
AC 2011-2746: THE 2010 HAITI EARTHQUAKE: REAL-TIME DISASTER INQUIRY IN THE CLASSROOM

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The 2010 Haiti earthquake: Real-time disaster inquiry in the classroom^[27]

Abstract

Civil engineering education commonly has classroom instructional strategies that include synchronous engagements between the instructor and the learner, but seldom has synchronous experiences between the learner and real-time external phenomena. As a consequence, separating students from the phenomena may inhibit formulating opinions and conclusions borne through live events. This paper explores a natural disaster as a real-time course inquiry and its semester long immersion into the structures classroom at a private liberal arts university. A participant observation study was performed in the narrative tradition to document forty-four third-year architecture students studying an unfolding disaster event. The findings indicate that students envision earthquake events as either a structural phenomenon with cultural implications or a cultural phenomenon with structural implications. The lessons learned were to use student's individual Eureka! moments to inform subsequent classroom instructional opportunities; accommodate unexpected cultural content and seek connections with structural content; and recognize that incremental inquiries of cultural phenomena are essential for developing long-term engineering solutions.

Introduction

“From birth, man carries the weight of gravity on his shoulders. He is bolted to earth. But man has only to sink beneath the surface and he is free . . .” wrote Jacques-Yves Cousteau.^[1] He bypassed the gravity constraints and co-developed the first aqualung device. Cousteau redefined the problem. He charted a new frontier as his solution made the invisible visible. This is a metaphor for educators continually confronted with the weight of prescriptive curricula in need of alternative innovation.

Two trends were found after investigating the top eleven undergraduate engineering programs ranked by the U.S. News and World Report. The curricula are very doctrinaire and the course descriptions are indicative of synchronous engagements between the instructor and the learner. Conversely, none of the eleven schools appear to dedicate a course that has a synchronous engagement between the learner and live content. A semester long course devoted to a single real-time dramatic event that has broad impacts in engineering. Educators may identify significant events as the Kansas City Hyatt walkway and the Tacoma Narrows Bridge collapses. Although these became very valuable learning moments in engineering education, their discussions or laboratory reenactments exhibit synchronicity between the instructor and the learners and not the learners and the events. The students are learning about the event asynchronously supported by a longer thread of scholarship performed and interpreted by several others. All of the relevant conclusions from academia and practice are available in the public domain. Therefore, the students may be inhibited from thinking critically and formulating their own opinions and conclusions informed by unfolding live events. A need exists for exploring synchronous, or real-time, student engagement between a significant event, such as a disaster, and the academic experience.

In response to this need, undergraduate students were immersed inside one disaster event in the structures classroom to explore, “What is the nature of synchronous engagements between the learner and the disaster event?” To examine this condition, a qualitative study was performed to document a course devoted to studying a natural disaster that evolved concurrently within the course timeframe. The primary purpose was to better understand the nature of student engagement. A secondary intention was to study the broad implications of disasters in education. The paper addresses persons interested in integrating engineering, education, and disasters.

The 2010 Haiti Earthquake

One of the world’s most destructive natural disasters occurred on January 12, 2010. The Caribbean and the North America tectonic plates adjusted and released energy that had a 474 kt [2 pj] TNT explosive equivalent. The earthquake epicenter was positioned near Port-au-Prince, Haiti. The earthquake measured a 7.0 on the moment magnitude scale (M_w). Although, the 7.0 M_w is comparable to the energy released from the 1989 Loma Prieta earthquake (6.9 M_w), it produced over 3,500 times the fatalities. The 2010 Haiti earthquake has the largest death toll of any previously recorded 7.0 M_w earthquake event.^[2] The significant loss of life and property is a reflection of the Haitian design and construction practices. The magnitude and the timing of the Haiti earthquake offered a unique learning opportunity for the students. An opportunity suited not for an isolated lecture and assignment, but rather its immersion into a structures course.

Course Description

Drury University is a private school that offers higher education rooted in the liberal arts tradition. Although the university houses the Hammons School of Architecture, it does not have an engineering program. The department offers three computational-based structures courses. The first course introduces the fundamental principles of statics and mechanics of materials. The second course focuses on structural steel and timber design. The third course is the immersion setting. The course is currently positioned in the spring semester of the third year. Forty-four architecture students were enrolled in the terminal course during the spring semester of 2010. The third course is in flux as our program transitions from a five-year bachelor to a five-year master’s program. The master’s curriculum is sunsetting some reinforced masonry and concrete design topical content in the third course in favor of a new research-based course. The third course is moving to the spring semester of the fourth year. The upcoming course description reads, “Application of engineering principles and analytical methods, as presented in the earlier technology coursework. Beginning team scientific research into implications and development of these systems through the collection of empirical data using methods of science. Students will write up research results in the form of a professional publication and present their work in a forum open to the full campus.” Of the two terminal courses, the research course is more suitable for immersing a natural disaster, but it has its weaknesses. The students have not been exposed to lateral forces or reinforced concrete design. These are two important components of earthquake engineering. The master’s curriculum has greater adaptability for an intervening disaster due to the research directive despite of this deficiency. The students chose to engage the new master’s course a couple of years early with uniform consensus.

Procedure

The central phenomenon is the intervention of a synchronous disaster event on student learning. To examine the nature of this phenomenon, a qualitative research design was selected with a constructivist approach.^[3] A participant observation study was performed in the narrative tradition.^{[4], [5]} The rationale was to capture the storied knowledge of the classroom experiences. The data include raw field notes and evaluations of student outcomes from their artifact analysis. The notes represent context and actions from the shared experiences in group discussions and classroom lectures. The student outcomes include their first impression journaling, literature reviews, scholarly papers, posters, and presentations. The data are analyzed to discover relationships, make interpretations, and develop explanations. This interpretive analysis follows a chronological journey and is presented in a findings format.

Findings

The course was configured into two stages (see Figure 1). The first stage was an introduction to earthquake principles and the Haiti earthquake event. The individual student journaling outcomes informed the subsequent research questions. The second stage was the group research inquiry where the students performed an artifact analysis.

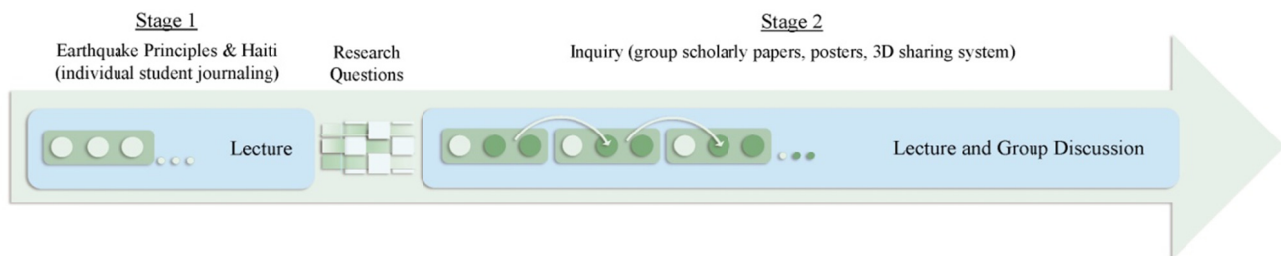


Figure 1. Course configuration.

Introducing Earthquake Principles and the Haiti Earthquake Event

The first stage duration was about one-quarter of the semester. The instruction was an instructor-centered lecture methodology which included a sprinkling of multimedia encounters, readings, and imagery. The topical areas were the evolution of earthquake principles. The lectures expressed how U.S. model building codes and lateral force procedures evolved as a result of significant earthquake events. The historical traces paralleled industry's knowledge progression regarding plate tectonics, quantifying earthquake events, building construction materials, and architectural form and configuration. The multimedia engagements included silent footage of San Francisco's Market Street prior to and after the 1906 earthquake, the 1908 Messina, Italy, earthquake, earthquake preparedness for the New Madrid fault region, architectural and engineering collaborations, and footage of the Haiti earthquake and aftermath. Some of the readings and imagery included a prediction of a Haitian earthquake^[6], the losses in higher education^[7], and a border image between Haiti and the Dominican Republic. The student outcomes were in the form of first impression journaling.

The students documented their impressions in the classroom immediately after viewing each individual artifact. The student impressions revealed that earthquake events were either a structural phenomenon with cultural implications or a cultural phenomenon with structural implications. One impression was more buoyant while the other descended in prominence. The impressions collapsed into five subsequent themes of the built environment, earthquakes v. buildings, Haitian culture, Haitian utopia, and survivor stories. This breadth of interest from structural to cultural sensibilities was not anticipated when the course was first orchestrated. Therefore, the research questions accommodated the two primary topical areas of earthquake engineering and Haiti where each topic allowed the other to act as a backdrop condition. The five theme-based research questions were created by weaving a topical area and its backdrop within the timeline parameters of pre-earthquake, earthquake, or post-earthquake. The timeline provides a holistic viewpoint of the disaster event. The student research questions are woven into the fabric of topical area and timeline illustrated in Figure 2. The divergent topical areas were addressed by coupling the two topical areas (earthquake engineering and Haiti) and the two timeframes (pre-earthquake and post-earthquake).

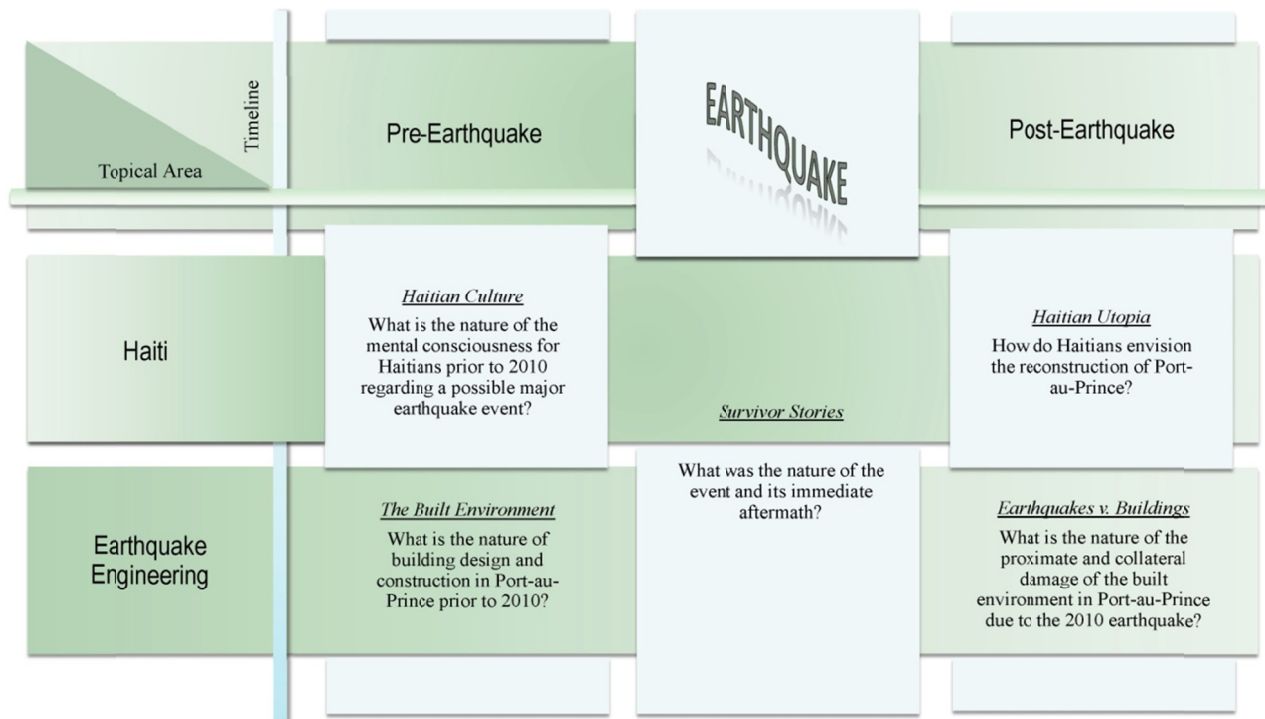


Figure 2. Student research questions.

The built environment. The individual student journaling revealed several comments that forged an interest in exploring the utility of buildings. This indicated a heightened interest in the structural phenomena. One student recognized the significance of the National Palace on the built environment and commented, “The sturdiest building in Haiti collapses?? Yikes. –What does that say about the rest of [the] buildings.” The student understood that one prominent failure

may have broader implications to the building industry. Another student provided a different structural angle and asked, “Are there building codes in Haiti[?]” The student questions the accountability of the designers and builders. This pattern of impressions highlighted a need to study the built environment to understand how buildings were designed and constructed before the earthquake. This theme of journaling led to the research question, “What is the nature of building design and construction in Port-au-Prince prior to 2010?”

Earthquakes v. buildings. The students recognized the relationship between the focus, epicenter, and the locations of buildings. One student noted, “The focal depth was shallow, so it was more catastrophic.” There were also varying degrees of damage severity. One student wrote, “Buildings don’t seem to collapse completely creating dangerous structures.” These students discovered post-earthquake relationships between the event and building damage. This pattern of thinking led to the notion of earthquakes versus buildings. The emphasis was the amount of harm inflicted upon the structures. This research question became, “What is the nature of proximate and collateral damage of the built environment in Port-au-Prince due to the 2010 earthquake?”

Haitian culture. Several comments expressed an interest in exploring the Haitian way of life prior to the 2010 earthquake. These impressions emphasized earthquakes as a cultural phenomenon with structural implications. The students were wondering why earthquake readiness was not part of the Haitian daily way of life. One student provided a viable question after reading the earthquake prediction, “Why did nobody act on this claim?” Another student wrote, “The country was completely unprepared.” Haitians are seldom exposed to severe earthquakes. One student recognized the time between significant earthquakes, “Longer periods w/out activity have left people . . . Dormancy.” The student was implying that the relative infrequency may make the citizens more complacent or passive about the dangers of earthquakes. The Haitians clearly have more immediate concerns. This pattern of impressions revealed a need to study the Haitian culture to better understand the plight of the people. This theme of journaling led to the research question, “What is the nature of the mental consciousness of Haitians prior to 2010 regarding a possible major earthquake event?”

Haitian utopia. There was a distinction between pre- and post-earthquake cultural impressions. Several students recognized the current economic conditions and future reconstruction, “4th poorest country in the world” and “Tent cities, rebuilding will be difficult due to monetary concerns.” Another student wrote, “How is the country going to recover?” The monetary aspect elevates the cultural sensitivity. These students inferred a difference between immediate and long-term reconstruction capabilities. This led to the notion of envisioning incremental post-earthquake activities. The students expressed a general concern regarding foreign involvement influencing the Haitian economy, government, and other social areas. One student noticed a difference between the economies of the two neighboring countries on the island of Hispaniola and questioned, “What are the differences between Haiti and the Dominican Republic politically?” Student responses within this theme observed that identity and progress may have been stifled in the past and that an idyllic community should be explored.^{[8], [9]} The Haitians should describe their ideal society as opposed to international contingents even with the best of intentions. This pattern of impressions revealed a need to understand utopia through the perceptions of Haitians. This theme of journaling led to the research question, “How do Haitians envision the reconstruction of Port-au-Prince?”

Survivor stories. The earthquake event found a position between the pre- and post-earthquake timeline and between the structural and cultural themes. Impressions indicated a sense of urgency to the event and its immediate aftermath. The students noticed the instantaneous hardship and transformation. One student commented on the broader essentials, “Needs: fresh water, food, shelter, medical care, utilities, [and] communications/control.” Some students wrote about why special needs existed, “A third of the population have lost their homes.” Several students noted an unusual situation, “Jail collapse[s], inmates escaped.” Others followed with, “Lucky day for the inmates!”, “need for law enforcement”, and “How do they protect people from starvation, looting, + prisoners?” These comments suggested a journey into the survivor stories that describes the event within a smaller reference timeframe. This pattern of journaling led to the research question, “What is the nature of the event and its immediate aftermath?”

Student Inquiry

The second stage extent was about three-quarters of the semester. The two major obstacles confronting educators in pursuing classroom discussions are the need for minimum topical content and the lack of a controlled discussion.^[10] Topical content is best managed through instructor-centered lectures. As discussion activities increase, the content progressively decreases. This shift facilitates an increase in learning comprehension. Therefore, a hybrid lecture and discussion format was chosen in an effort to inform content during the inquiry stage. Weekly lectures were conducted on Mondays and group discussions on Wednesdays and Fridays. The group discussions were coordinated with the group research questions. Each group was assigned one research question. The lectures were outcomes of the group discussions from the previous week. This stage was fluid and integrated student discovery.

The ten groups performed artifact analyses in the narrative traditions to examine the nature of their structural or cultural phenomenon. Their artifact data was acquired unobtrusively and in the form of traces, documents, personal communications, records, photographs, videos, and archives. One of the most unexpected artifacts was secret surveillance footage during the earthquake. The artifacts were indicators of individual or group life and the built environment. The students interpreted the data by recognizing patterns and making generalizations. Students chose to analyze datum without its companion explanation. For example, the students frequently turned off the audio when viewing a video file from a journalistic source. This had two benefits. First, the students may be researching a topic that is divergent from the purpose of the video. In general, the unfiltered imagery was a valuable resource. Second, the students were not relying on third party explanation of events. Therefore, students performed more critical thinking. Their research culminated in scholarly papers, posters, presentations, and a 3D information sharing system. The student outcomes and engagements from the entire course revealed several interesting findings. The findings represent the interpretations of the relationships inside the student outcomes. Seven themes that emerged from their journey follow.

Global impact. The students found that earthquakes may induce damage in other parts of the world. The Chilean earthquake registered an 8.8 M_w about five weeks into the course. The energy released from the Chilean earthquake was considerably greater than the Haiti earthquake and in a location that may induce a tsunami. The students became informed of the broader implications as Hawaii may have been subjected to a tsunami induced by the Chilean earthquake.

The students learned that the 1964 Alaskan earthquake in Anchorage created a tsunami that damaged Hawaii 2,800 miles [4,500 km] away.^[11] These other earthquakes reminded the students that the tectonic plates are under constant strain and continually inducing ground motion globally. The students began to independently track the daily ground motion through the U.S. Geological Survey. The daily motion also reinforced the importance of soil characteristics, building construction techniques, and the proximity of structures to the edges of tectonic plates.

Model building codes and insurance. The students discovered that design and construction practices in Haiti are not comparable to current U.S. building practices. Although the students found a 1985 Caribbean Uniform Building Code (CUBiC), they were unable to locate a code specific to Haiti. Haiti never adopted the CUBiC even though several other neighboring nations deploy this code. Regardless, the CUBiC was found to be insufficient for hurricanes and earthquakes.^[12] The students found that some buildings were built and occupied by foreign entities. Builders abide by international standards when the foreign structures are privately insured. These structures were less vulnerable to collapse. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) provides coverage for uninsured structures. The CCRIF is a consortium of nations that provides insurance as a result of hurricanes and earthquakes. There is no financial incentive for implementing a code with earthquake provisions when governmental insurance is accessible.^[13]

Earthquake frequency. The students found that the last relevant earthquake near Port-au-Prince was almost two and a half centuries ago. The last major earthquake on the island of Hispaniola registered an 8.0 M_W in 1946.^[14] This occurred at Samana, Dominican Republic. The 64 years since the earthquake exceeds the life expectancy of Haitians.^[15] This infrequency, led the Haitians to a state of complacency regarding earthquake dangers and preparedness. Hurricanes and heavy rains are impacting the Haitians more than earthquakes. These happen on a seasonal and an annual basis and are pertinent to their daily way of life. The result is that some construction has portable tendencies. The rains and associated flooding necessitate the movement of homes. The infrastructure deficiencies exacerbate the consequences of the flooding. Understandably, the Haitians are more prepared for hurricanes than earthquakes.

Concrete construction. The students found that concrete was a common construction material which seemed unusual in a tropical climate. One would suspect that a mass material would store then release too much heat energy to be a viable product. They found several instances where the water to cement ratio was extremely high. They were seeking answers to whether the material was chosen for its strength, availability, cost, etc. or were other materials neglected due to the same circumstances. The students realized that material choices were sometimes influenced by society and that policymakers dictated the use of land and resources. The students discovered that construction techniques and materials were inconsistent.^{[16], [17]} Several buildings were left incomplete. These structures were not subjected to inspection. One example is where the concrete columns extend beyond the structure with the reinforcement bars exposed. This implied that additional stories were forthcoming. The material exposure permitted the students to find several conditions where the concrete columns neglected reinforcement, were under-reinforced, or used reinforcement bars without deformations.^[18] These became learning opportunities for the whole class on designing unreinforced concrete members and the impact on the strength affiliated with the development length of smooth reinforcement bars.

BIM and interactive 3D. The students found that building information modeling (BIM) is interoperable with on-line interactive 3D visualization software programs. Some student teams pursued a 3D information sharing system. BIM is a digital representation of a building and becomes a shared knowledge resource amongst its users. Two student teams chose to create an urban context of buildings. Artifact data was placed in the environment on the sides of buildings for information sharing. The urban environment was imported into a user-friendly gaming engine. The interactive 3D allows novice users to freely navigate within the urban context and view the relevant artifacts. Figure 3 illustrates a screen capture outside the urban environment. Using BIM and interoperable interactive 3D has industry potential to compliment the integrated project delivery methods.^[19]

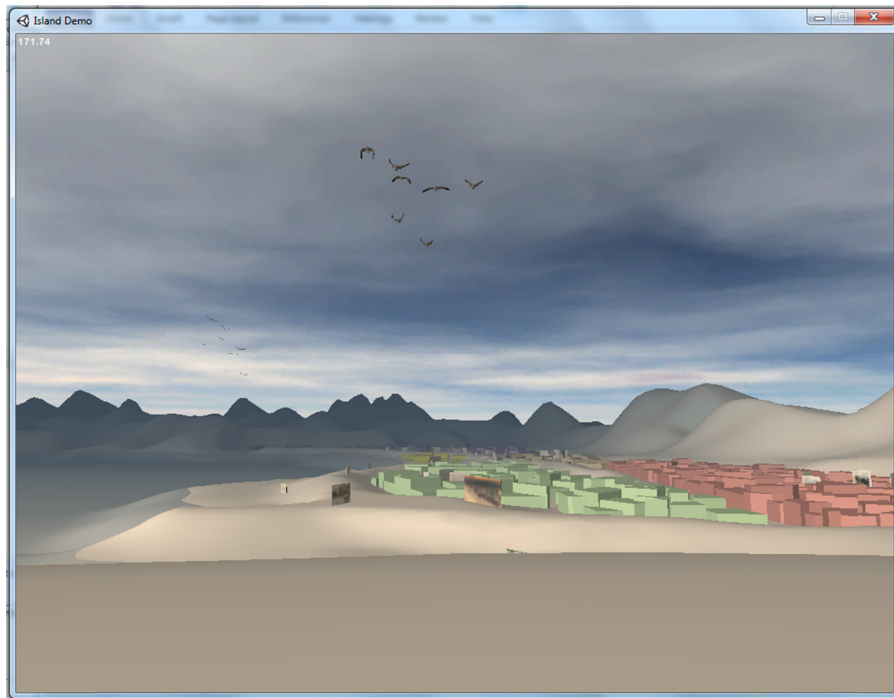


Figure 3. Artifact data sharing with interactive 3D.

Artifact retrieval. The students discovered that sometimes the research trail terminates. The newness of the Haiti earthquake hindered some student inquiries where the artifact trail ended. Some students did not uncover enough data to continue on a thread of exploration. When the references concluded, the students sought representative examples from other situations to draw their own conclusions. One example was the brief appearance of the CUBiC on the World Wide Web before it inexplicably vanished. Subsequently, the students located third party artifacts regarding the code. The St. Lucia version is available, but this is not the same document as the 1985 CUBiC. This problem was also indicative of a weakness in their search methods where they did not properly document the keywords used in the original search parameters. Some groups embraced the challenge. There was a Sherlock Holmes appeal to locating artifacts during their journey.^[20] The students thought more critically when they attempted to solve the mystery.

Traditional media. The students discovered that the U.S. news media readily jumped on the earthquake story due to the catastrophic nature of the event and its proximity to the U.S. Artifacts retrieved from the media outlets should be triangulation for validation. As phenomena unfold, factual data may be misrepresented. The students found that interviews of Haitians were more reliable than the reporter accounts in the field.^[21] The students noticed the diminishing return of media coverage as time became more distant from the event. From a cultural sensitivity, less aid will be forthcoming to the Haitians as the media coverage lessens. This would occur a time most critical due to the upcoming hurricane and rain season. Even with aid coming arriving, students were finding several survivor stories concerning its lack of adequate distribution.

Discussion

The primary purpose of the study was to better understand the nature of student engagement and the secondary purpose was to study the broad implications of disasters in education. The author explored the research question, “What is the nature of synchronous engagements between the learner and the disaster event?” I extruded three educational lessons learned by observing the student themes evolve. These are reflections from the real-time disaster inquiries in the areas of course instruction, content, and student outcomes. These function as hallmarks of best practices to integrate liberal education into engineering curricula.

Major Findings

The first lesson learned was to develop the students’ Eureka! moments into subsequent lecture topics. The students experienced these discoveries during the inquiry stage. The students revealed the Eureka! moments during the group discussions. One example was the discovery that the National Palace was built with some concrete columns that contained four thin and smooth vertical reinforcement bars (see Figure 4). The students instinctively knew that this was incorrect, but did not have the technical knowledge to understand why. This was an opportunity to discuss the significance of stirrups, hooks, bar deformations, and development lengths with the individual group and then extend into the class lecture the following Monday. This was knowledge strengthening for the original discovery group and knowledge acquisition for the remaining students. Each group had individual discoveries that occurred at different times. The daily ASEE briefings facilitated the discoveries.^[22] These artifacts were distributed as a tool to initiate discussions. The ASEE readings proved to be invaluable.



Figure 4. National Palace, Port-au-Prince: (a) August 7, 2006;^[23] and (b) January 14, 2010.^[24]

The second lesson was to accommodate unexpected cultural content and seek connections with structural content. The breadth of content associated with a disaster phenomenon seems endless. Unusual topics arose during the discussions such as economics, politics, anthropology, sociology, foreign language, history, violent crime, and even food science, etc. This was, in part, due to Drury's liberal arts general education experience. The expanded inquiry was integral in recognizing themes regarding Haitian design and construction practices. The economy was one example of transforming a non-technical cultural theme back into the structural domain. Discussions of economy were transformed into concrete failure conditions for unreinforced, under-reinforced, balanced, and over-reinforced members. This was relevant due to the amount of reinforcement that a client could afford to purchase rather than meeting a strength requirement. Permitting cultural journeys fostered critical thinking.

The third lesson learned was to recognize that incremental inquiries of the cultural phenomena are essential for developing long-term engineering solutions. If cultural topics are avoided, students arrive at the final destination without making incremental inquiries along the way. A risk exists of making inappropriate long-term solutions. The initial viewing of the earthquake aftermath images may create a rush to judgment. One may readily conclude that there are problems with the design and construction of the buildings as these were clearly inadequate for the applied loads. A final solution, therefore, must be to educate and provide the Haitians with the most current model building code. Not so fast. An exclusive inquiry of only the structural phenomenon may not provide an implementable solution. Incremental inquiries of the cultural phenomena are needed along the way before a long-term solution is realized. The Haitians showed us that securing basic sustenance and finding shelter prior to the rain season have a greater sense of urgency than the design and construction of permanent structures. In addition, portable structures represent a significant contribution to their built environment. The Haitians must also overcome years of cultural notions that earthquakes rarely strike Haiti. Both structural and cultural inquiries should be embraced to paint a holistic portrait before rebuilding Haiti.

Recent Disasters

Most Americans live in areas that are exposed to hazards whether naturally occurring or through involvement with humankind. Natural hazards may be in the form of tornadoes, earthquakes, or hurricanes and may impact the Midwest, West Coast, and Gulf States, respectively. Hazards occurring from human involvement may be oil drilling rigs, physical neglect of buildings and infrastructure, or acts of terrorism. Hazards are the initial sources of the phenomena. The selected phenomenon should have broad implications and significance to warrant a classroom inquiry. Broad implications exist when there is harm to human life, its shelter, or to ecosystems. The significance is the degree of harm such as human lives lost, reconstruction costs of buildings and infrastructure, or the corresponding loss of fauna and flora. A disaster occurs when a hazard achieves the aforementioned harm.

The past decade witnessed the 2000 Carlsbad pipeline explosion, 2001 September 11 attacks, 2002 Hayman Fire disaster, 2003 Midwest tornado outbreak sequence, 2004 Indian Ocean tsunami, 2005 Hurricane Katrina, 2006 North American heat wave, 2007 I-35W Mississippi River bridge collapse, 2008 Bihar India flood, 2009 Typhoon Ketsana, 2010 Deepwater Horizon oil drilling platform explosion, and the 2011 Sendai, Honshu, Japan earthquake. These disasters

illustrate the range of sources and globalism. We are all potentially connected to an unwanted disaster situation since no region is immune from some adverse risk. The potential of student travel and first-hand accounts is increased when a disaster has geographic proximity. First-hand accounts would enrich the learning experience.

Real-time is the synchronicity between the disaster phenomenon and the academic experience. Inquiry is the student investigation of the event. When too much time passes between the event and the inquiry, professionals and academics may have their conclusions available in the public domain. Although this peer review data has significant value, its accessibility may inhibit the students from experiencing more frequent Eureka! moments. To optimize this learning experience, the event and the academic experience are concurrent and the recent events are still under active investigation and remediation by industry. The research questions should not yet to be fully explored. Synchronous engagements encourage critical thinking and permit the students to confront dramatic events in higher education. This may improve the response quality and timing exhibited later in professional practice.

Limitations of the Study

There were three concerns with study regarding the architecture students as participants, prerequisite engineering knowledge, and traditional news media. First, architecture students may not elicit the same impressions and outcomes as students in engineering programs. The liberal arts backdrop may influence the amount of cultural implications generated by the students. To counterbalance this potential effect, the instructor emphasized earthquake principles and events as topical content wherever possible. Secondly, this course was the third structures course in a sequence of three. The students did not have ample prerequisite engineering knowledge. This limited their depth of envisioning more structural implications, but this change and sometimes loss of content also provided more instructor opportunities to introduce engineering topics through real life scenarios. Thirdly, some of the artifacts originated from traditional news media outlets. This datum was triangulated with other sources for validation. Even with this degree of care, journalistic sources appear to elevate cultural themes with a greater sense of urgency than structural themes. This concern was addressed by using the readings provided by the ASEE.

Implications of Future Research

The study was not designed to make a claim that students learn more from a synchronous disaster immersion than an asynchronous replication. Future research may consider teaching the same course at different points in time. The first course is synchronous with the phenomenon. The second course is asynchronous and conducted several years after the event. This becomes a longitudinal study of the quality and quantity of impressions and Eureka! moments as time increases between the event and the classroom experience. This research may indicate a greater frequency of cultural impressions during the synchronous experience. Future research should include different stages of prerequisite knowledge. A disaster inquiry course at the undergraduate level may furnish different student outcomes and instructor interpretations than a graduate course. Other suggestions include using an engineering course integrated with a humanities class, or situations where the course is team taught across disciplines. This combination of structural and cultural perspectives surrounding disaster inquiry is worth further investigation.

Overall Significance of the Study

Civil engineering education strives for broader exposure to the humanities and social sciences. This course enlisted topics such as Haitian history and political structures which are inside the foundational knowledge areas of the humanities and social sciences, respectively. This classroom experience places the students, “In a position to understand the physical world and the behaviors of its inhabitants.”^[25] The student outcomes of scholarly papers, posters, and presentations illustrate the importance and incorporation of the humanities and social sciences. The course outcomes demonstrate the knowledge, comprehension, and application levels of achievement in a manner that is coupled with technical content. In conclusion, consider real-time disaster inquiries as an opportunity for broader implications where, “Education is for improving the lives of others and for leaving your community and world better than what you found it.”^[26]

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