions, the Academy follows the philosophy of "what happens in the Academy stays in the Academy." Feedback from assessments is provided to participants, but only cumulative results are shared. Participants listen to each other's stories of struggles and conflicts with water-related issues. They are encouraged to share strategies for coping. Accomplishments are celebrated. Participants develop professional and personal relationships with each other and Academy personnel. Furthermore, participants broaden their professional networks by connecting with presenters and others associated with the Academy. News and information are shared through newsletters, Facebook, and other media.

In addition to the developmental experiences through assessment, challenge, and support, the Academy provides field trips to learn first-hand about water issues across Nebraska and to make leadership challenges more tangible. The field trips have specific learning objectives and time is provided for participants to reflect and share what they learned. Teams are expected to identify and design a project over the course of the year-long Academy and present their final project to the Academy at the last session. Team construction is intentionally diverse based on a personality assessment, gender, age, profession/background, and region of the state represented.

Enhancing the ability to learn comes through participants recognizing they need new behaviors, skills, or abilities to lead the change necessary to address the emerging challenges of water management. Enhancing the ability to learn also comes through the participants sharing their

expectations of the Academy. The Academy asks participants to reflect upon their current strengths and weaknesses and their own learning process. The Academy also shares expectations with participants. Expectations include completing pre- and post-assessments; accepting responsibility for their own development; actively engaging with presenters, organizers, and each other; respecting one another's prior experiences and viewpoints; taking advantage of the opportunities offered; completing session evaluations; and completing homework. The Academy shares with participants the program curriculum prior to the first session, as well as agendas and other curricular information before each session.

Theoretical Foundation of the Nebraska Water Leaders Academy Curriculum

While the Academy follows the McCauley et al. (2010) model of leadership development to meet its curricular objectives, the subjects that comprise its curriculum are transformational leadership, champions of innovation, civic capacity, and entrepreneurial leadership. Transformational leadership theory suggests leaders can influence others to achieve change in any organization, at any level (Burns 1978; Bass 1990). Transformational leaders encourage and facilitate innovation, creativity, critical examination, and adaptive change (Moynihan et al. 2014). According to Bass and Avolio (1985, 1990), transformational leaders: 1) have high standards of moral, ethical, and personal conduct as well as gain respect, trust, and confidence from others; 2) increase optimism and enthusiasm and provide a strong vision for the future; 3) challenge norms, encourage a new look at old methods/problems, foster creative thinking, and stress re-examination of assumptions underlying problems; and 4) diagnose the needs and capabilities of others, delegate and coach, and attend to the personal development of others.

The Academy is also based on Howell et al. (2005) champions of innovation model. Champions of water management innovation are change agents promoting a philosophy of sustainable water management (Taylor 2009). Champions play a critical role in driving environmental change at multiple levels; from the project level through organizations and broader institutions (Olsson et al. 2006; Penning-Rowsell et al. 2006; Brouwer and Biermann 2011). Champions have a strong personal commitment to the environmental change they promote (Schon 1963; Markham et al. 1991). Effective champions convey confidence and enthusiasm about the innovation, enlist the support and involvement of key stakeholders, and persist in the face of adversity (Howell 2005).

Sun and Anderson's (2012) civic capacity model is another grounding framework for the Academy. Civic capacity is "the combination of interest and motivation to be engaged in public service and the ability to foster collaborations through the use of one's social connections and through the pragmatic use of processes and structures" (Sun and Anderson 2012, p. 317). Water leaders have a keen interest and motivation for civic engagement and the ability to successfully guide multi-sector collaborations (Crosby and Bryson 2010; Morse 2010; Silvia and McGuire 2010) and develop collaborative partnerships (Margerum and Robinson 2015). In order for the change that leaders initiate to be successful, the outcome must be socially acceptable in addition to bio-physically possible and economically feasible (Allan et al. 2008).

The Academy curriculum is also grounded in Renko et al.'s (2015) entrepreneurial leadership concept. An entrepreneurial individual is an innovative person who is open to change and recognizes and pursues opportunities irrespective of existing resources, such as time, money, personal support, and/or technology. Entrepreneurs are characterized as innovative people that convert problems into opportunities and whose ideas inspire others while serving as catalysts of change (Drucker 1985). Entrepreneurial individuals, who may or may not start a business, are critical to the success of communities and organizations, because they are innovators who proactively move ideas forward. In addition, it takes entrepreneurial leadership to foster a culture of sustainable innovation characterized by entrepreneurial actions and behaviors (Reimers-Hild and King 2009). Entrepreneurial leaders are noted for their ability to develop a compelling vision, recognize opportunities where others do not, operate in a highly unpredictable atmosphere, influence others (both followers and a larger constituency), absorb

uncertainty and risk, build commitment, and overcome barriers (Renko et al. 2015).

The Academy also introduces participants to the Meyers-Briggs model of personality type (Jung 1971; Myers and Myers 1995), conflict management (Delli Priscoli and Wolf 2009), work motivation (Leonard et al. 1999), and adaptive management (Holling 1978; Walters 1986). These elements of the Academy contribute to increased self-awareness and self-efficacy (Hannah et al. 2008; Day et al. 2009; Ashley and Reiter-Palmon 2012), and current best practices in resource management; however, these facets of leadership are not assessed by the Academy.

Program Evaluation

Program evaluation is an essential component of the Academy because it assesses the development of participants' leadership knowledge, skills, and abilities; evaluates the instructional methods used in the Academy; provides constructive feedback from participants; and guides the development of future sessions and curriculum (Ely et al. 2010; Day et al. 2014). The evaluation is both summative (i.e., assessing the outcomes of the program) and formative (i.e., improving program development and implementation) in order to empirically advance leadership practices. The evaluation process consists of individual session evaluations and an empirical analysis using a pre- and post-Academy leadership assessment (Figure 2). While the session evaluations and participant feedback are briefly discussed below, the primary component of the evaluation is the pre- and post-Academy assessment that is described in detail below.

The session evaluations gauge participants' change in knowledge levels related to leadership, water policy/law, and natural resource issues covered in each session. Participants also provide subjective feedback concerning the major knowledge they gained from the session, a summary of the session experience, and other important takeaways they want to share with the Academy planners. The session evaluations include a post-session quiz in the form of a word game to gauge participants' knowledge of material covered in the session. Post-field trip guided discussions are linked to field trip learning objectives. Evaluations are used by session planners to modify and adjust future sessions, particularly with regard to topics and presenters. Likewise, feedback from participants is used to evaluate participant needs, and may result in adjustments to future sessions. Periodically, alumni are surveyed on a variety of topics related to performance and future directions of the Academy.

The empirical analysis is conducted to measure the participants' change in leadership knowledge, skills, abilities, and behaviors from the beginning to the end of the Academy. This evaluation component provides a gauge of the cumulative effect of the Academy on participants and the overall effectiveness of the Academy curriculum. The objective is to explore research-based leadership knowledge, skills, and abilities associated with increasing leadership capacity. Participants' change in awareness of, and engagement with, water issues in Nebraska is also assessed. This analysis is on-going. The latest pre- and post-Academy assessment is further described below.
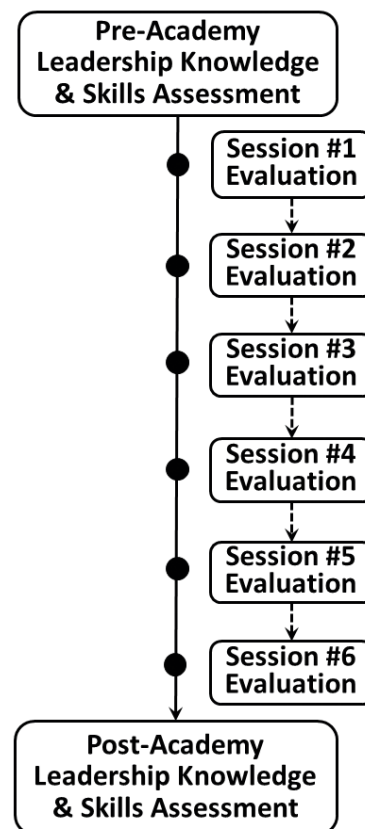

Figure 2. Flow chart of the Nebraska Water Leaders Academy program evaluation.

Assessment of the Nebraska Water Leaders Academy

Objective one of the pre- and post-Academy assessment was to determine any significant change in participants' leadership behaviors after the Academy from participants' perspectives. A series of paired-samples *t*-tests were conducted to compare the cumulative Academy participants' pre- and post-Academy leadership behaviors. A paired-samples *t*-test is used to compare two population means where you have two samples in which observations in one sample can be paired with observations in the other sample (i.e., Academy participants before and after).

One hundred eighteen of the 120 total Academy participants have completed the pre- and post-Academy assessment of transformational leadership abilities, champion of innovation behaviors, civic capacity, entrepreneurial leadership, and Nebraska water issues awareness and engagement. Twenty-six females and 92 males have completed the pre- and post-assessment (27 females and 93 males have completed the Academy). The participants' average age was 38.4 with a range of 21 to 61. Civic Capacity was assessed for the first time in 2016; thus, 54 Academy participants (42 males, 12 females) have completed the pre- and post-Academy assessment of civic capacity.

Objective two of the pre- and post-Academy assessment was to determine any significant change in participants' leadership behaviors after the Academy from raters' perspectives. A series of independent samples *t*-tests were conducted to compare the cumulative Academy participants' pre- and post-Academy leadership behaviors from raters' perspectives. An independent samples *t*-test is used to determine statistically significant difference between the means in two unrelated groups (i.e. anonymous raters before and after). Two hundred sixty-one raters have completed pre-Academy assessments and 244 raters have completed post-Academy assessments.

Procedures. A research-based questionnaire composed of previously validated items was employed to assess changes in leadership behaviors among participants over the course of the Academy. The survey is administered online

using Qualtrics™ software with the assistance of a trained graduate assistant from the UNL. The UNL Institutional Review Board (IRB) approved the research prior to beginning the study. The IRB continues to review and approve the research protocol on an annual basis.

Academy participants were notified of the online questionnaire three weeks prior to the first Academy session in January and given instructions on completing the questionnaire. The process is repeated three weeks prior to the final session in November (objective one). Participants were also asked to invite others with whom they have a professional relationship to rate their leadership behaviors (objective two). Participants send raters an e-mail invitation that includes the link to the online questionnaire. The only modification to the questionnaire was that the items were written from an observer's perspective. All IRB protocols are followed to ensure anonymity of participants and raters.

Measures. The online questionnaire consisted of four research-based leadership assessments. The first assessment consisted of 36 items from the Multi-factor Leadership Questionnaire (MLQ-5, Bass and Avolio 1995) intended to evaluate transformational leadership styles - *Idealized Influence*, *Inspirational Motivation, Intellectual Stimulation, Individualized Consideration.*

The second assessment is a modified Champions of Innovation scale developed by Howell et al. (2005). It is a 14-item, five-point Likert-type scale that measures characteristics of champions of innovation. The scale was modified by eliminating one or two items from each of the three subscales for a total of 10 items. The constructs' three subscales are: *enthusiasm and confidence in what innovation can do*, *persisting under adversity*, and *getting the right people involved*.

A third assessment measures characteristics of civic capacity. The civic capacity scale was developed by Cramer (2015). Nine items of the five-point Likert-type scale were used. Civic capacity is "the combination of interest and motivation to be engaged in public service and the ability to foster collaborations through the use of one's social connections and through the pragmatic use of processes and structures" (Sun and Anderson 2012, p. 317). Civic capacity is

composed of the following subscales - *Civic Drive, Civic Connections*, and *Civic Pragmatism*.

A fourth assessment measures participants' tendencies for entrepreneurial leadership. Five items are used to measure entrepreneurial leadership following the Renko et al. (2015) conceptualization.

The questionnaire also includes items to measure participants' knowledge and behavior related to Nebraska water issues. The knowledge and behavior scale is an eight-item, five-point Likert-type scale that measures *awareness* of water issues in Nebraska and *engagement* in water issues in Nebraska. An example of awareness is: "I am aware of the major water issues confronting Nebraska." An example item for engagement is: "I am actively engaged in Nebraska water policy issues."

The internal reliability (Cronbach's alpha) for all the scales ranged from 0.70 to 0.95. Nunnally and Bernstein (1994) concluded that acceptable minimum reliability for measurement scales should be 0.70; and the measures meet this standard.

Results

Participants' Perspective (Objective One)

There has been a statistically significant increase in the participants' total transformational leadership behaviors from pre- to post-Academy from the participants' perspective (Table 1). Additionally, all four transformational leadership behaviors from pre- to post-Academy showed a significant increase. There has also been a significant increase in participants' total innovation behaviors from pre- to post-Academy, as well as all three champions of innovation behaviors from pre- to post-Academy. Participants' awareness of, and engagement in, Nebraska policy water issues has increased significantly from pre- to post-Academy (Table 1). There has been a significant increase in entrepreneurial leadership in participants from pre- to post-Academy.

Civic Capacity was assessed for the first time in 2016. Thus, cumulative results for civic capacity represent three Academy classes. There was a significant increase in participants' civic capacity from pre- to post-Academy (Table 1). The past three classes of Academy participants have also demonstrated a significant increase in all three

dimensions of civic capacity from pre- to post-Academy.

Raters' Perspective (Objective Two)

There has been a statistically significant increase in participants' total transformational leadership behaviors as well as all four subscales of transformational leadership behavior from pre- to post-Academy from the raters' perspective (Table 2). Participants' total champion of innovation behaviors has increased significantly from pre- to post-Academy from the raters' perspective, as well as all three champion of innovation dimensions.

Academy participants' awareness of, and engagement in, Nebraska water policy issues has increased significantly from pre- to post-Academy from the raters' perspective (Table 2). There has also been a significant increase in Academy participants' entrepreneurial leadership from pre- to post-Academy from the raters' perspective.

Additionally, a significant increase was revealed in the past three classes of Academy participants' civic capacity from pre- to post-Academy from the raters' perspective (Table 2). These three classes of Academy participants have also demonstrated a significant increase in all three dimensions of civic capacity from pre- to post-Academy.

The Leadership Experience of Academy Alumni

The Academy also conducts formal interviews of alumni to gauge their involvement in water policy issues. There is substantial evidence from post-Academy interviews that alumni are becoming engaged as water leaders impacting water-related issues at the local, state, regional, and national levels. Several alumni have been elected to Natural Resources Districts boards of directors, the primary groundwater management and regulatory agency in Nebraska. Other examples of leadership include alumni serving as a Special Advisor to the Secretary of the U.S. Department of Agriculture, two Nebraska Natural Resource Commissioners, a Nebraska Environmental Trust board member, a city council member, a coordinator for a state senator, and several foundation board members.

Others are now active in local water basin boards, planning boards, religious boards, community organizations, and service clubs. All alumni interviewed and those updating their

alumni profile with the Academy have advanced within their jobs, crediting the Academy for giving them the skills, confidence, and experience needed to advance. Many alumni volunteer in local and community organizations, schools, and religious groups. One Academy alumnus is working on a team designing and facilitating transboundary water cooperation between Afghanistan, Tajikistan, and Pakistan with funding from the U.S. Institute of Peace. One Academy alumnus, a groundwater management engineer, teaches a course at the University of Nebraska-Omaha on geography and water resources using knowledge and experience gained from his participation in the Academy. Finally, one Academy alumnus is preparing to run for the state legislature in the next election.

Discussion

Unprecedented water management challenges require new leaders with skills based in the social sciences, in addition to technical skills; and new or modified leadership development programs are needed to master these skills. The Nebraska Water Leaders Academy provides a case study of a leadership development program grounded in social science theories and methods to prepare leaders to catalyze change. The Academy also provides an example of how to evaluate a leadership development program. The Academy is successfully building the leadership capacity of future water leaders by enabling them to drive the change necessary to address emerging water management challenges. Results of the empirical analysis

Table 1. Results of paired samples *t*-tests comparing cumulative participants' transformational leadership behavior before and after the Academy (N = 118).

	Pre-Academy		Post-Academy						
	M	SD	M	SD	Diff.	t	df	Sig.	Cohen's d
Transform. Leadership	2.75	0.46	3.06	0.38	0.31	10.97	117	0.000*	0.73
Idealized Influence	2.69	0.49	3.00	0.41	0.31	8.68	117	0.000*	0.69
Inspirational Motivation	2.74	0.60	3.07	0.51	0.33	8.40	117	0.000*	0.59
Intellectual Stimulation	2.74	0.59	3.10	0.50	0.36	9.59	117	0.000*	0.66
Individual Consideration	2.84	0.54	3.10	0.39	0.26	6.77	117	0.000*	0.55
Champion of Innovation	3.01	0.49	3.29	0.39	0.28	9.29	117	0.000*	0.63
Enthusiasm and Confidence in Innovation	2.95	0.65	3.25	0.50	0.30	7.15	117	0.000*	0.52
Persistence under Adversity	2.97	0.55	3.24	0.46	0.27	6.92	117	0.000*	0.53
Get Right People Involved	3.10	0.59	3.37	0.51	0.27	7.28	117	0.000*	0.49
Water Issue Awareness	2.84	0.74	3.46	0.50	0.62	9.88	117	0.000*	0.98
Water Issue Engagement	2.59	0.86	3.14	0.66	0.55	8.94	117	0.000*	0.72
*Civic Capacity***	2.39	0.73	2.88	0.56	0.49	7.59	53	0.000*	0.75
Drive	2.48	0.89	2.86	0.72	0.38	5.26	53	0.000*	0.47
Connections	2.51	0.80	3.11	0.58	0.60	7.58	53	0.000*	0.86
Pragmatism	2.17	0.83	2.66	0.69	0.49	5.80	53	0.000*	0.64
Entrepreneurial Leadership	2.68	0.72	3.02	0.60	0.34	7.32	117	0.000*	0.51

* p < 0.001; ** N = 54

Table 2. Results of independent samples *t*-tests comparing cumulative raters' perspectives of participants' transformational leadership behaviors before and after the Academy.

	N	M	SD	t	df	Sig.	Cohen's d
Transform. Leadership – Pre-Academy	312	3.01	0.52	6.75	587	0.000*	0.57
Transform. Leadership – Post-Academy	277	3.29	0.44				
Idealized Influence – Pre-Academy	312	3.03	0.55	6.31	587	0.000*	0.52
Idealized Influence – Post-Academy	277	3.29	0.44				
Inspirational Motivation – Pre-Academy	312	3.07	0.59	5.39	587	0.000*	0.44
Inspirational Motivation – Post-Academy	277	3.31	0.49				
Intellectual Stimulation – Pre-Academy	312	2.96	0.59	6.54	587	0.000*	0.55
Intellectual Stimulation – Post-Academy	277	3.26	0.50				
Individual Consideration – Pre-Academy	312	2.99	0.61	5.41	587	0.000*	0.44
Individual Consideration – Post-Academy	277	3.22	0.52				
Champion of Innovation – Pre-Academy	311	3.20	0.48	7.50	586	0.000*	0.61
Champion of Innovation – Post-Academy	277	3.48	0.43				
Enthusiasm & Confidence – Pre-Academy	311	3.10	0.62	5.77	586	0.000*	0.47
Enthusiasm & Confidence – Post-Academy	277	3.37	0.53				
Persistence – Pre-Academy	311	3.24	0.51	6.28	586	0.000*	0.51
Persistence – Post-Academy	277	3.50	0.50				
Right People Involved – Pre-Academy	311	3.27	0.51	7.87	586	0.000*	0.66
Right People Involved – Post-Academy	277	3.58	0.43				
Water Issue Awareness – Pre-Academy	312	3.26	0.62	6.98	587	0.000*	0.57
Water Issue Awareness – Post-Academy	277	3.58	0.49				
Water Issue Engagement – Pre-Academy	312	3.05	0.75	7.05	587	0.000*	0.57
Water Issue Engagement – Post-Academy	277	3.44	0.60				
Civic Capacity – Pre-Academy	157	3.02	0.60	5.13	291	0.000*	0.62
Civic Capacity – Post-Academy	136	3.38	0.57				
Drive – Pre-Academy	157	3.02	0.66	4.40	291	0.000*	0.54
Drive – Post-Academy	136	3.37	0.63				
Connections – Pre-Academy	157	3.02	0.64	5.41	291	0.000*	0.64
Connections – Post-Academy	136	3.41	0.58				
Pragmatism – Pre-Academy	157	3.01	0.62	4.72	291	0.000*	0.58
Pragmatism – Post-Academy	136	3.35	0.58				
Entrepreneurial Leadership – Pre-Academy	261	3.12	0.60	4.43	503	0.000*	0.39
Entrepreneurial Leadership – Post-Academy	244	3.36	0.62				

* p < 0.001

of the Academy from participants' and raters' perspectives demonstrate a statistically significant increase in Academy participants' transformational leadership behaviors, champion of innovation behaviors, civic capacity, entrepreneurial leadership behavior, awareness of Nebraska water issues, and engagement with Nebraska water issues. Feedback from alumni demonstrates that they are positioning themselves to be catalysts of change in water issues at local, state, regional, national, and even international levels.

Conclusion

Emerging challenges to water management are adding to what has always been a difficult, complex task for communities and states. Future water leaders must be capable of leading change and preparing others for change. Leadership development program designers must look to the social sciences and social science theories in creating leadership development programs to produce catalysts of change to sustain freshwater ecosystem services. By using a theoretically-based foundation and employing a process-based curriculum involving developmental experiences that include assessment, challenge, and support, these leadership development programs are more likely to produce the necessary catalysts of change.

Acknowledgements

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References

Abrahamse, W., L. Steg, C. Vlek, and T. Rothengatter. 2005. A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology* 25: 273-291.

Addor, M., T. Cobb, E. Dukes, M. Ellerbrock, and L. Smutko. 2005. Linking theory to practice: A theory of change model of the Natural Resources Leadership Institute. *Conflict Resolution Quarterly* 23(2): 203-223.

Allan, C., A. Curtis, G. Stankey, and B. Shindler. 2008. Adaptive management and watersheds: A social science perspective. *Journal of the American Water Resources Association* 44(1): 166-174.

Allen, K.E., J. Bordas, G.R. Hickman, L.R. Matusak, G.J. Sorenson, and K.J. Whitmire. 2006. Leadership in the twenty-first century. *IEEE Engineering Management Review* 34: 60-67.

Antonakis, J., B.J. Avolio, and N. Sivasubramaniam. 2003. Context and leadership: An examination of the nine-factor full-range leadership theory using the Multifactor Leadership Questionnaire. *Leadership Quarterly* 14: 261-295.

Argyris, C. and D. Schon. 1978. *Organizational Learning: A Theory of Action Perspective*. Addison-Wesley, London, UK.

Arthur, W., Jr., W. Bennett, W., Jr., P.S. Edens, and S.T.

Bell. 2003. Effectiveness of training in organizations: A meta-analysis of design and evaluation features. *Journal of Applied Psychology* 88: 234-245.

Ashley, G.C. and R. Reiter-Palmon. 2012. Self-awareness and the evolution of leaders: The need for a better measure of self-awareness. *Journal of Behavioral & Applied Management* 14(1): 2-17.

Bak, H.-J. 2001. Education and public attitudes toward science: Implications for the "Deficit Model" of education and support for science and technology. *Social Science Quarterly* 82: 779-795.

Bandura, A. 1977. *Social Learning Theory*. Prentice Hall, Englewood Cliffs, NJ.

Bandura, A. 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice Hall, Englewood Cliffs, NJ.

Barling, J., T. Weber, and E. Kelloway. 1996. Effects of transformational leadership training on attitudinal and financial outcomes: A field experiment. *Journal of Applied Psychology* 81: 827-832.

Bass, B.M. 1985. *Leadership and Performance Beyond Expectations*. Free Press, New York, NY.

Bass, B.M. 1990. From transactional to transformational leadership: Learning to share the vision. *Organizational Dynamics* 18(3): 19-31.

Bass, B.M. and R. Bass. 2008. *The Bass Handbook of Leadership: Theory, Research, and Managerial Applications*. 4th edition. Free Press, New York, NY.

Bass, B.M. and B.J. Avolio. 1990. Developing transformational leadership: 1992 and beyond. *Journal of European Industrial Training* 14: 21-27.

Bass, B.M. and B.J. Avolio. 1995. *Multifactor Leadership Questionnaire*. Mind Garden, Redwood City, CA.

Beer, M., M. Finnström, and D. Schrader. 2016. Why leadership training fails—And what to do about it. *Harvard Business Review* 94(10): 50-57.

Benn, S., D. Dunphy, and A. Griffiths. 2006. Enabling change for corporate sustainability: An integrated perspective. *Australasian Journal of Environmental Management* 13: 156-165.

Berry, J.K. and J.C. Gordon. (Eds.). 1993. *Environmental Leadership: Developing Effective Skills and Styles*. Island Press, Washington, D.C.

Boyatzis, R.E. 1982. *The Competent Manager: A Model for Effective Performance*. Wiley, New York, NY.

Brasier, K.J., B. Lee, R. Stedman, and J. Weigle. 2011. Local champions speak out: Pennsylvania's Community Watershed Organizations. In: *Pathways for Getting to Better Water Quality: The Citizen Effect*, L.W. Morton and S.S. Brown (Eds.). Springer, New York, NY, pp. 133-144.

Brouwer, S. and F. Biermann. 2011. Towards adaptive management: Examining the strategies of policy entrepreneurs in Dutch water management. *Ecology and Society* 16(4): 5.

Brown, P. and V. Brown. 2012. *Neuropsychology for Coaches – Understanding the Basics*. McGraw-Hill, Maidenhead, UK.

Burbach, M.E., K. Floress, and E.K. Kaufman. 2015. Are water-related leadership development programs designed to be effective? An exploratory study. *Journal of Leadership Education* 14(1): 107-123.

Burke, W.W. and G.H. Litwin. 1992. A causal model of organizational performance and change. *Journal of Management* 18: 523-545.

Burns, J.M. 1978. *Leadership*. Harper & Row, New York, NY.

By, R.T. 2005. Organisational change management: A critical review. *Journal of Change Management* 5: 369-380.

Byrne, J.C. and R.T. Rees. 2006. *The Successful Leadership Development Program: How to Build It and How to Keep It Going*. Pfeiffer, San Francisco, CA.

Cacioppe, R. 2000. Creating spirit at work: Re-visioning organization development and leadership - Part II. *Leadership & Organization Development Journal* 21(2): 110-119.

Clayton, S. and S. Opotow. (Eds.). 2003. *Identity and the Natural Environment: The Psychological Significance of Nature*. MIT Press, Cambridge, MA.

Combe I.A. and D. Carrington. 2015. Leaders' sensemaking under crises: Emerging cognitive consensus over time within management teams. *Leadership Quarterly* 26: 307-322.

Cosgrove, W.J. and D.P. Loucks. 2015. Water management: Current and future challenges and research directions. *Water Resources Research* 51: 4823-4839.

Cramer, J.S. 2015. Civic capacity and integrative public leadership: A case study of the Nebraska Water Leaders Academy. Thesis, University of Nebraska-Lincoln, Lincoln, Nebraska.

Crosby, B.C. and J.M. Bryson. 2010. Integrative leadership and the creation and maintenance of cross-sector collaboration. *Leadership Quarterly* 21: 211-230.

Day, D.V. 2000. Leadership development: A review in context. *Leadership Quarterly* 11: 581-613.

Day, D. and L. Dragoni. 2015. Leadership development: An outcome-oriented review based on time and levels of analyses. *The Annual Review of Organizational Psychology and Organizational Behavior* 2(3): 1-24.

Day, D.V., J.W. Fleenor, L.E. Atwater, R.E. Sturm, and R.A. McKee. 2014. Advances in leader and leadership development: A review of 25 years of research and theory. *Leadership Quarterly* 25: 63-82.

Day, D.V. and S.M. Halpin. 2004. Growing leaders for tomorrow: An introduction. In: *Leadership Development for Transforming Organizations: Growing Leaders for Tomorrow*, D.V. Day, S.J. Zaccaro, and S.M. Halpin (Eds.). Lawrence Erlbaum, Mahwah, NJ, pp. 3-22.

Day, D., M. Harrison, and S. Halpin. 2009. *An Integrative Approach to Leader Development. Connecting Adult Development, Identity and Expertise*. Taylor & Francis, New York, NY.

Delli Priscoli, J. and A.T. Wolf. 2009. *Managing and Transforming Water Conflicts*. Cambridge University Press, Cambridge, MA.

DeVenney, M. 2009. *Leadership: Making the Critical Investment*. Bluteau DeVenney & Company, Halifax, Nova Scotia.

Díaz-Siefer, P., A. Neaman, E. Salgado, J.L. Celis-Diez, and S. Otto. 2015. Human-environment system knowledge: A correlate of pro-environmental behavior. *Sustainability* 7: 15510-15526.

Dietz, T., A. Fitzgerald, and R. Shwom. 2005. Environmental values. *Annual Review of Environmental Resources* 30: 335-372.

Dietz, T. and P.C. Stern (Eds.). 2002. Exploring new tools for environmental protection. In: *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*. National Academy Press, Washington, D.C., pp. 3-15.

Donaldson, S.I. and E.J. Grant-Vallone. 2002. Understanding self-report bias on organizational behavior research. *Journal of Business and Psychology* 17(2): 245-260.

Drucker, P.F. 1985. *Innovation and Entrepreneurship*. Harper Collins, New York, NY.

Dunphy, D., A. Griffiths, and S. Benn. 2007. *Organizational Change for Corporate Sustainability: A Guide for Leaders and Change Agents of the Future*. 2nd edition. Routledge, London, UK.

Ely, K., L.A. Boyce, J.K. Nelson, S.J. Zaccaro, G. Hernez-Broome, and W. Whyman. 2010. Evaluating leadership coaching: A review and integrated framework. *Leadership Quarterly* 21(4): 585-599.

Faruqi, M. 2012. Embracing complexity to enable change. In: *Environmental Leadership: A Reference Handbook*, D. Rigling Gallagher, N. Christiansen, and P. Andrews (Eds.). Sage, Thousand Oaks, CA, pp. 772-781.

Feser, C., N. Nielsen, and M. Rennie. 2017. What's missing in leadership development? *McKinsey Quarterly* 2017(3): 20-24.

Folke, C., S.R. Carpenter, B. Walker, M. Scheffer, T. Chapin, and J. Rockström. 2010. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecology and Society* 15(4): 20.

Gilley, A., H.S. McMillan, and J.W. Gilley. 2009. Organizational change and characteristics of leadership effectiveness. *Journal of Leadership & Organizational Studies* 16(1): 38-47.

Gordon, J.C. and J.K. Berry. 2006. *Environmental Leadership Equals Essential Leadership: Redefining Who Leads and How*. Yale University Press, New Haven, CT.

Hannah, S.T., B.J. Avolio, F. Luthans, and P.D. Harms. 2008. Leadership efficacy: Review and future directions. *Leadership Quarterly* 19: 669-692.

Heifetz, R., A. Grashow, and M. Linsky. 2009. *The Practice of Adaptive Leadership*. Harvard Business Press, Boston, MA.

Higgs, M. and R. Rowland. 2005. All changes great and small: Exploring approaches to change and its leadership. *Journal of Change Management* 5(2): 121-151.

Holling, C.S. 1978. *Adaptive Environmental Assessment and Management*. John Wiley and Sons, Chichester, UK.

Howell, J.M. 2005. The right stuff: Identifying and developing effective champions of innovation. *Academy of Management Executive* 19: 108-119.

Howell, J.M. C.M. Shea, and C.A. Higgins. 2005. Champions of product innovations: Defining, developing and validating a measure of champion behavior. *Journal of Business Venturing* 20: 641-661.

Hughes, R.L., R.C. Ginnett, and G.J. Curphy. 2009. *Leadership: Enhancing the Lessons of Experience*. 5th edition. McGraw-Hill, New York, NY.

Jung, C.G. 1971. *Psychological Types*. Princeton University Press, Princeton, NJ.

Kaiser, F. and U. Fuhrer. 2003. Ecological behavior's dependency on different forms of knowledge.

Applied Psychology: An International Review 52: 598-613.

Kaplan, A. 1964. *The Conduct of Inquiry: Methodology for Behavioral Science*. Thomas Y. Crowell, New York, NY.

Kollmuss, A. and J. Agyeman. 2002. Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research* 8: 239-260.

Kotter, J.P. 1995. Leading change: Why transformation efforts fail. *Harvard Business Review* 73(2): 59-67.

Leonard, N.H., L.L. Beauvais, and R.W. Scholl. 1999. Work motivation: The incorporation of self-concept-based processes. *Human Relations* 52: 969-998.

Lewin, K. 1947. Frontiers in group dynamics: Concepts, method and reality in social science, social equilibria and social change. *Human Relations* 1(1): 5-41.

Lincklaen Arriëns, W. and U. Wehn de Montalvo. 2013. Exploring water leadership. *Water Policy* 15(Suppl.2): 15-41.

Mabey, C. 2013. Leadership development in organizations: Multiple discourses and diverse practice. *International Journal of Management Reviews* 15: 359-380.

Margerum, R.D. and C.J. Robinson. 2015. Collaborative partnerships and the challenges for sustainable water management. *Current Opinion in Environmental Sustainability* 12: 53-58.

Markham, S., S. Green, and R. Basu. 1991. Champions and antagonists: Relationships with R&D project characteristics and management. *Journal of Engineering and Technology Management* 8: 217-242.

Maxwell, J. 1998. *The 21 Irrefutable Laws of Leadership: Follow Them and People Will Follow You*. Thomas Nelson, Inc., Nashville, TN.

McCallum, S. and D. O'Connell. 2008. Social capital and leadership development. *Leadership and Organizational Development Journal* 30: 152-166.

McCauley, C.D., E. Van Velsor, and M.N. Ruderman (Eds.). 2010. Introduction: Our viewpoint of leadership development. In: *The Center for Creative Leadership Handbook of Leadership Development*. Wiley, San Francisco, CA, pp. 1-26.

McIntosh, B.S. and A. Taylor. 2013. Developing t-shaped water professionals: Reflections on a framework for building capacity for innovation through collaboration, learning and leadership. *Water Policy* 15: 42-60.

McKenzie-Mohr, D. 2000. Promoting sustainable behavior: An introduction to community-based social marketing. *Journal of Social Issues* 56: 543-554.

Mezirow, J. 1997. Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education 74*: 5-12.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis*. Island Press and World Resources Institute, Washington, D.C.

Monroe, M. 2003. Two avenues of encouraging conservation behaviors. *Human and Ecology Review, Society for Human Ecology* 10(2): 113-125.

Morse, R.S. 2010. Integrative public leadership: Catalyzing collaboration to create public value. *Leadership Quarterly* 21: 231-245.

Morton, L.W. and S.S. Brown. 2011. *Pathways for Getting to Better Water Quality: The Citizen Effect*. Springer, New York, NY.

Morton, L.W., T. Selfa, and T.A. Becerra. 2011. Shared leadership for watershed management. In: *Pathways for Getting to Better Water Quality: The Citizen Effect*, L.W. Morton and S.S. Brown (Eds.). Springer, New York, NY, pp. 29-39.

Moynihan, D.P., S.K. Pandey, and B.E. Wright. 2014. Transformational leadership in the public sector: Empirical evidence of its effects. In: *Public Administration Reformation: Market Demand from Public Organizations*, Y.K. Dwivedi, M.A. Shareef, S.K. Pandey, and V. Kumar (Eds.). Routledge, New York, NY, pp. 87-104.

Myers, I.B. and P. Myers. 1995. *Gifts Differing: Understanding Personality Type*. Davies-Black Publishing, Mountain View, CA.

Neuborne, E. 2003. Bright ideas. *Sales and Marketing Management* 155(8): 26-30.

Newman, P., B.L. Bruyere, and A. Beh. 2007. Service-learning and natural resource leadership. *Journal of Experiential Education* 30: 54-69.

Nunnally, J.C. and I.H. Bernstein. 1994. *Psychometric Theory*. 3rd edition. McGraw-Hill, New York, NY.

O'Connor, E.J. and C.M. Fiol. 2002. Mindful over mindless: Learning to think like an entrepreneur. *The Physician Executive* 28(4): 18-23.

Olsson, P., L.H Gunderson, S.R. Carpenter, P. Ryan, L. Lebel, C. Folke, and C.S. Holling. 2006. Shooting the rapids: Navigating transitions to adaptive governance of social-ecological systems. *Ecology and Society* 11(1): 1-21.

Pahl-Wostl, C., K. Conca, A. Kramer, J. Maestu, and

F. Schmidt. 2013. Missing links in global water governance: A processes-oriented analysis. *Ecology and Society* 18(2): 33.

Pahl-Wostl, C., P. Jeffrey, N. Isendahl, M. Brugnach. 2011a. Maturing the new water management paradigm: Progressing from aspiration to practice. *Water Resource Management* 25: 837-856.

Pahl-Wostl, C., C. Nilsson, J. Gupta, and K. Tockner. 2011b. Societal learning needed to face the water challenge. *Ambio* 40: 549-553.

Penning-Rowsell, E., C. Johnson, and S. Tunstall. 2006. 'Signals' from pre-crisis discourse: Lessons from UK flooding for global environmental policy change? *Global Environmental Change* 16: 323-339.

Petrie, N. 2013. *Vertical Leadership Development – Part 1: Developing Leaders for a Complex World*. Center for Creative Leadership, Greensboro, NC.

Pittock, J., L. Hanson, and R. Abell. 2008. Running dry: Freshwater biodiversity, protected areas and climate change. *Biodiversity* 9(3 & 4): 30-38.

Pittock, J., K. Hussey, and S. McGlennon. 2013. Australian climate, energy and water policies: Conflicts and synergies. *Australian Geographer* 44(1): 3-22.

Popper, M. and O. Mayseless. 2007. The building blocks of leadership development: A psychological conceptual framework. *Leadership & Organizational Development* 28: 664-668.

Pradhananga, A., M. Davenport, and E. Green. 2019. Cultural narratives on constraints to community engagement in urban water restoration. *Journal of Contemporary Water Research & Education* 166: 79-94.

Redekop, B.W. (Ed.). 2010. *Leadership for Environmental Sustainability*. Routledge, New York, NY.

Reimers-Hild, C.I. and J.W. King. 2009. Six questions for entrepreneurial leadership and innovation in distance education. *Online Journal of Distance Learning Administration* 12(4). Available at: http://www.westga.edu/~distance/ojdla/winter124/reimers-hild124.html. Accessed July 16, 2019.

Renko, M., A. El Tarabishy, A. Carsrud, and M. Brannback. 2015. Understanding and measuring entrepreneurial leadership. *Journal of Small Business Management* 53(1): 54-74.

Ritch, S. and T. Mengel. 2009. Guiding questions: Guidelines for leadership education programs. *Journal of Leadership Education* 8(1): 216-227.

Roberts, C. 2008. Developing future leaders: The role of reflection in the classroom. *Journal of Leadership Education* 7: 116-130.

Rockström J., W. Steffen, K. Noone, A. Persson, F.S. Chapin, E.F. Lambin, T.M. Lenton, M. Scheffer, C. Folke, H.J. Schellnhuber, B. Nykvist, C.A. de Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P.K. Snyder, R. Constanza, U. Svedin, M. Falkenmark, L. Karlberg, R.W. Corell, V.J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J.A. Foley. 2009. A safe operating space for humanity. *Nature* 461: 472-475.

Rost, J.C. 1993. Leadership development in the new millennium. *The Journal of Leadership Studies* 1: 92-110.

Schultz, P.W. 2002. Knowledge, education, and household recycling: Examining the knowledge-deficit model of behavior change. In: *Education, Information, and Voluntary Measures in Environmental Protection*, T. Dietz and P. Stern (Eds.). National Academy of Sciences, Washington, D.C., pp. 67-82.

Schon, D. 1963. Champions for radical new inventions. *Harvard Business Review* 41(2): 77-86.

Scott, G.M., L.E. Leritz, and M.D. Mumford. 2004. The effectiveness of creativity training: A meta-analysis. *Creativity Research Journal* 16: 361-388.

Singh A., D. Saha, and A.C. Tyagi (Eds.). 2019. Emerging issues in water resources management: Challenges and prospects. In: *Water Governance: Challenges and Prospects*. Springer, Singapore.

Silvia, C. and M. McGuire. 2010. Leading public sector networks: An empirical examination of integrative leadership behaviors. *Leadership Quarterly* 21: 264-277.

Steg, L. and C. Vlek. 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology* 29: 309-317.

Sturgis, P. and N. Allum. 2004. Science in society: Re-evaluating the deficit model of public attitudes. *Public Understanding of Science* 13(1): 55-74.

Sun, P. and M. Anderson. 2012. Civic capacity: Building on transformational leadership to explain successful integrative public leadership. *Leadership Quarterly* 23(3): 309-323.

Taylor, A. 2009. Sustainable urban water management: Understanding and fostering champions of change. *Water Science and Technology* 59: 883-891.

Taylor, A., C. Cocklin, and R. Brown. 2012. Fostering environmental champions: A process to build their capacity to drive change. *Journal of Environmental Management* 98: 84-97.

Taylor, A. and B. McIntosh. 2012. Building leadership capacity to drive change: Lessons from a new program. In: *Proceedings of the Enviro 2012 Conference*. July 24-26, 2012, Adelaide, South Australia, pp. 1-17.

Tosey, P. and G. Robinson. 2002. When change is no longer enough: What do we mean by "transformation" in organizational change work? *The TQM Magazine* 14(2): 100-109.

United Nations Department of Economic and Social Affairs (UNDESA). 2014. *International Decade for Action 'Water for Life' 2005-2015*. Available at: https://www.un.org/waterforlifedecade/iwrm.shtml. Accessed July 16, 2019.

Wacker, J. 1998. A definition of theory: Research guidelines for different theory-building research methods in operations management. *Journal of Operations Management* 16: 361-385.

Waller. L., M. Reitz, E. Poole, and A. Muir. 2014. *The Neuroscience of Leadership Development: Preparing through Experience. Ashridge Business School Report,* Berkhamsted, UK, *p. 23.*

Walters, C.J. 1986. *Adaptive Management of Renewable Resources*. Macmillan, New York, NY.

Wang, G., I.S. Oh, S.H. Courtright, and A.E. Colbert. 2011. Transformational leadership and performance across criteria and levels: A meta-analytic review of 25 years of research. *Group & Organization Management* 36: 223-270.

Weick, K.E. 1995. *Sensemaking in Organizations*. Sage, Thousand Oaks, CA.

Weick, K.E., K.M. Sutcliffe, and D. Obstfeld. 2005. Organizing and the process of sensemaking. *Organization Science* 16: 409-421.

Whitney, R. and L.M. D'Andrea. 2007. The process of becoming a leader: An individual identity model. *Vistas Online Journal*. Available at: http://counselingoutfitters.com/vistas/vistas07/Whitney.htm.

Winch, G.M. and E. Maytorena. 2009. Making good sense: Assessing the quality of risky decision-making. *Organization Studies* 30: 181-203.

Yukl, G. 2012. *Leadership in Organizations.* 8th edition. Prentice Hall, Englewood Cliffs, NJ.