Teaching Key Elements of Decision Making Online for Homeland Security and Emergency Management

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ABSTRACT

In order to design online teaching and learning activities that promote effective decision-making skills under conditions of uncertainty, we adopt key findings from the fields of cognitive psychology and public management and employ strategies from the Scholarship of Teaching and Learning. The learning activities outlined in this article – readings, films, writing and research assignments, and interactive exercises – promote the ability to detect, recognize, and interpret risk while developing collaborative strategies for action to reduce that risk. Students develop those skills in three stages – first, developing individual skills, second integrating those skills, and finally by demonstrating all skills in the absence of an instructor's guidance. We do not suggest that these learning activities replicate the precise conditions of stress and uncertainty experienced in the field. Rather, they lay a foundation for education and training that is rooted in both theory and practice, contributing a proof of concept for homeland security and emergency management curricula. We analyze two semesters of qualitative student evaluations and report that positive student response suggests the potential effectiveness of our strategy.

INTRODUCTION

During an emergency, the difference between success and failure quite often is the judgment brought to bear by the professionals responsible for response operations. Effective decision making under conditions of uncertainty requires personnel to make meaning from ambiguity and develop strategies for action that protect life and property and maintain continuity of operations. Despite its importance in practice, little research has been conducted regarding how to facilitate those skills via formal curricula. Comfort and Wukich (2013) examined how to teach decision making in a classroom setting. However, even less research has been conducted on the challenges educators and students face online. This is a growing area of concern as an increasing number of first responders, emergency managers, and homeland security personnel are turning to online education (Cwiak, 2014).

This article provides a follow-up to Comfort and Wukich (2013) and examines a set of online teaching and learning activities designed to promote key decision-making skills. Evidence from

cognitive psychology and public administration shape this strategy, while the Scholarship of Teaching and Learning (SoTL) informs our implementation. The activities promote what Comfort (2007) refers to as cognition – the ability to detect, recognize, and interpret risk while developing collaborative strategies for action that reduce that risk. Students first complete basic foundational tasks, such as identifying susceptibility to potential hazards and social vulnerability. These tasks are presented in stages through learning activities which build upon one another. They then practice integrating those skills and demonstrate the ability to know when and how to apply those skills in the absence of an instructor's guidance. The strategy conforms to the steps discussed by Ambrose, Bridges, DiPeitro, Lovett, and Norman (2010) to achieve mastery over a complex set of tasks.

In higher education, instructors and students often struggle to make the transition to online education, and traditional classroom instruction techniques quite often fail to maximize the potential of online learning environments (Boettcher & Conrad, 2010). Emergency management and homeland security academic programs are not immune to this problem. An emerging dialogue exists intended to inform the design and delivery of these courses (see Maxfield & Fisher, 2012). This article is meant to contribute to that discussion. The evidence-based strategies presented focus on emergency services but are applicable across academic disciplines (public management, political science, and sociology) and across policy domains (homeland security and emergency management).

Homeland Security and Emergency Management in Higher Education. Higher education degrees and some certificate programs offer venues through which personnel can develop their critical thinking and decision-making skills (Collins & Peerbolte, 2011; Kiltz, 2009a). Institutions across the United States have developed programs which contribute to the professionalization of the fields of homeland security and emergency management (Waugh, 2007; Kapucu, 2010; Cwiak, 2014). The University and Agency Partnership Initiative at the Naval Postgraduate School, for example, currently lists 312 institutions that offer related courses (UAPI, n.d.). Many of these institutions make their courses available online. The FEMA Higher Education Program identifies 119 institutions with online degree or certificate programs (FEMA, n.d.). Meanwhile, the number of such programs continues to grow, as the demand for online practitioner focused education increases (Cwiak, 2014; UAPI, n.d.; FEMA, n.d.).

Aided by an abundance of public-sector funding following the terrorist attacks of 9/11, scholars and practitioners worked collaboratively to design curricula that addressed the demands of an increasingly complex operating environment (Blanchard, 2005; Drabek, 2009; Kapucu, 2010; Pelfrey & Kelley, 2013). The FEMA Higher Education Program and professional associations such as the National Emergency Management Association, for example, released a set of core competencies to guide the development of emergency management programs. The ideal emergency manager was considered to be risk-driven, all-hazard focused, networked, and collaborative (Blanchard, 2005). An informed, scientific understanding of hazards and related techniques to prevent or mitigate disasters were encouraged (Woodbury, 2005), and institutions of higher education seemingly adopted many of these key competencies and principles. At the University of Central Florida, for example, Kapucu (2010) adopted these competencies (e.g., critical decision making skills, effective networking skills, and strong leadership and communication skills,) as a basis for their emergency management and homeland security programs, acknowledging the uncertainty in which managers must develop situational awareness and make decisions.

The demand for effective decision making while operating under intense or uncertain conditions exists among practitioners. In a 2012 survey of Department of Homeland Security personnel, respondents on average ranked critical thinking and analytical skills as the third most important potential course or subject out of 52, after terrorism and homeland security fundamentals (Ramirez & Rioux, 2012). Based on interviews with domain experts, Pelfrey and Kelley (2013) noted that "homeland security education should steer away from specific knowledge [such as checklists and procedures], centering instead on more complex cognitive tasks [such as critical thinking and decision making]" (p. 3).

Conventional wisdom holds that both educators and practitioners agree on the importance of decision-making, but the extent to which these skills are facilitated in existing curricula is less clear. In the growing Scholarship of Teaching and Learning (SoTL) on homeland security and emergency management, however, little research examines the subject. Collins and Peerbolte (2011) contemplated specific measures for critical thinking skills in homeland security. Kiltz (2009a) focused on generating critical thinking in the classroom through class discussion, case studies, and writing assignments. Critical thinking, however, is essentially about evaluating arguments (Brookfield, 1987). This process is different from decision making under conditions of uncertainty, which requires different assumptions and skill sets.

Decision Making under Conditions of Uncertainty and Facilitating Mastery. While divisions exist between homeland security and emergency management curricula in terms of what hazards and management strategies are emphasized (see Drabek, 2009), decision-making under conditions of uncertainty provides a shared operational reality. Decision spaces often differ based on incident type and scope, but basic similarities (e.g., the need to interpret risk and develop collaborative strategies for action) make possible adaptable teaching and learning strategies to help prepare the next generation.

Decision-making skills are clearly important, but relatively little attention has been paid to actually facilitating the development of these skills within a classroom or in online environments (Comfort & Wukich, 2013). Traditional activities such as lectures and discussions facilitate the development of more basic learning levels such as remembering and understanding in a Bloom's Taxonomy (Anderson & Krathwohl, 2000); however, critical thinking (Kiltz, 2009a), problem-solving (Savin-Baden, 2000), and related decision-making skills (Comfort & Wukich, 2013) require more diverse and sophisticated strategies. Educators in homeland security and emergency management appear not to be systematically implementing the type of higher-level learning objectives necessary for decision making under conditions of uncertainty. Comfort and Wukich (2013) analyzed the 29 emergency management-related courses commissioned by FEMA's Higher Education Program and found that only nine courses (31.03%) were designed to facilitate high levels of thinking such as evaluation and creation, key objectives for critical thinking and decision making. This finding might indicate that instructors need to apply further education to facilitate decision making skills whether in a classroom or online.

Second, the decision spaces that exist within the fields of homeland security and emergency management are often characterized by high levels of stress and uncertainty (Comfort, 2002; 2007). Cognitive psychologists have argued that this leads to processes that are fundamentally different from traditional models of rationality (Weick & Sutcliff, 2007; Klein, 1998; Weick, 1995). Due to

the heavily contingent nature of both the homeland security and emergency management professions, teaching decision making to identify every possible alternative and carefully weigh costs and benefits is not an effective approach. Other methods are required.

Through extensive fieldwork, Klein (1998) developed his *recognition-primed decision making* model to explain how personnel develop strategies for action in the face of increased stress and uncertainty in which a decision maker assesses a situation based on its familiarity as related to past experience. Generally, alternative decisions are neither identified nor weighed. Instead, personnel select what they consider to be the first workable option (Klein, 1998). Also, decision making in this context is not the product of actors operating independently. Weick (1995) suggests that people make sense of their environments through an ongoing and interactive process in which they extract cues. Some types of organizations do better in institutionalizing sensemaking, organizational learning, and communication than others and therefore represent more highly reliable organizations (see Weick & Sutcliffe, 2007). Teaching and learning activities that replicate some aspects of these organizational processes contribute to more authentic learning environments. Whether for a novice or an experienced professional, formal education, if designed appropriately, can build a foundation for effective decision making (Comfort & Wukich, 2013).

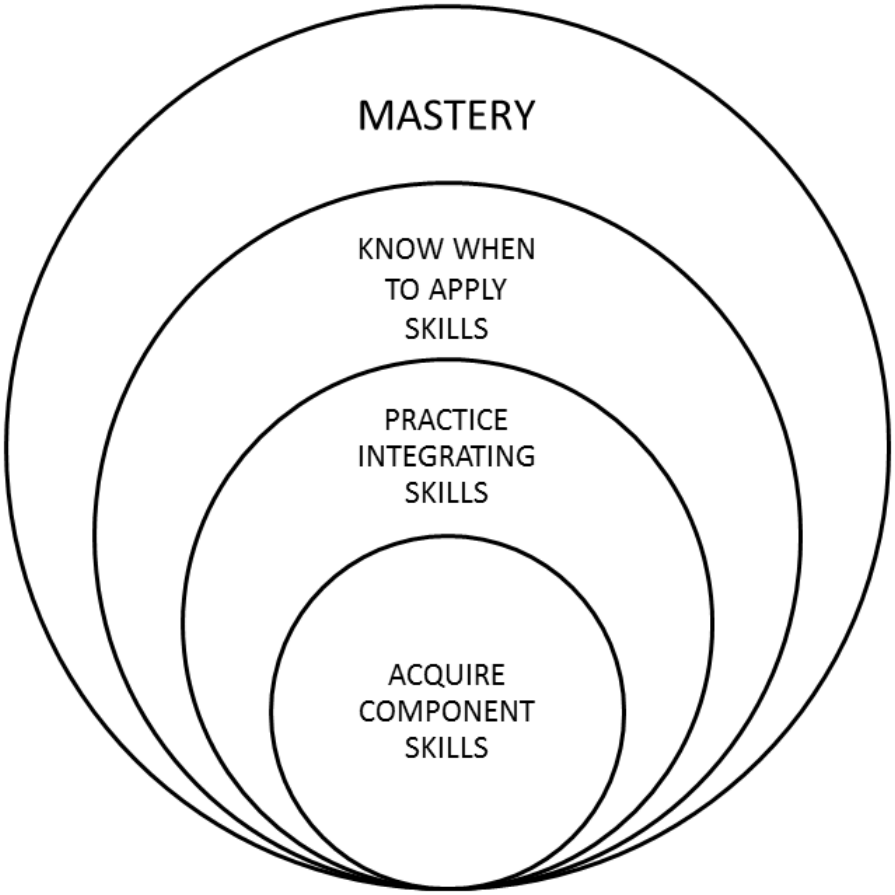
Instructors have long implemented simulation exercises that provide students with valuable training (Rolfe, Saunders, & Powell, 1998). Recent SoTL research related to the field, however, generally fails to illustrate the strategies used to design these activities. Johnson (2012), for example, examined student perceptions of whether certain online simulation exercises represent authentic learning environments. What his approach lacks is a discussion of how those exercises were designed and the andragogical foundations that support them; the main focus is on specific learning outcomes without illustrating replicable strategies that could inform other educators. Practitioner literature on exercise design and implementation, however, offers possible road maps.

Phelps (2012) outlined a range of activities related to exercise design ranging from orientation to tabletop to full-scale and multi-site exercises. Likewise, McCreight (2011) demonstrated the steps to design exercises based on best practices and the HSEEP model. These sources, however, are not purely intended for academics. Because the audience represents managerial positions with significant operational experience, this type of practitioner literature addresses a wide range of goals and contingencies that sit beyond the scope of an introductory or intermediary classroom. Rolfe et al. (1998) acknowledged the tension designers face in replicating the scope of an exercise for a variety of audiences. Here SoTL research is instructive in devising strategies to simplify exercises while still maintaining baseline levels of authenticity.

Effective decision making under conditions of uncertainty represent a distinct set of skills such as the ability to detect and interpret risk and develop collaborative strategies for action that reduce that risk (Comfort, 2007). These abilities require high-order thinking (e.g., analyzing, evaluating, and creating). Ambrose et al. (2010, p. 95) suggested that across disciplines, mastery represents a cumulative process. Basic skills are acquired within learning activities that increase in complexity and decrease in instructor participation as students demonstrate aptitude.
In higher education, students achieve mastery over a specific skillset via three steps, according to Ambrose et al. (2010). First, they must acquire basic component skills. Students then practice those

component skills and integrate them often under an instructor's supervision. Mastery is not achieved until a student knows when and how to apply and integrate those skills without guidance. These learning activities are initially a product of scaffolding, a process "whereby instructors temporarily relieve some of the cognitive load so that students can focus on particular dimensions of learning" (Ambrose et al., 2010, p. 106). Comfort and Wukich (2013) apply this logic to face-to-face courses in emergency management. Figure 1 illustrates the three steps toward mastery.

Figure 1. Elements of Mastery



Adapted from Ambrose et al. (2010, p. 96).

At this point, mastery does not assume that a student can perfectly execute complex tasks in the field without further experience; many obstacles exist to educating and training experts. In an online format, the lack of realistic auditory and sensory experiences, such as face-to-face interaction, as well as the lack multifaceted demands faced in the field, such as physical simulation exercises, contrasts with the realty of a work situation. Guided field experience, therefore, is required to achieve the type of intuitive decision making and skill application demonstrated by experts (Dreyfus & Dreyfus, 1986). Online learning, however, can simulate basic decision spaces and provide the foundation for effective operations.

Challenges of Achieving Mastery in Online, Asynchronous Environments. Online learning represents "education or training without sustained direct contact with the providers and using remote communication methods" (Alexander, 2003, p. 119). Online learning presents certain opportunities as well as challenges. Increasingly, distance learning takes place via online platforms such as Blackboard, Adobe Connect, and Desire2Learn. Some of these classes take place in real-time with students logging on and interacting directly. Most courses, however, are designed for students to participate at their convenience. In that way, the course is asynchronous, a format that diverges sharply from traditional face-to-face lecture formats.

Due to advancements in technology and the number of providers, the online learning environment is seemingly in a state of constant change. When the technology was first adopted, an initial challenge was for instructors to understand the tools and related teaching strategies (Clark-Ibanez & Scott, 2008). However, "faculty have progressed from simply putting course content online to designing active learning and knowledge creating environments that immerse the student in the cognitive style of the discipline" (Barone, 2002). The asynchronous teaching paradigm is gradually shifting from one of basic knowledge acquisition to mastery. Since time is a fixed quantity, rather than focusing on testing, students can repeat skills to build mastery on their own schedules (Crippen, 2003). Discussion board assignments might require activities across multiple days to maximize participation (Frey, 2012). The online environment is therefore conducive to mastery despite the lack of auditory and sensory queues.

Challenges still exist for students, be it a lack of technology readiness, misconceptions of course work and time commitments, or different styles of interaction (Clark-Ibanez & Scott, 2008). The challenges of asynchronous learning once overcome, though, can provide benefits to the student. First time online students are often not used to the environment and the technological problems that may arise (Clark-Ibanez & Scott, 2008) but initial tutoring and practice will alleviate these issues. The online asynchronous approach can promote self-regulated learning, and may increase a student's confidence. As students increase their mastery of a topic, they are more able to adapt to circumstances and approach new challenges within the asynchronous environment (Van Gundy, Morton, Liu, & Kline, 2006).

Additionally, students often enter online courses unprepared for self-directed asynchronous learning, expecting it to be leisurely (Clark-Ibanez & Scott, 2008), when online courses actually require more self-discipline; thus these courses may be better suited for nontraditional students (Maxfield & Fisher, 2012). Some learners may benefit, since some research suggests students welcome this autonomy (Tallent-Runnels et al., 2006). Additionally, the asynchronous, online format can serve as a time-saving factor for students with prior knowledge (Schmeeckle, 2003). Furthermore, curricula that simply replicate in-class approaches (e.g., predominantly lecture formats) deny students the diversity of teaching and learning activities that allow them to develop and practice skills. Evidence suggests that a variety of activities designed to be completed in relatively short increments hold student attention and facilitate the application of specific skills (Garrison, Anderson, & Archer, 2000).

Another concern about learning in the online environment is the lack of social learning environment and cues that are present in face-to-face courses (Benson et al., 2002) and contribute to engagement and motivation problems online (Schmeeckle, 2003). However,

discussion boards, blogs, and journals can alleviate these problems (Clark-Ibanez & Scott, 2008). Instructor feedback assists students in becoming more autonomous in their learning since they can alter strategies and tactics (Espasa & Meneses, 2010). In emergency management and homeland security courses, reflective writing including discussion boards and critical reflection assignments allow learners to incorporate their prior experiences and have been proven to be successful engagement tools (Maxfield & Fisher, 2012).

A separate strategy for increasing student interaction is problem-based learning, which focuses on case studies (Durrington, Berryhill, & Swafford, 2012; Savin-Baden, 2000). "A case focuses people on a common situation–one full of specific, interconnected issues" (McNergney, Ducharme, & Ducharme, 1999, p. 6). As content shifts from the abstract to the concrete, students apply learned concepts which promote higher-order thinking (McAninch 1999).

Problem-based learning in relatively short increments provides a set of strategies to structure a curriculum on decision making. Coupled with the three steps to achieve mastery, the authors apply this evidence to design, arrange, and implement specific teaching and learning activities.

DESIGN, DATA, AND METHODS

The teaching and learning activities examined here were designed according to the best practices noted in the sections on facilitating mastery and the challenges of achieving mastery online. Activities were implemented during the fall semesters of 2013 and 2014 in an online, asynchronous course offered within a Masters of Public Administration class on emergency management titled "Decision Making under Conditions of Uncertainty." Twenty-eight midcareer professionals working in the public and nonprofit sectors took part, except for one who took the year off to concentrate solely on school. Most students served in either county or municipal agencies or in nonprofit organizations. Five students had positions in emergency services, three in law enforcement.

The following sections examine the specific teaching and learning activities employed. An open-ended student questionnaire provided initial input for evaluation. Questions were adapted from Brookfield's (1995) "critical incident questionnaire" and were intended to illustrate areas of potential confusion, areas of success, and points needing improvement. Completed questionnaires were given and completed anonymously and labeled "Student 1" through "Student 28." Twenty-eight of 29 students completed the questionnaires (96.5%) which prompted students to identify the activities they were the most and least engaged in during the semester. Additional questions encouraged students to critically reflect on specific learning activities, and how those activities influenced their understanding and capability of making decisions and their ability to apply related skills.

Data were analyzed using the qualitative software MAXQDA (VERBI Software, 2013) and an evaluative framework from Ritchie and Spencer (2002). The authors identified specific trends and themes from the responses. Most were related to the extent to which students perceived that learning objectives were achieved, the factors that facilitated that performance, and the barriers to success. Codes included the acknowledgment of key skills, including elements of cognition. Factors perceived to be related to either success or failure were identified by the students and categorized by the authors.

While this coding strategy incorporates elements of content analysis, no strict tabulations were used. The authors followed the general framework presented by Atkins and Wallace (2012, p. 219) instructing researchers to make sure findings are "illuminative, indicative, and representative" of the data as whole. The small sample size (28 students) offers enough evidence to warrant subsequent study but is not robust and would not lead to a level of external validity.

The strategy presented is rooted in both theory and practice. We leverage professional experience, academic field research, and teaching experience while applying evidence-based strategies from cognitive psychology, public management, and SoTL. The design is therefore rooted in the values of both practice (see McCreight, 2009) and academia (see Kiltz, 2009b).

TEACHING AND LEARNING ACTIVITIES

Teaching and learning activities were designed for an online, asynchronous format within a graduate-level course on decision making. Students evaluated not just the scholarly research on the topic, but how decisions were typically made in practice. Table 1 outlines the strategy by which the course was built. Students worked to acquire component skills, practiced integrating those skills, and then were put in situations in which they had to decide when and how to apply those skills, based on elements of mastery discussed by Ambrose et al. (2010). Specific learning objectives (Table 1, See Appendix) are modeled after Comfort's (2007) concept of cognition.

Lower-levels of learning and basic skills were implemented first with higher-levels achieved as cumulative effort. Case studies, video games, and orientation exercises ultimately helped to create more realistic learning environments, allowing students to apply theoretical concepts to various simulated decisions. In the following sections, specific learning activities are illustrated–ordered by where they fit into the three steps of achieving mastery: 1) the acquisition of component skills; 2) the integration of those skills: and 3) knowing when and how to apply those skills without an instructor's guidance. Instructor reflection and student feedback provide an initial appraisal of effectiveness. The authors also provide a description of the methods by which student performance was evaluated (e.g., discussion boards and short papers).

Acquisition of Component Skills. Before students could replicate decision making processes typically used in the field, they needed to acquire and develop basic competencies. The course's first two weeks focused on risk and vulnerability with several learning activities. For example, the National Oceanic and Atmospheric Administration's *NOAAWatch Headlines* provide clear and accessible readings on hazards; the University of South Carolina's Hazards and Vulnerability Research Institute centered on vulnerability. *The Threat and Hazard Identification and Risk Assessment Guide* from the Department of Homeland Security as well as text books (see Perry & Lindell, 2007) offer hazard and vulnerability assessments. These readings coupled with use of a discussion board prompts provide a strategy to facilitate an understanding of these processes–the detection and interpretation of risk indicators.

Relevant documentary films were also employed throughout the semester such as those from The Public Broadcasting System. As an introductory film, NOVA's *Inside the Megastorm* provided an illuminating analysis of how officials detected and interpreted risk and vulnerability during Superstorm Sandy.

Week 3 introduced the strategies employed in the United States regarding homeland security and emergency management, which generated the baseline understanding of official actors and their goals, laying the foundation for more sophisticated analysis. The analysis of governance structures was reinforced throughout the semester. Case study readings, FEMA computer-based Incident Command System modules, briefings on news reports, and other documentary films [see Frontline's *The Storm* (Smith, 2005)] provided an array of learning activities that illuminate organizational structures, formal decision-making process, and standard operating procedures, particularly regarding interagency communication and coordination.

If governance structure provides critical information regarding the rules and the context in which decisions are made, the ability to monitor data, interpret risk, and develop strategies to reduce that risk represent key skills that practitioners should develop. Starting in Week 4, students demonstrated their ability to monitor real-time data by creating situational awareness briefs. Practitioners use these presentations to inform individuals on current matters to support decision making and build a larger common operating picture. This assignment was based on briefings created by the Texas Division of Emergency Management which personnel present regularly to the Governor and other high-ranking policymakers and operators. Students evaluated and presented real-time data drawing from meteorological [see the National Oceanic and Atmospheric Administration (NOAA)] and other sociotechnical sources available online [see the U.S. Geological Survey (USGS), the Texas Forest Service, regional utility providers, local 911 dispatch, and media outlets]. The assignment's format encouraged students to evaluate situations at multiple scales of action on all levels of governance from city to international.

In traditional courses, students would present their work and practice their oral briefing skills. In our online environment, students posted PowerPoint presentations as part of their weekly discussion board activities. Video and audio presentations were possible; however, the instructor decided that teaching those specific skills might overload the assignment and detract from the core learning objectives, especially if students struggled with the technology.

Instructor reflection and student evaluations identified an implementation problem with this assignment. Students did well in collecting and presenting data but meaningful analysis was lacking. While the instructor encouraged students to consider how indicators presented might impact emergency managers, student response was slight. Student 13 explains "my peers and I relied too strongly on the provided template and didn't think enough about what implications the data presented." After reflection following the Fall 2013 semester, more specific prompts were added to scaffold the learning activities – more instructor support was given throughout the assignment to guide student learning during the Fall 2014 semester. Questions that prompted students to identify specific risks, vulnerability populations, and possible protective actions were applied and helped to guide student learning.

Skills Integration. As students acquired component skills, learning activities including orientation exercises and video games allowed students to integrate those skills in a way that mimicked basic decision-making processes in the field. However, the situational awareness brief fell short on the skills integration front.

The situational awareness brief asked students to evaluate how potential hazards and risk might interact with different levels of vulnerability. Students were then asked to develop appropriate strategies to reduce risk. While students generally succeeded at identifying potential hazards and levels vulnerability, they often failed to demonstrate the integration of those skills through analysis. It appears that students needed additional instructional support to guide them through these tasks; assignments that called for analysis of a more narrow set of real-time hazards and vulnerability data may prove to be useful here. Comfort and Wukich (2013) illustrated a watch floor exercise in which the instructor guided students through these tasks; this provides for additional scaffolding and may be of benefit.

During weeks 4 through 7 of the semester, readings from Klein (1998), Weick (1995), and Comfort (2007) among others provided related theoretical perspectives. Case study readings offered examples from the field which students evaluated to gain perspective on decisions made. A common theme was wildfire response; however, as the course progressed, other natural disasters as well as technological and terrorist incidents were discussed and evaluated. Orientation exercises introduced later in the semester provided opportunities to practice newly developed skills, to demonstrate component skills, and integrate those skills without explicit guidance from the instructor.

Knowing When and How to Apply Skills without an Instructor's Guidance. Beginning in Week 8, the instructor introduced more complicated assignments in which explicit guides and prompts were not necessarily available. Students were expected to rely on their judgment, in part, based on their newly developed skills. Orientation exercises and the video game *Stop Disasters!* offered two useful learning activities.

Stop Disasters! The video game *Stop Disasters!* was developed by the United Nation's Office of Disaster Risk Reduction (see http://www.stopdisastersgame.org). Similar to *SimCity*™, the game focuses on risk reduction prompting a single player to make mitigation investments in five scenarios (tsunami, flooding, wildfire, hurricane, and earthquake). While initial prompts introduced players to potential hazards as well as specific strategies to reduce risk, information throughout the game is incomplete.

Some students embraced the game faster than others. Because of the learning curve for those without a gaming background, the instructor included time for practice. Most students found the game to be a valuable learning tool. Student 3, for example, stated that "one of the biggest takeaways for me was that resources are limited; thus decisions need to be prioritized and not every option can be taken."

Student 7 described the value of seeing the larger system. "Since you didn't know when the disaster was happening or what area it would affect, you had to step back and take a big picture look at the community and do what you could with limited time and resources. This is a very real-life situation for most communities when there is never enough time or money to effectively mitigate hazards." Student 23 liked "how there were also multiple scenarios to experience and learn from."

Orientation exercises. A number of orientation simulations were developed and implemented asynchronously via the discussion board; these provided students with opportunities to examine a

variety of roles and responsibilities related to local-level actors routinely deployed during disasters and make decisions as the simulation unfolded.

Four scenarios were developed: 1. An urban-wild land interface canyon fire, 2. The flooding of a commercial district due to lack of infrastructure maintenance, 3. A gas leak due equipment malfunction, and 4. An ice storm and related emergency.[1] The scenarios reflected typical incidents that occur throughout the United States, representing a variety of geographical environments, differing community lifestyles, and natural and technological hazards and risks. The exercise scenarios required different response strategies and tactics and impacted a full range of vital community elements, including residents, infrastructure, environment, culture and the economy.

Each exercise included at least two phases. The first described the initial context. Here students were asked to identify varying levels of risk and vulnerability. The next phases prompted students to make decisions to reduce risk. Exercise injects – events and activities – were developed and inserted to further along the students' experience in exploring their own decision-making capabilities. Students were encouraged to evaluate their peers' responses and take these into account as they developed their own strategies for action. Student 11 explained that this "resulted in direct student interaction… that required us to work together to solve problems."

Five roles (players) were created to represent responders who typically respond to local events. Students were introduced to the professional roles and responsibilities each player held during both peacetime and an initial operational response period. Student 4 stated that "By changing the position each week, students were encouraged to think about the many roles in public services and what is important in those roles." Roles and actors included the following:

- City emergency manager
- Fire chief
- Police officer
- Paramedic
- Community emergency response team (CERT) member

The basic role definitions, work priorities, and scenario responses were developed and described for each player; and high-level descriptions were provided for each. Actors' roles were defined and described, providing an overview of the actor in regular work and the responsibilities in a non-disaster role compared to additional responsibilities often assumed when an event occurs. Priorities in a regular work environment as well as a disaster response were described to give the students an introductory understanding of the pivotal roles of the player. Probable actor scenario responses were described such as the activities a local police officer might be called on to accomplish in an uncontained fire response; working with an operational area mutual aid coordinator (sheriff) and fire department to evacuate the area at risk; communications outreach to alert the community by air, squad car, radio; and other methods, along with traffic control.

Creating these player roles required consideration of which actions could be exercised most effectively in an isolated, online, asynchronous environment. Without face-to-face contact,

[1] Several practitioner-level exercises and the Homeland Security Exercise and Evaluation Program were evaluated in developing these scenarios to simulate processes experienced in the field.

students lose the opportunity to absorb critical verbal and non-verbal cues and clues from ongoing discussions with fellow responders; from the unfolding events surrounding them; and from their own personal level of engagement in order to gain situational awareness of the synergistic energy of a team working environment.

The online asynchronous environment provided students with time to contemplate their decisions; this contrasts with the narrow time constraints experienced in the field. The concerted steps of evaluating levels of risk and vulnerability as well as developing strategies for action shaped and constrained by the decisions of others provide a basic replication of real-time operating environments. As Student 1 suggested, "We really used critical thinking skills to apply what we learned to real-life situations." Student 20 stated that the exercises provided opportunities "to gain a better understanding of the big picture and how all the various actors and aspects of emergency management must work together and coordinate their efforts for the best possible outcome."

Another critique of the exercises was that students were not always able to assign consequences to their actions. The instructor did not intervene with the exercise to illustrate possible consequences because of the principles of mastery laid out by Ambrose et al. (2010). However, suggesting possible consequences would not have interfered with key learning processes–it would have aided student analysis. This offers one potential point of improvement for future implementation.

Evaluating Student Performance. To evaluate student performance, the instructor employed best practices from asynchronous discussion boards and developed a writing assignment styled from after-action reports in the field which allowed students to evaluate specific decision spaces. Students were asked to evaluate an initial case study reading (see Maclean, 1992), their participation in the *Stop Disasters!* game, and one of the several orientation exercises. "The assignment," Student 2 reflected, "allowed me to put into practice the skills and information I gathered from the readings, including the rationale behind my decisions." Reports were short (500 words), focusing on one or a small set of decisions. This forced students to identify and analyze pivotal decision points. "This ability is a critical skill in the real world," Student 10 offered. "As a potential administrator, we must be able to review decisions and understand how we can improve in the future."

Students wrote each after-action report over a four week period. First, students took part in the learning activity and filled out a predesigned worksheet. In the second week, students drafted their report, uploading it to blackboard for peer review. Each student peer reviewed two reports during the third week, thus interacting with their classmates; and revised reports were submitted the fourth week. The intent was for students to put considerable time into preparing their final assignment and less time into writing a long term paper (Bean, 2011). Student 1 suggested that the assignment was "more valuable in the workplace than looking up references in putting together a research paper." By replicating a writing product from the field and adhering to strict word limits, students were forced to be thoughtful and precise.

DISCUSSION AND CONCLUSION

Identifying key actors, remembering the strategies intended to facilitate cooperation, and discussing specific incidents represents the foundation for homeland security and emergency

management courses. Many instructors depend disproportionately on these vital if slightly lower level learning activities. The role of uncertainty in the field, however, deserves more attention. Disasters generate ambiguous decision spaces in which personnel shoulder legal and moral obligations despite insufficient information, resources or time. Navigating uncertainty in urgent and stressful situations, therefore, represents a key ability for emergency managers as well as homeland security professionals.

The teaching and learning activities evaluated in this article provide a proof of concept that warrants replication and additional testing. While context and hazard type may vary, the three general steps toward subject mastery; the acquisition of component skills; the integration of those skills; and the ability to decide how and when to use them without an instructor provide a guiding framework. This strategy will not prepare perfect decision makers; instead, it offers a road map informed by both theory and practice. The activities presented are not the only approach; we encourage dialogue, experimentation, and testing.

Whether for introductory students or experienced professionals, the applied nature of the assignments and the diversity of assignment type proved to be engaging. The varied assignments were attention getters for students socialized to more traditional lecture formats. The key here was for students to apply their knowledge. Across disciplines, mastery requires the ability not just to understand, but to apply, analyze, and create. Evidence from cognitive psychology and public management demonstrates how highly effective practitioners make decisions in the field despite constraints. Students who are informed by risk and vulnerability data from the beginning of their education and training will be in stronger positions to pursue their organizational missions.

Simulation exercises designed for professional training programs demonstrate rich complexity, assuming sophisticated levels of experience and knowledge by participants. Introductory students, however, require scaffolded, less complex assignments to begin their path toward effective decision making. These scaffolded assignments are valuable to both undergraduate as well as graduate students. Balancing a mix of students with varying levels of experience, however, requires careful consideration. Students with more professional experience may be less receptive to basic exercises. In situations such as these, instructors may request experienced students take an active role in mentoring and providing feedback to their less experience classmates. This approach engages the experienced student and allows him or her to provide value to other students at the same time.

The orientation exercises developed for this project focused on local level action. More complex simulations are possible and would facilitate the addition of actors from other levels of government and more complex and detailed scenarios. In determining the level of complexity, instructor should consider again the experience level of the students.

The lack of visual and verbal cues, particularly with respect to the orientation exercises, limited the ability of the instructor to produce a truly authentic learning environment. The *Stop Disasters!* game and documentary films provided visual and verbal cues. As technology and budgeting permits the development and acquisition of more online gaming activities, instructors will have the ability to overcome some of the constraints of an online, asynchronous environment.

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APPENDIX

Table 1: Matching Elements of Mastery, Learning Objectives, and Teaching & Learning Activities

Elements of 'Mastery'	Learning Objectives	Teaching & Learning Activities
Acquire component skills	Identify and describe hazards	Readings; discussion boards; lectures; films; news reports; analysis of real-time data; online games (see Stopdisastersgame.org)
	Identify and describe vulnerability	Readings; discussion boards; lectures; films; news reports; analysis of real-time data; online games
	Describe the structure of the emergency management system	Readings; films; other case studies; discussion boards; online lectures; computer-based training modules (see FEMA and the American Red Cross)
	Monitor change	Discussion boards; news reports; social media; analysis of real-time hazards data (see USGS, NOAA, and others); situational awareness brief exercise
Practice integrating skills	Link hazards and risk with vulnerability	Analysis of real-time hazards data; analysis of vulnerability data (see Cutter's vulnerability index); situational awareness brief exercise
	Link hazards, risks, and vulnerability to appropriate strategies to reduce risk	Analysis of real-time hazards data; analysis of vulnerability data; online games; situational awareness brief exercise; watch floor exercise; orientation exercises
Know when & how to apply skills (Transfer)	Analyze simulated decision spaces	Online games; orientation exercises (see disaster scenarios; watch floor exercise; emergency operations center exercise)
	Communicate with multiple actors within a simulation	Orientation exercises
	Create strategy for proper course of action	Online games; orientation exercises
	Communicate strategy and coordinate action across groups	Orientation exercises
	Reflect on, evaluate decisions	Discussion boards for post-exercise "hotwashes" and evaluation of case study material; After action report assignments