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Integrating Cultural Perspectives into International Interdisciplinary Work

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Abstract: There are well-established methods for working in interdisciplinary natural resource management settings, but place-based cultural differences are often poorly integrated into interdisciplinary projects. Intercultural adequacy is necessary to ensure that water management strategies are acceptable within the local contexts of water users. In this study we followed four cohorts of graduate students from Canada, Chile, Cuba, and the United States that participated in an international graduate-level water resource management course hosted at the Universidad de Concepción in Chile. The North American students participated in post-experience surveys and interviews to assess changes in their interdisciplinary and intercultural comfort levels. The interviews and survey identified factors that enhanced or detracted from their progress towards integrating disciplinary and cultural differences into their work. Though course material promoted interdisciplinary collaborations across various disciplinary cultures, participants noted that traditional methods of integrating did not adequately bridge differences in place-based cultural worldviews. We propose a framework developed during the experience to integrate place-based cultural differences into all phases of the interdisciplinary research and natural resource management processes.

Keywords: *intercultural adequacy, water management, collaboration, education, water resources*

Water resource management impacts natural, social, and economic systems. Water managers must consider impacts on all systems (Grigg 2016) through interdisciplinary lenses. Applying an interdisciplinary approach in water resource management allows for the incorporation of different disciplinary viewpoints and understandings to develop concrete management solutions to specific problems. Working in interdisciplinary groups poses many challenges, however. Disciplinary language barriers disrupt communication (Cosens et al. 2011; Repko 2012). Disciplinary methodologies vary (Repko 2012), which can be frustrating and often culminates in a lack of trust between disciplines and research group members (Heemskerk et al. 2003; Eigenbrode et al. 2007; Cosens et al. 2011).

The interdisciplinary literature has established methods to create a synthesis of understanding by weaving together relevant disciplinary knowledge (Newell 2001; Cosens et al. 2011). The process aides in understanding complex problems in natural sciences, social sciences, and the humanities (Newell 2001). We propose fostering intercultural adequacy by adding culturally focused discussions into interdisciplinary methodology. We define intercultural adequacy as the process of integrating place-based cultural views, discussions, and understanding into the interdisciplinary process

Research Implications

- This research highlights the importance of integrating cultural perspective into water management;
- Provides a method to include cultural discussion in the interdisciplinary water management process; and
- Identifies pathways to improve interdisciplinary and intercultural collaboration in water management.

so that individuals can work across cultural differences. Intercultural adequacy incorporates cultural contexts into natural resource research and management. The term intercultural adequacy mirrors interdisciplinary adequacy, where Cosens et al. (2011) recognize that it is highly unlikely for individuals to become experts in more than one discipline—or in the present context, for cultural learning to translate into competency (Zotzmann 2016).

We follow the method of interdisciplinary investigations and integration presented by Cosens et al. (2011), which begins by building disciplinary adequacy from each represented field to overcome disciplinary barriers (Cosens et al. 2011; Repko 2012). Disciplinary adequacy requires building a basic understanding of the methodologies, assumptions, and terminology from the various disciplines represented on the interdisciplinary team. With an understanding of the differing disciplines, the interdisciplinary team can foster disciplinary trust through interactive exercises such as the *Toolbox for Philosophical Dialogue* (Toolbox; Eigenbrode et al. 2007). The Toolbox is a series of prompts that facilitates dialogue to identify and address philosophical differences and similarities among disciplines from biological to physical to social sciences. Conceptual models or diagrams then can be constructed to aid interdisciplinary teams to create a simplified representation of the system of study (Heemskerk et al. 2003). The conceptual model can serve as a platform to develop complex integrating questions that cannot be answered using a single discipline approach (Thompson Klein 1991; Newell 2001; Cosens et al. 2011). Developing an integrating question and designing a conceptual model allowed team members to narrow the scope of their project, create a communication platform for ideas (Heemskerk et al. 2003), and continually check the focus of their working hypotheses. Figure 1 presents a flow chart of this interdisciplinary process.

Working in an interdisciplinary space also requires intercultural awareness (Muratovski 2017; Thompson Klein et al. 2018) and intercultural competency (Sarmento 2016). In 2018, the Association for Integrative Studies expanded its mission statement to explicitly include cultural diversity as an integral component of interdisciplinarity (Thompson Klein et al. 2018). Currently, there is multiplicity in definitions of intercultural study in the interdisciplinary literature. In some cases, the interdisciplinary literature focuses on differences between disciplinary cultures (Reich and Reich 2006; Thompson Klein et al. 2018)—even with relatively narrow differences such as between the humanities and the arts (Lotrecchiano and Hess 2019). Other articles stress the need for understanding place-based cultures and practices (e.g., Egidiussen Egekvist et al. 2016) and integrating cultural based ways of knowing into research designs (Morgan 2006; Sterling et al. 2017). The movement of adding intercultural discussions into the interdisciplinary process is still relatively new. Literature about interdisciplinary studies and intercultural studies still remains largely separated.

Disciplinary and place-based culture are defined differently. Disciplinary culture is the difference between the norms and practices of one discipline versus another within the academic community (Reich and Reich 2006). Place-based culture is defined as beliefs, customs, lifestyles, and arts of a particular society or group. Place-based culture is often tied in place and time to landscapes themselves, and must be interpreted in relation to context, history, and power (Swensen et al. 2013). Natural, family, and social experiences may additionally be incorporated into an individual's cultural worldviews.

Understanding and acceptance of cultural differences is a process. Responses to exposure to other cultures can be described on a continuum, where individuals may begin with denial, defense, and minimization of other cultures—especially if the cultural differences are overwhelming (Hammer 2012)—before accepting or adapting to the foreign culture (Figure 2). Individual or group development across the continuum to an intercultural mindset, or open acceptance of cultural differences, is aided by supportive interactions with people from different cultures (Hammer 2012). Hammer and Bennett (1998) propose an Intercultural Development Index (IDI) that is often used to assess the progress towards the intercultural sensitivity of students in international immersion experiences. In the interdisciplinary,

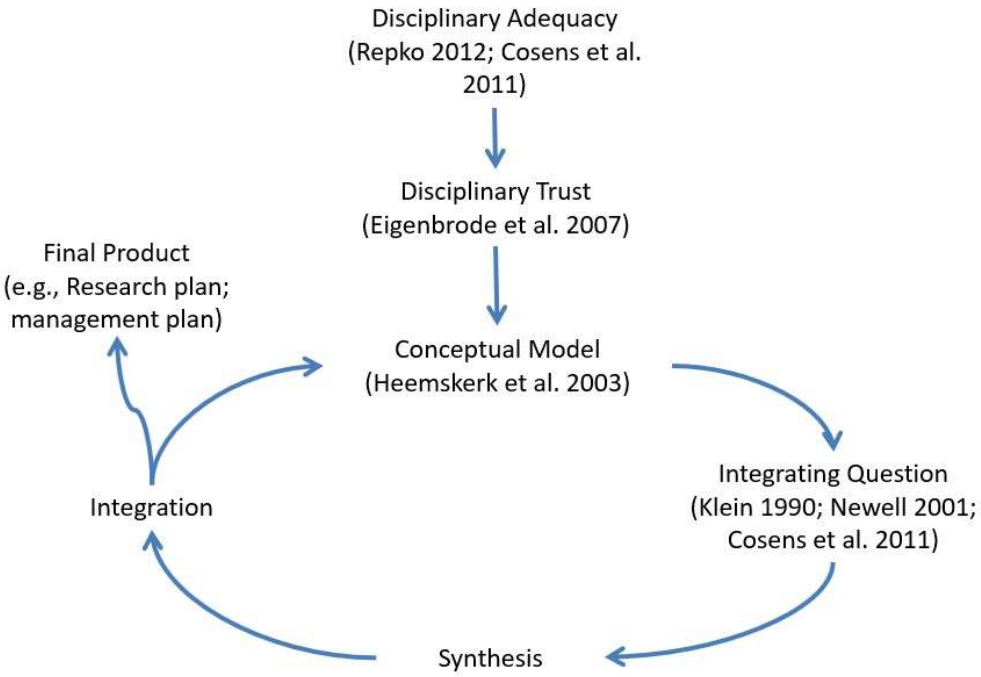

Figure 1. Overview of the interdisciplinary process presented in Cosens et al. (2011).

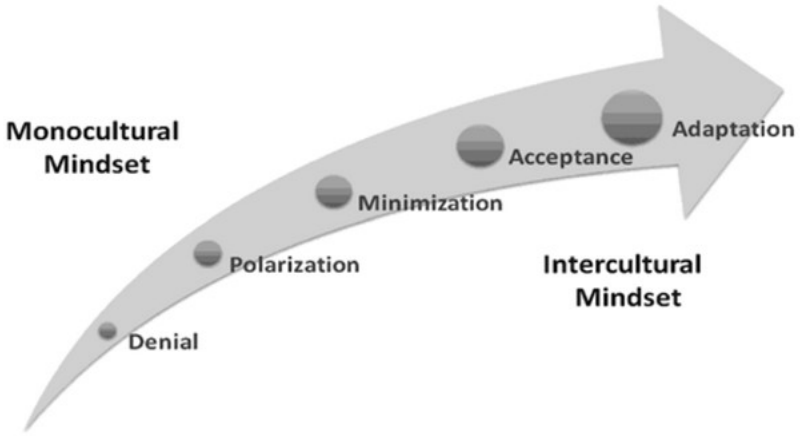

Figure 2. Intercultural Development Continuum: Growth from a monocultural to an intercultural mindset follows a continuum through Bennett's (2001) steps of denial, polarization, minimization, acceptance, and adaption. Integration is the ideal that lies beyond adaptation. Source: Hammer 2012.

intercultural context, individuals need to move across the cultural continuum for each of the cultural differences faced, such as disciplinary and place-based cultural differences.

Specific methodologies can further close the gap between disciplinary cultures by facilitating the establishment of trust within interdisciplinary teams. Existing tools do not address differences in place-based cultures, however. Allen et al. (2014) note that interdisciplinary initiatives commonly fail because of a lack of a methodology that fosters internal group dynamics and allows for group engagement and social learning. Graduate fellows in an interdisciplinary program between the United States and Costa Rica (NSF Award Number 0903479, 2012-2019) found that the lack of method(s) to integrate both disciplinary culture and place-based culture into the research process

hindered team progress (Morse et al. 2007; J.D. Wulfhorst, personal communications, 5-Jan-2017).

One proposed path to bridge cultural differences and foster cultural understanding is to encourage diverse forms of intercultural dialogue and engagement (Crossley 2008; Jackson 2009). Outcomes should lead to useful integration of cultural differences and commonalities to allow for the development of shared visions, goals, or directions (Crossley 2008; Smit and Tremethick 2013; Wiek et al. 2013), now known as intercultural competence (Sample 2013). Given the term's complexity, however, there is a lack of consensus in how to operationalize intercultural competency (Wahyudi 2016). Furthermore, Zotzmann (2016) questions whether it is, "theoretically sensible and ethically desirable to conceptualize the outcomes of intercultural learning as 'competence'" (p. 252). In this manuscript, we therefore prefer the term intercultural adequacy, which parallels interdisciplinary adequacy in interdisciplinary literature (e.g., Cosens et al. 2011).

As part of an Integrative Graduate Education and Research Traineeship (IGERT) fellowship program at the University of Idaho (NSF Award Number 1249400), graduate students participated in an interdisciplinary/intercultural experience in Concepción, Chile. The course was listed as WR 604: Int'l Water Issues; we refer to it hereafter as the Water Issues course. Graduate students came from engineering, natural sciences, social sciences, and law backgrounds from Canada, Chile, Cuba, and the United States. Students were assigned into groups of intentionally diverse disciplinary and cultural compositions. Teams were tasked with developing a water resource management plan for the Río Laja and Río Biobío systems. After the course, North American students were interviewed and completed a survey to assess whether the course changed the participants' perceived comfort working in interdisciplinary and intercultural settings. Analysis of the interviews and surveys identified factors that helped or hindered working across cultural and disciplinary bounds.

Whether talking about disciplinary or placed-based culture, there is no clear path in the literature to include cultural discussions in the interdisciplinary process. The objective of this paper is twofold. First we present factors that helped or hindered working in an interdisciplinary/intercultural setting; then we propose an addition to the interdisciplinary process that facilitates intercultural adequacy and cultural integration within natural and water resource management and research.

Methods

Course Context and Research Setting

The Water Issues course curriculum was taught in collaboration with Universidad de Concepción and Universidad Católica de la Santísima Concepción. The approximately three-week course was designed to integrate graduate students from various disciplinary and cultural backgrounds—law, social science, natural science, and engineering—to take part in this unique interdisciplinary experience aimed at understanding different perspectives on watersheds and watershed management. The course was offered during winter break in four consecutive academic years from 2014 to 2018. The course was divided into three dimensions: field trips, lectures, and teamwork—the proportion of time spent in each facet of the course varied year to year.

Students participated in a tour (field trip) of the Río Biobío and Río Laja Basins from the mouth of the river into the Pacific Ocean to the headwaters of both river systems. The field trip, which lasted three days on average, provided background information on the physical, geographical, and cultural settings. Time was spent with Indigenous members in Pehuenche communities, and on their lands. The field experience familiarized participants with the complexities of the Río Biobío and Río Laja Basins systems and provided social time to foster teamwork.

A week of lectures provided historical, ecological, and hydrological context, an overview of Chilean water policy and management, and regional political issues of the Río Biobío and Río Laja. Professors from the corresponding universities lectured to provide "disciplinary adequacy"—a basic understanding of the methodologies, assumptions, and terminology from each discipline (Cosens et al. 2011)—within the context of the Río Laja and Río Biobío systems. Question and answer sessions following

the disciplinary lectures further facilitated cross-disciplinary communication. The lectures and question sessions were intentionally structured to allow students to understand better the importance of the current state of the watersheds, as well as the active research within each basin. The course delved into the complexities of the interdisciplinary process by presenting complex experiential case studies that link multiple disciplines.

Students were divided into working groups by the faculty, who intentionally populated each research team with diverse disciplinary and cultural representation. All groups had at least one student who could speak both English and Spanish and served as a group translator. Groups were tasked with developing water resource management plans to increase the ecological and water yield sustainability of the systems. In the context of this course, sustainability was never defined. Each team had to work out what they meant by sustainability across their disciplinary understanding. Plans were required to integrate engineering, ecological, legal, and operational recommendations. The professors leading the course allowed the students to find their own paths to accomplish the course project. However, professors encouraged students to work through the interdisciplinary process outlined in Cosens et al. (2011) (Figure 1) before attempting the interdisciplinary integration activities. Each group had to develop a presentation and a final report that was co-authored and co-presented by all students in the team. This paper focuses on the intercultural dynamics of the collaboration processes rather than the products from the course.

To facilitate disciplinary trust, student groups participated in a modified version of the Toolbox exercise. The Toolbox prompts were translated into Spanish for the Water Issues course, so that Spanish-speaking students could engage in the exercise in their native language, understanding, and perspectives. The Toolbox exercise allowed for team members to see behind the curtain of other disciplinary cultures by discussing the fundamental principles and assumptions used in each field through guided dialogue—taking students beyond disciplinary adequacy, developing disciplinary trust, following the interdisciplinary collaboration process (Figure 1). Groups were encouraged to develop a conceptual model and an integrating question to focus the team efforts to improve the sustainability of the river systems.

Data Collection: Surveys and Interviews

Following participation in the Water Issues course, the North American students from the four successive cohorts were asked to participate in a post-course survey and interview. Participation in this study was entirely voluntary, and no compensation was provided. Twenty-three out of twenty-five North American students who completed the course participated in the survey. Twenty-two of these were IGERT fellows, one of whom was a fellow in a similar IGERT program at another university. One student was from a university in Canada. We were unable to survey and interview the South American students due to institutional hurdles and lack of financial support—this is a limitation to our study since we were only able to evaluate insights from the North American half of the student cohorts. We do, however, include in our results some observations that our Chilean colleagues offered during and after the experience.

The survey and semi-structured interview format were designed using Hammer and Bennett's (1998) IDI. Questions were organized into three categories, following Medina-López-Portillo (2004): individual student experience, external course dynamics, and student decisions. Individual student experience questions built an understanding of participants' previous years in interdisciplinary work, immersion experiences abroad, proficiency in other languages, and personal experiences in the course. External course dynamics questions were designed to get the participants' viewpoints on the content provided by the organizers and instructors in the Water Issues course. External course dynamics factors included pre-trip orientation, lecture topics, and the amount of time spent in classroom lectures and field trips. The third section was focused on understanding choices made by students during the course, such as the extent of contact and immersion efforts with their international colleagues.

The survey component collected background information using quantitative Likert-scaled responses via the online Qualtrics™ survey platform. Potential identifiers were removed, and respondents were randomly assigned an identification number to preserve confidentiality.

The survey instrument proved useful by collecting data for quantitative analysis. Participants were asked to complete the survey instrument before their interviews.

Interviews followed the developmental interview process described by Hammer (2012), which leads to more robust survey data in the IDI context. The core intent of the semi-structured interviews was to explore students' collaborative experiences to learn how they negotiated disciplinary and place-based cultural differences in their team science efforts. Students were asked to provide details of specific incidents of cultural differences that impacted the group project, how they navigated the situation, and their perceived outcomes (Hammer 2012). By asking similar questions in multiple forms, the combination of surveys and interviews allowed for triangulation (i.e., asking similar questions from different angles) of responses to cross-check for consistency.

One researcher conducted all interviews. The interview duration averaged 30 minutes with a minimum and maximum of 20 and 33 minutes, respectively. Interviews were administered in person, by phone, or by video conferencing, and were recorded. One participant responded to the questions in writing from a remote location. Additional interview questions emerged during the first few conversations and were carried forward through subsequent interviews. Transcripts of responses were coded into an expanded matrix of questions. Direct references to other members of the cohorts were removed to preserve confidentiality. Respondents' names were replaced by matching identification numbers on interviews and surveys. Statements were aggregated by question to discover trends in responses for qualitative dimensions of this study.

Additionally, respondents were asked to plot themselves on a 2 x 2 matrix (-5 to +5 scale) of interdisciplinary comfort level (y-axis) and intercultural comfort level (x-axis). The matrix was designed to gauge respondents' degree of both cultural and disciplinary comfort in collaborative research after this international experience. Matrix results were added to the quantitative dataset. Correlation analyses were performed on the variables of interest using Spearman's rho, a non-parametric test commonly used with ordinal data to test for rank correlation. Results are reported following Cohen (1988), where moderate correlations occur between (+/-) 0.30 and 0.50, and high correlations are greater than 0.50 or less than -0.50. Positive correlations indicate factors that improved interdisciplinary and intercultural comfort and negative correlations indicate factors that hindered comfort.

Results

After completing the course, interview participants indicated how comfortable they were working in an interdisciplinary, intercultural setting prior to the course versus after. Respondents plotted themselves on a Cartesian coordinate system in comfort level working in interdisciplinary (x-axis) and intercultural (y-axis) settings (Figure 3). Comfort level is plotted using a Likert Scale from negative five, meaning no experience or comfort, to positive five, meaning extremely comfortable. Participants experienced an increased comfort level working across disciplines of 1.9. The students experienced an average comfort increase of 2.1 working across cultures because of their Water Issues course experience in Chile.

The interdisciplinary comfort level before the trip correlated positively (moderate significance) with both age of participant at time of trip and years of experience in interdisciplinary research. Age and years of experience in an interdisciplinary setting were highly correlated, as expected. Interdisciplinary comfort after participation in the course had a moderate correlation in the positive direction with the helpfulness of the interdisciplinary activities (i.e., the Toolbox exercise), respondents' age at the trip, and time spent in lectures. There was a moderate negative correlation between current interdisciplinary comfort levels with time spent in field trips (i.e., the more time in the field, the lower the interdisciplinary comfort). Change in interdisciplinary comfort was positively correlated (moderate significance) with the percent composition of North American students within a working group, group social time, and time spent in lectures. Interdisciplinary comfort was negatively correlated (moderate significance) between personal time spent previously in other countries and time spent with Indigenous people in Chile.

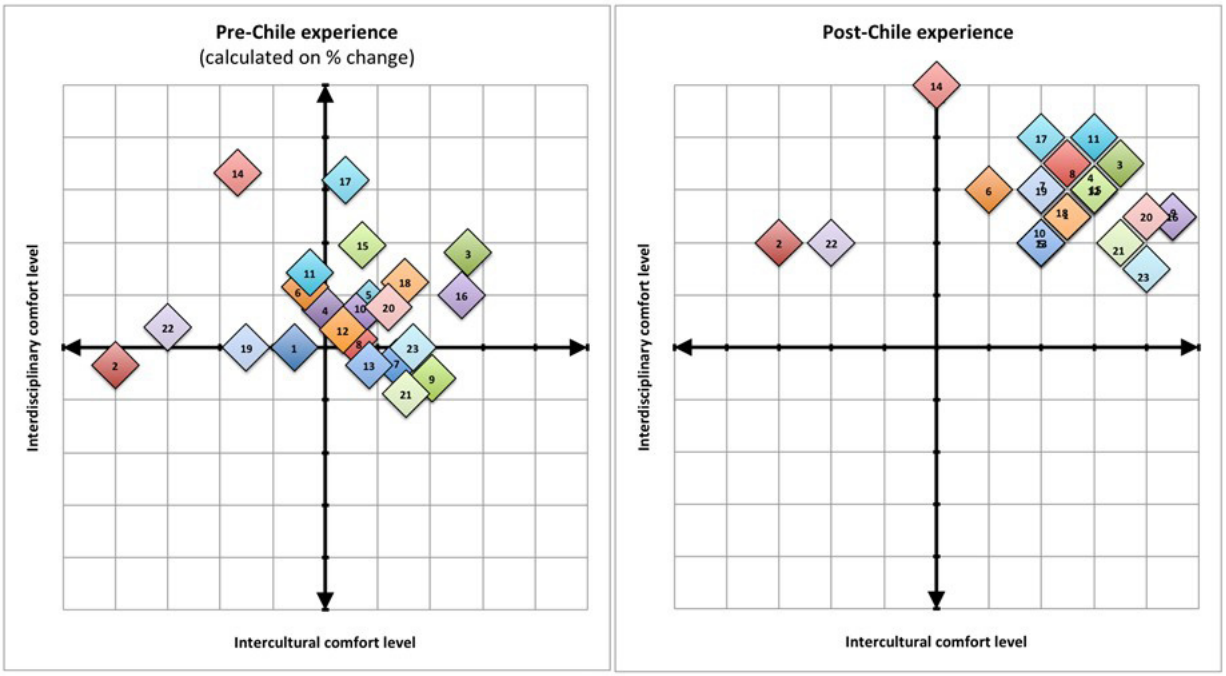

Figure 3. Participants' self-evaluations of comfort working in an interdisciplinary (on the x-axis), intercultural (on the y-axis) setting.

Post-course intercultural comfort (i.e., after the Water Issues course) was positively correlated (strong significance) with personal time spent in other countries previously, but negatively correlated (moderate significance) to time spent in lectures during the Chilean experience. The change in intercultural comfort levels because of the trip demonstrated weak positive correlation with group social time and weak negative correlation with time spent in other countries. While the level of fluency in another language showed a strong, positive correlation with time spent in other countries, the correlation was low with cultural comfort indices. Following participation in the Water Issues course, students increased their comfort working in both interdisciplinary ($p = 0.0006$) and intercultural ($p = 0.0007$) settings at an α level of 0.05. Table 1 summarizes the results of the correlation analysis form the survey results.

Discussion

Of the twenty-three North American students, twenty-one of them had previous experience and course work that explicitly taught how to collaboratively work across disciplinary divides. The average age among the North American cohort when they participated in the Water Issues course was 31, and many had extensive experience working in interdisciplinary settings. Those experiences and backgrounds with formal training were brought into group negotiations in the Water Issues course. Furthermore, the University of Idaho's IGERT program pointedly recruited interdisciplinary students, which was reflected in the relatively high interdisciplinary comfort levels reported by the participants.

Numerous interviewees specifically mentioned barriers to disciplinary adequacy, however. For example, one respondent felt that "engineers struggled to grasp what the biologists were saying." Through various forms of language and disciplinary translation within the group, others were able to understand the biological concerns better, even though the disciplinary trust was never fully achieved. To facilitate disciplinary adequacy, some groups turned to scholarly literature outside their respective fields. Not all groups had the same perspective or difficulties integrating. One respondent stated, "differences (are) in tools, rather than disciplines."

Hammer and Bennett's Intercultural Development Continuum (Figure 2) shows the process that individuals undertake to develop

intercultural mindsets. Working across disciplinary bounds follows a similar continuum. During the Water Issues course, each student joined the course with their own experience and progress working through interdisciplinary and intercultural continuums. Their experiences were brought into the course and leveraged to aid in the class project. The post-survey results do not account for the students' pre-course experience and comfort levels. However, the experience aided in further developing the skillset and comfort necessary (as shown by the results of the correlation analysis) to further progress individuals across disciplinary and cultural continuums.

Results of the interviews and the correlation analysis show that the best methods to facilitate interdisciplinary efforts were to: 1) have a formal instructional setting, and 2) allow for open discussion of disciplinary differences within teams. A key component in the group discussions—as one interviewee stated—was to allow for "open and honest" conversations and to be "willing to debate both intellectually and jokingly, and share and listen." The open dialogue allowed members to "discover how each member viewed things to get beyond that sticking point." Interestingly, all the participants who mentioned the different interdisciplinary processes in the interview reported a high level of interdisciplinary comfort (average of 8.5 out of 10) following the Water Issues course. The high level of interdisciplinary comfort allowed groups to apply interdisciplinary tools to overcome interdisciplinary hurdles.

Many of the students had previously studied or lived in immersive international settings. Eight considered themselves competent or fluent in at least one other language. Six additional students felt they could "get by pretty well" in another language. Twelve had at least some knowledge of Spanish. The previous intercultural comfort that these students brought to the course helped move them across the Intercultural Development Continuum (Figure 2).

In contrast to the interdisciplinary process, however, students were not provided with methods to embrace intercultural differences in the Water Issues course. The curriculum provided on-site cultural experiences in Chile, but did not address other influential program components identified in IDI literature to increase intercultural adequacies, such as: pre-departure and re-entry preparation, cultural mentoring, and reflection on intercultural experiences (Jackson 2009; Hammer 2012; Egidiussen Egekvist et al. 2016). Bennett (2010) laments that a major impediment to intercultural learning in studies abroad is the "failure as international educators to be knowledgeable protagonists of intercultural learning" (p. 446). Indeed, we discovered that for most of the Water Issues cohorts, our interviews were the first time they had been asked to reflect on the experience—in some cases this was four years later.

It is therefore no surprise that the need to integrate cultural consideration into interdisciplinary research was not discussed in the context of the course, which was one impetus for this study. Interviewees were asked if any cultural differences or barriers occurred while working on the group project. Eleven respondents out of the twenty-three either implied or explicitly stated that cultural differences arose while working on the international teams; ten mentioned that they did not notice cultural differences. Two of the interviewees stated that either they or members from their group had previously spent time in Chile, which may have increased intercultural adequacy between team members.

Results showed that people who self-reported feeling more comfortable working across cultures were less aware of the existence of cultural differences; this falls in line with the Dunning-Kruger effect of being ignorant of one's own ignorance (Dunning 2011). Participants who observed distinct cultural differences, self-reported an average cultural comfort level of only 6.7. In contrast, the individuals who claimed that they did not notice cultural differences responded with a higher average cultural competence, 7.7. However, one student who self-reported an experience of severe culture shock was well aware of their own limitations and ranked their intercultural comfort the lowest of the cohort. Both survey and interview results suggest that time spent in social settings helped to foster intercultural comfort, whereas formal, lecture-based settings inhibited comfort in working across cultures.

Differences also arose among all the groups around the idea of how rivers should be managed—

these are issues that are neither clearly disciplinary nor completely cultural—and were evident in the surveys and interview transcripts. As an example, one interviewee noted that:

> *People in Chile don't have the same perspective on the environment than we [Americans] do; Americans came in with "dams are bad" while Chileans wanted to make their country great through the development of hydropower*.

In the authors' working group, the North American students advocated for limiting or even removing dams from riverine systems to allow for the restoration of natural processes. Being from the Columbia River Basin, the North American students have seen how dams, over time, have become the primary contributor to ecological consequences, such as a large decline in salmon populations. In contrast, Chilean students appreciated the importance of dams in their economy. The Chilean students were in favor of installing additional infrastructure, with limits, to hold water for future use, including electricity generation and irrigation. Further, while Chilean academic communities embrace the importance of biodiversity and species preservation, the endemic species within the Laja and Biobío River systems are not iconic species and do not occupy preeminent cultural status, such as salmonids do in the American Pacific Northwest. Many interviewees discussed differences between the native species located in the Biobío and Laja River systems compared to the Columbia River. One American interviewee stated that the Chilean rivers lacked native "charismatic megafauna" within the river systems like the iconic salmon in the rivers of the Pacific Northwest.

Within the Chilean river system, many of the endemic species are dissimilar to endemic species that the American counterparts find in their river systems. The North Americans were interested in preserving endemic species, but one observed that:

> *Chilean culture doesn't have the connection with the fish, especially because the endemic fish are small galaxids*[1] *and of no particular cultural value*.

[1]Adult *Galaxias maculatus* specimen average only 10.5 cm (Froese and Pauli 2017).

Some students struggled with the differing viewpoints regarding endemic species between the salmon and steelhead in the Pacific Northwest to the small fish species in the Chilean rivers. One interviewee stated that, "we Americans had to get over it," meaning the North American students had to grasp and understand differing cultural views on endemic species. To ensure that the proposed outcomes from the class project were favorable within the Chilean setting, the North American students needed to re-evaluate their ideas about dams and fish to include the cross-cultural perspective of both the locals and North American students.

Proposing a Methodological Framework

While working on the group project, our team (the co-authors) was able to work through the beginning steps of the interdisciplinary process of building disciplinary adequacy, facilitating disciplinary trust, and developing a conceptual model of the system. For these steps we drew on our lecture and field trip notes, our individual specialties, generous use of a white board, and the previous experiences of interdisciplinary experience of two group members. However, we had trouble building a conceptual model and could not agree upon an integrating question. Our progress was at an impasse.

Through conversation we realized that the North American students and the Chilean students had different cultural perspectives on dams and river operations (as elaborated above). The underlying differences on dams crosscut both disciplinary and cultural differences, contexts, and perspectives. Reflecting on the interdisciplinary objectives of our course, we realized there was a gap in the process: there was no discussion of cultural differences. At this point in the interdisciplinary process (building a conceptual model and developing an integrating question), we were able to facilitate a supportive conversation regarding the different cultural views of dams. The resulting integrating question allowed for a solution with reasonable regionally relevant ecological compromises, rather than an absolutist approach.

In the synthesis phase of our project, an unexpected but particularly interesting cultural impasse occurred over the definition of time. The

future, in Euro-American culture, is typically represented in a discrete time frame. As an example, management plans will have a time horizon of five, ten, or even 30 years. Our Chilean colleagues had a different understanding of what it meant to even articulate a time horizon. To explain the Chilean concept of the future, our colleagues told the folklore story of Pedro Urdemales (Memoria Chilena n.d.). In the story, Pedro promises his soul to the devil, payable tomorrow. Whenever the devil comes to collect, Pedro tells him that he promised to pay tomorrow; but it is currently today. Thus the idea of tomorrow—or the future—remains an indefinite concept that can always be pushed onward. In essence, there are different views of timelines between the North and South American cultures. By revisiting the cultural context throughout the interdisciplinary process, we were able to blend both the North and South American students' perspective into our process. We designed our management schemes to reflect the cultural difference by not defining specific periods, but in casting the solutions on relatively "short," "moderate," and "long-term" time horizons.

Figure 4 demonstrates the addition of cultural-based discussions to build cultural adequacy during the interdisciplinary process. By adding cultural discussions, we were able to collaborate on an international interdisciplinary research/management project. Our group did not experience place-based cultural differences until we started developing a conceptual model of the water management issue. Other teams encountered process-slowing issues at other times in the cycle. It is prudent to check the intercultural adequacy of the members frequently, and iteratively, throughout the interdisciplinary process. Revisiting the cultural context of the interdisciplinary process at every step ensures that place-based cultural perspectives are being addressed throughout the process so that the integrative results are meaningful in the regional context and local communities.

While the Water Issues course took place with students between North and South America, the overarching theme of intercultural adequacy applies to water management throughout the United States. For example, in the arid west Native American tribes play a critical role in water management in numerous basins e.g., Pyramid Lake Paiute Tribe in the Truckee River Basin, California/Nevada (Cosens 2003); Yakima Nation in the Yakima River Basin (Graham 2012). The cultural value of water and fisheries can differ largely from the cultural value of water for farmers and power producers (e.g., Freeman 2005). Building intercultural adequacy can help bridge between cultural viewpoints and further support the intercultural aspects of integrated water resource management.

Conclusion

The international collaborations of faculty at the University of Idaho with their counterparts at Universidad de Concepción and Universidad Católica de la Santísima Concepción made a space for a creative interdisciplinary, intercultural experience. Results from the interviews and surveys conducted in this research suggest that increased time in formal settings, such as lectures, aids in increasing interdisciplinary collaboration. In contrast, however, more time in informal situations and team interactions was needed to foster intercultural learning and collaboration. Balance is needed between time spent in formal and social/informal settings to work effectively across intercultural and interdisciplinary bounds.

The Water Issues course improved students' comfort level working across interdisciplinary and intercultural boundaries. A short, culture-focused immersion course can facilitate individuals' comfort in working across boundaries. Groups working across cultural and disciplinary boundaries could benefit by starting their experience in a similar setting. Our findings have broad applicability in interdisciplinary and intercultural settings. Water resource management interlinks numerous disciplinary fields and binds cultures together. Interdisciplinary and intercultural education programs train the next generation of natural resource managers who need to blend complex needs of society and the environment. Collaborators in fields like water resource management must learn how to work across disciplinary and cultural divides including ideologies and cultural philosophies, as demonstrated in our different working approaches to space (e.g., landscapes, dams, and biota) and even to time. People and landscapes should be interpreted

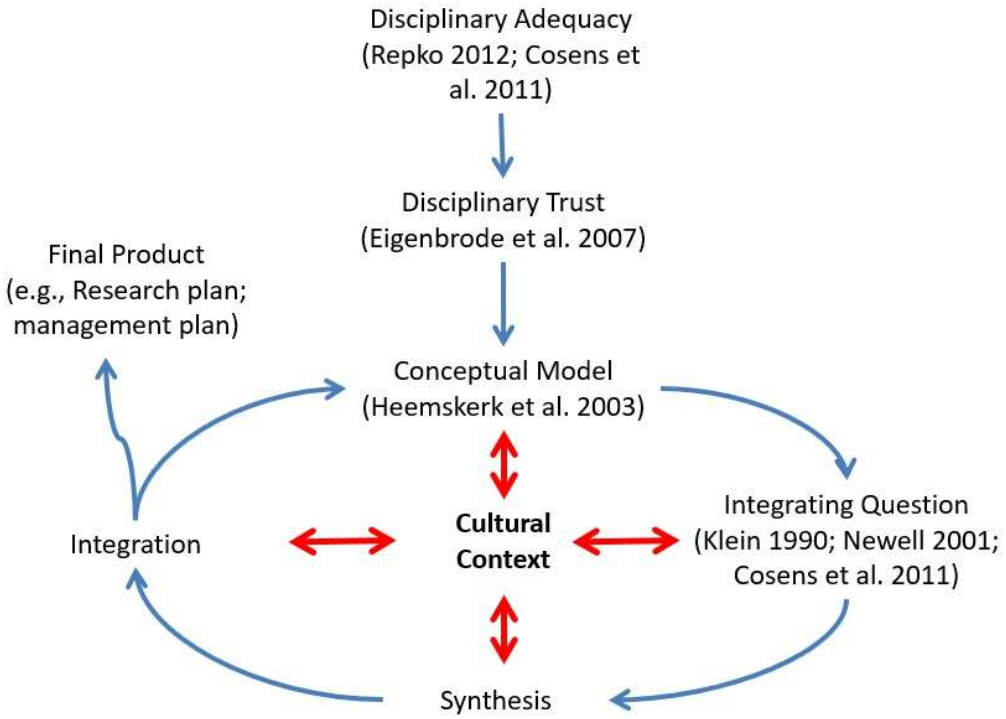

Figure 4. The interdisciplinary process presented in Cosens et al. (2011) with the addition of cultural discussion feedback loops throughout.

with context and history (Swensen et al. 2013) to understand place-based and heritage cultural perspectives. Groups need to develop intercultural adequacy when working on interdisciplinary teams with members from different countries and bioregions, and acknowledge that perspectives on natural systems can differ.

Trust and understanding take time to build. More activities than just working together are needed to overcome intercultural adequacy. Good facilitation and support before, during, and after a study visit aid in developing intercultural competencies (Jackson 2009; Egidiussen Egekvist et al. 2016). Getting to know teammates' stories, such as where each person came from, further links conversations back to the connections between people and the local environments (Allen et al. 2014). In the intercultural setting, our research found that there is value in moving away from traditional lecture-style presentations to more personal interactions to foster intercultural adequacy. Social interaction time helps "move the emphasis of the research discussions away from just the technical issues (how to do it) towards the aims (what to do and why)" (Allen et al. 2014, p. 11).

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