TECHNOLOGY INTEGRATION, ARTIFICIAL INTELLIGENCE, AND EXPERIENTIAL LEARNING IN EMERGENCY MANAGEMENT EDUCATION: A COMPARATIVE REVIEW OF UNIVERSITY PROGRAMS

FISHER, JOHN R., Utah Valley University
john.fisher@uvu.edu

LINDQUIST, CHRISTIAN O., Utah Valley University
chrisl@uvu.edu

ABSTRACT

Artificial intelligence (AI), geographic information systems (GIS), predictive analytics, and digital decision-support systems are increasingly important in emergency management practice, but less is known about how university programs prepare students to use these technologies. This study used comparative document analysis to examine publicly available curriculum materials from 10 emergency management and homeland security programs and compare them with Utah Valley University's (UVU) emergency management program. The study reviewed six areas: AI and analytics, simulation training, agency partnerships, GIS and decision-support tools, experiential learning, and ethics or policy instruction. Findings showed strong emphasis on experiential learning, internships, practitioner engagement, and agency partnerships. GIS and decision-support tools appeared in many curricula, although practical instruction varied. Explicit AI and advanced analytics instruction remained limited. UVU aligned with benchmark programs in leadership, planning, and policy education but showed opportunities to strengthen simulation training, applied technology integration, and AI literacy.

Keywords: *emergency management education, geographic information systems, artificial intelligence, experiential learning, emergency response training, technology integration*

Modern emergency management increasingly depends on digital technologies to analyze hazards, monitor disasters, and coordinate response activities. Emergency operations centers use geographic information systems (GIS), predictive analytics, digital dashboards, and emerging artificial intelligence (AI) tools to support situational awareness, resource allocation, and operational decision-making. As these tools become more central to disaster operations, emergency management professionals must interpret geospatial data, evaluate predictive information, and use technology-supported decision systems effectively.

A significant gap remains between emergency management education and practice. Many advanced systems used by government agencies and emergency operations centers are proprietary, expensive, or restricted within operational networks. As a result, universities often

lack direct access to the same tools students encounter in professional settings, limiting opportunities for hands-on learning and practical skill development.

Despite these challenges, emergency management programs must prepare students to understand how GIS, analytics, AI-assisted systems, and decision-support technologies function during disasters. Scenario-based exercises, real disaster data, demonstrations, and practitioner partnerships offer practical ways to approximate operational environments. This study examines how emergency management and homeland security programs incorporate these technology-related competencies and applied learning opportunities into their curricula.

LITERATURE REVIEW

This literature review examines how technological change is reshaping emergency management practice and education. It reviews the growing use of GIS, predictive analytics, digital dashboards, artificial intelligence, and related decision-support technologies in emergency operations. It then considers the competencies modern emergency managers need, the challenges universities face in keeping curricula aligned with professional practice, and the education-practice gap created by limited access to operational technologies. The review examines experiential learning, simulations, disaster datasets, and practitioner partnerships as strategies for bridging this gap. Finally, it identifies remaining gaps in the literature related to technology integration, AI literacy, and the need for comparative analysis across emergency management programs.

The Technology Revolution in Emergency Management

Emergency management increasingly depends on digital technologies to support situational awareness, resource allocation, and operational decision-making. Emergency operations centers and disaster-response organizations use geographic information systems, volunteered geographic information, predictive analytics, digital dashboards, artificial intelligence, and digital-twin technologies to analyze hazards, monitor incidents, visualize complex information, and coordinate resources (Haworth et al., 2018; Khorram-Manesh et al., 2025; Nadj et al., 2020; Rinaldi et al., 2025). These tools have moved emergency management beyond a primarily reactive model toward a more data-driven profession focused on anticipation, visualization, and proactive decision-making.

GIS platforms support spatial situational awareness by mapping hazards, identifying vulnerable populations, and informing evacuation and resource-planning decisions (Haworth et al., 2018). Predictive analytics and machine-learning models help emergency managers forecast hazard impacts, estimate infrastructure damage, and anticipate resource needs before incidents occur. Digital dashboards combine information from multiple sources into a common operating picture that supports faster and more informed decisions (Nadj et al., 2020). AI applications strengthen emergency operations through damage assessment, social media monitoring, resource optimization, and predictive modeling (Khorram-Manesh et al., 2025; Organisation for

Economic Co-operation and Development [OECD], 2023). As these technologies become more central to disaster management practice, emergency managers need competencies that extend beyond traditional response coordination.

Competencies Required of Modern Emergency Managers

The professionalization of emergency management has led to competency-based education frameworks that define the knowledge, skills, and abilities needed for effective practice. The Federal Emergency Management Agency (FEMA) Emergency Management Core Competencies identify 13 competencies for future emergency managers, including leadership, community engagement, governance, disaster risk management, scientific literacy, technological literacy, ethics, critical thinking, and continual learning. Developed through the FEMA-sponsored Next Generation Core Competencies project, the competencies are organized around three areas: the individual, the emergency management practitioner, and professional relationships (Feldmann-Jensen et al., 2019).

Modern emergency managers must understand more than emergency response principles. They need working knowledge of geospatial technologies, data analytics, information management, and technology-supported decision-making. These technical abilities complement traditional emergency management skills, including communication, leadership, interagency coordination, and community engagement (Feldmann-Jensen et al., 2019). As disaster operations become more technology-driven, educational programs must prepare graduates to work in environments where digital systems support nearly every stage of emergency management.

Educational Challenges in Emergency Management

Emergency management education has changed substantially over the past several decades. What began as a practice-oriented field rooted in civil defense and emergency response has become an academic discipline drawing on public administration, disaster science, policy analysis, and organizational management (Waugh & Sadiq, 2011).

Universities began creating dedicated emergency management programs during the 1980s and 1990s as disasters became more complex and interdisciplinary. FEMA's Higher Education Program, launched in 1994, helped accelerate this growth by supporting curriculum development and collaboration among practitioners and scholars (Waugh & Goss, 2019). Today, emergency management education includes certificate programs, undergraduate and graduate degrees, and doctoral study. These programs prepare professionals for leadership, planning, mitigation, response, recovery, and resilience-building roles. Historically, the professionalization of emergency management education relied heavily on a top-down framework shaped by FEMA's Higher Education Program (Waugh & Goss, 2019). However, recent institutional shifts have raised questions about this dependency. Montano et al. (2026) argue that changing federal priorities have created uncertainty but also provide an opportunity for the academic community to take greater responsibility for shaping the future of emergency management curricula and

professional standards. Despite these advances, emergency management programs face significant challenges in keeping pace with rapidly changing technology. University curricula often require lengthy review and approval processes, while technological innovation moves much faster. Faculty may also have limited access to emerging operational technologies, and universities often struggle to secure the funding needed to keep software, hardware, and instructional infrastructure current.

The Education-Practice Gap in Emergency Management

A significant gap remains between emergency management education and professional practice as the discipline continues to professionalize (Darlington, 2008). Public safety and emergency response agencies increasingly rely on advanced digital tools, including geographic information systems (GIS), predictive analytics, visual dashboards, and artificial intelligence-supported decision systems (Haworth et al., 2018; Nadj et al., 2020). However, many higher education programs lack direct access to the systems used in live operational environments.

Several factors contribute to this technological gap. First, advanced emergency management technologies require substantial investments in software licensing, specialized hardware, implementation, maintenance, and technical support. These costs often place professional-grade systems beyond the reach of many educational programs (Khorram-Manesh et al., 2025). Blaya and Otzoy (2019) similarly note that proprietary systems create long-term costs related to ownership, infrastructure management, and technical support that many academic programs cannot sustain.

Second, many operational systems run on secure, proprietary networks that educational institutions cannot access. Crisis-related data feeds and communication streams are often restricted to local, regional, or national government networks to protect sensitive information and maintain operational integrity. As a result, students rarely gain hands-on experience with the same platforms used by practicing emergency managers (Barr et al., 2010; Khorram-Manesh et al., 2025).

Third, limited access to operational technologies weakens experiential learning. Barr et al. (2010) identified persistent technical and cognitive skill gaps in the emergency response community, particularly in managing complex information under pressure. Without opportunities to use realistic decision-support technologies, students may graduate with strong theoretical knowledge but limited practical experience applying it in technology-rich settings.

Fourth, these gaps are compounded by instability in the emergency management academic workforce. Bridging theory and practice requires sustained curriculum development, infrastructure management, faculty research, and practitioner partnerships. However, Dadson and Bennett-Gayle (2026) identify a decline in full-time, tenure-track faculty positions, particularly at the assistant professor level, alongside increased reliance on part-time and adjunct instructors.

This shift threatens institutional memory, research capacity, and program stability. Because adjunct faculty are often not compensated or supported to redesign curricula, pursue technology grants, or manage software integrations, a shrinking group of tenure-track faculty must shoulder responsibility for closing the academic-practice gap. To address these limitations, emergency management educators increasingly use alternative pedagogical approaches. Functional exercises, scenario-based simulations, open-source disaster datasets, and practitioner partnerships can help universities approximate the uncertainty, incomplete information, time pressure, and multi-agency coordination that characterize operational emergency management environments (Federal Emergency Management Agency [FEMA], 2020; Khorram-Manesh et al., 2025; Knox & Harris, 2016).

Existing Solutions for Bridging the Education-Practice Gap

Universities have adopted several approaches to strengthen the connection between academic preparation and professional practice. Bergeron (2019) argues that as emergency management has become more professionalized, entry-level applicants are increasingly expected to have both academic preparation and practical experience. This expectation can disadvantage students and recent graduates who understand emergency management concepts but have limited opportunities to apply them in authentic settings. Experiential learning helps address this problem by connecting classroom knowledge with applied professional practice. For the present study, this supports examining whether university programs not only teach technology, artificial intelligence, and crisis decision-making, but also provide structured opportunities for students to practice these competencies through simulations, exercises, field experiences, applied projects, or other experiential methods.

Experiential learning has become central to emergency management education. Kolb's framework emphasizes learning through experience, reflection, conceptualization, and experimentation (Fisher et al., 2014; Kolb, 1984). Emergency management programs increasingly use tabletop exercises, functional exercises, and full-scale simulations to help students practice decision-making, communication, and coordination under realistic conditions.

Knox et al. (2026) show that tabletop exercises can help emergency management students practice ethical decision-making, collaboration, and higher-order thinking under uncertainty. Although their study does not focus specifically on advanced technologies, it supports experiential learning models that approximate the complexity of emergency management practice. For programs with limited access to costly simulation systems, AI platforms, or operational technologies, tabletop exercises can provide a practical bridge between classroom learning and field-based decision environments.

Scenario-based exercises and demonstrations replicate the uncertainty and complexity of disaster operations by placing students in simulated emergency environments. These activities promote

critical thinking, adaptive leadership, and rapid decision-making while exposing students to emergency operations center coordination challenges (Curnin & Owen, 2014).

Meng and Ritchie's (2026) case-study approach also shows how partnerships between universities and local emergency management agencies can help close the education-practice gap. Their model gives students applied exposure to preparedness training, emergency services competencies, and technology-supported response activities, including drone-assisted search and rescue. This approach is especially relevant for programs that lack direct access to advanced technologies but can use practitioner partnerships to connect students with current field practices.

Emergency management programs can also incorporate real disaster data into coursework. Historical disaster datasets, GIS and geospatial analysis, crisis informatics data, and post-incident reports allow students to analyze realistic hazard and disaster information. These resources help students develop geographic and analytical literacy and gain practical experience with emergency management tools without relying exclusively on proprietary systems (Leidig & Teeuw, 2015; Siebeneck et al., 2019).

Partnerships with emergency management agencies provide another important pathway for applied learning. Internships, field experiences, guest lectures, joint exercises, and collaborative research projects connect students with practitioners and expose them to current operational practices (Knox et al., 2021). These partnerships also support networking and workforce development.

Knox and Harris (2016) provide an early example of how emergency management higher education can bridge classroom learning and professional practice through sustained experiential partnerships. Their study describes a university-local emergency management partnership in which a functional exercise was integrated into an undergraduate course. This model matters because many programs lack the resources to provide advanced simulations, operational technologies, or field-based training environments. Local agency partnerships can expose students to real-world emergency management processes, professional expectations, and technology-supported decision-making contexts. However, Knox and Harris (2016) also highlight barriers such as limited time and resources, suggesting that experiential and technology-integrated learning require intentional curriculum design rather than occasional applied activities.

Remaining Gaps in the Literature

Although the literature supports experiential learning and practitioner partnerships, several gaps remain. Most studies emphasize traditional emergency management competencies, such as leadership, communication, coordination, and collaboration, rather than technology-focused competencies. Less attention has been given to how emergency management programs

incorporate GIS, predictive analytics, artificial intelligence, and decision-support technologies into their curricula.

Research also remains limited on how much programs provide technology-related experiential learning opportunities. Few studies evaluate which instructional approaches are most effective for teaching emerging technologies in emergency management education. The rapid development of AI has further outpaced curriculum research, creating uncertainty about how programs are preparing students for AI-supported disaster operations.

Finally, relatively few studies systematically compare university emergency management programs to determine how technology integration varies across institutions or how closely curricula align with changing workforce needs.

PROBLEM STATEMENT

Emergency management practice increasingly depends on technologies such as GIS, predictive analytics, decision-support platforms, and AI. These tools support hazard prediction, situational awareness, resource allocation, and disaster response coordination. As emergency operations become more technology-driven, future emergency managers must be prepared to interpret data and use technology-supported decision-making processes.

Although emergency management education has expanded significantly, it remains unclear how consistently academic programs incorporate AI, analytics, GIS, simulations, and other emerging technologies into their curricula. Existing programs often emphasize leadership, planning, and interagency coordination, but less is known about how they develop technology-related competencies or provide applied learning opportunities connected to current professional practice.

This study addresses that gap by examining selected emergency management and homeland security programs across six areas: AI, analytics, and data science coursework; simulation and scenario-based learning; agency partnerships; GIS, predictive analytics, and decision-support tools; experiential learning opportunities; and ethical or policy discussions related to technology use. The study also compares these findings with the Emergency Management program at Utah Valley University to identify similarities, differences, and opportunities for curriculum development. This approach offers a possible framework for evaluating individual programs, supporting curriculum improvement, and aligning emergency management education with evolving workforce needs.

Study Questions

RQ1. How do selected university emergency management programs incorporate technology-related competencies, including GIS, data analytics, and decision-support tools, into their curricula?

RQ2. To what extent do emergency management programs include instruction related to artificial intelligence or advanced analytics in disaster management education?

RQ3. What types of experiential learning activities, such as simulations, exercises, internships, or field placements, are used in emergency management programs?

RQ4. How do emergency management programs collaborate with government agencies or practitioner organizations to provide applied learning opportunities for students?

RQ5. How does the Emergency Management program at Utah Valley University compare with benchmark programs in terms of technology integration, experiential learning, and practitioner collaboration?

METHODOLOGY

This study examined ten benchmark emergency management and homeland security programs and compared them with the Utah Valley University Emergency Management program. The purpose was to identify trends in technology integration, experiential learning, and professional preparation within emergency management education.

The study used criterion-based purposive sampling. The ten benchmark programs were selected because they represented visible, established, or information-rich emergency management or homeland security programs. Researchers, assisted by AI tools (OpenAI, 2026), reviewed FEMA Higher Education Program listings, national rankings, professional association directories, and institutional program descriptions. Programs were selected if they: (a) offered emergency management or homeland security degrees or certificates; (b) demonstrated national visibility through research, professional recognition, or field relevance; and (c) provided sufficient public curriculum information for analysis. The sample included both research universities and teaching-focused institutions.

Data Collection and Verification

Data were collected from publicly available sources, including university program websites, course catalogs, available syllabi, faculty profiles, internship descriptions, and information about agency partnerships. Generative AI was used as a research assistance tool to help identify relevant program information, organize findings, and locate references to technology-related

courses, experiential learning opportunities, AI, GIS, data analytics, simulations, internships, and practitioner partnerships.

AI supported the search, organization, and preliminary summarization of public information, but it did not replace researcher judgment. Researchers reviewed the AI-assisted summaries against institutional sources and conducted manual spot checks of university websites, course catalogs, and program pages to confirm that the findings were supported by publicly available information. No discrepancies were identified during the verification process. The researchers assigned final ratings after reviewing both the AI-assisted summaries and the supporting institutional materials.

Variables and Analysis

The study examined six variables: (1) AI and analytics instruction, (2) simulation-based training, (3) agency partnerships, (4) GIS and decision-support tools, (5) experiential learning, and (6) ethics or policy discussions related to technology.

A standardized three-step analytical process was used. First, researchers conducted document analysis of public curriculum materials and program descriptions. The same search categories, variables, and rating criteria were applied to each benchmark program and to UVU to support consistent cross-program comparison.

Second, programs were evaluated using a five-point rating scale based on the strength of publicly available evidence for each variable. A score of 1 indicated limited evidence, meaning the variable was minimal, isolated, or unclear. A score of 2 indicated limited to moderate evidence, meaning the variable appeared occasionally but was often implied or inconsistently addressed. A score of 3 indicated moderate evidence, meaning the variable was recognizable, recurring, and reasonably developed within curriculum or program materials. A score of 4 indicated moderate to strong evidence, meaning the variable was substantial, structured, and integrated across multiple parts of the program. A score of 5 indicated strong evidence, meaning the variable was extensive, visible, and clearly emphasized as part of professional preparation.

Third, researchers compared programs across the six variables to identify patterns in technology integration, GIS and analytics instruction, simulations, experiential learning, AI literacy, agency partnerships, and ethics or policy instruction. Because the study relied on ordinal ratings derived from public documents, analysis emphasized descriptive comparisons, including means, totals, standard deviations, and rank ordering.

Findings should be interpreted as exploratory rather than statistically generalizable. Ratings reflect evidence available in public documents and should not be interpreted as a complete measure of all instruction, informal learning, or internal program activity occurring within each program.

FINDINGS

This section summarizes findings from the comparative review of ten emergency management and homeland security programs and the Utah Valley University (UVU) Emergency Management program. Overall, most programs emphasized experiential learning, practitioner engagement, and operational preparation. Agency partnerships and internships were common strengths across institutions. GIS and decision-support technologies appeared in many curricula, although the depth of instruction varied considerably. In contrast, formal instruction related to artificial intelligence and advanced analytics remained limited across most programs.

Table 1 presents the comparative ratings and total scores of the selected emergency management programs across the six study variables. Scores ranged from 1 (Limited) to 5 (Strong), and total scores were calculated by summing each institution's ratings across all variables.

The results show that the Naval Postgraduate School, SUNY Albany, and Arizona State University demonstrated the strongest overall integration of technology instruction, experiential learning, and professional partnerships. Higher-ranked programs generally combined practitioner collaboration with simulations, internships, GIS or decision-support instruction, and visible technology integration. Across institutions, AI instruction was rarely presented as a dedicated area of study and was more often embedded indirectly within broader coursework.

Table 2 presents the overall statistical comparison of the university programs, including total score, mean score, standard deviation, and rank. These results show how programs varied in their overall integration of technology, experiential learning, simulations, agency partnerships, GIS and decision tools, AI and analytics, and ethics or policy instruction.

The total and mean scores indicate each program's overall level of integration, while the rank order shows how each institution compared with the others. The Naval Postgraduate School, SUNY Albany, and Arizona State received the highest overall scores, indicating stronger and more comprehensive integration across the six variables. Utah Valley University received a total score of 15 and a mean score of 2.50, tying for ninth among the programs reviewed.

Standard deviation values provide insight into program balance. Lower standard deviations suggest more consistent integration across the six variables, while higher values indicate uneven emphasis across areas such as technology instruction, experiential learning, partnerships, and policy education.

Table 1. Program Ratings Across Six Study Variables

University	AI/A	Sim/Scen	Agency	GIS/DT	Exp. Learn	Ethics/Policy	Total
Naval Postgraduate	4	5	5	3	5	5	27
SUNY Albany	4	3	5	5	5	4	26
Arizona State	3	3	5	5	5	4	25
John Jay	3	3	5	3	5	5	24
UCF	3	3	5	4	5	3	23
North Texas	3	3	5	4	5	3	23
Alaska Fairbanks	2	3	5	4	5	3	22
George Mason	2	3	5	1	3	5	19
Columbia College	1	3	3	2	3	3	15
Drury	1	3	3	2	3	3	15
Utah Valley Univ.	2	1	3	3	3	3	15

Table 2. Overall Program Scores, Variation, and Rank Order

University	Total	Mean	Std. Dev.	Rank
Naval Postgraduate School	27	4.50	0.84	1
SUNY Albany	26	4.33	0.82	2
Arizona State	25	4.17	0.98	3
John Jay	24	4.00	1.10	4
North Texas	23	3.83	0.98	5
UCF	23	3.83	0.98	5
Alaska Fairbanks	22	3.67	1.21	7
George Mason	19	3.17	1.60	8
Columbia College	15	2.50	0.84	9
Drury	15	2.50	0.84	9
Utah Valley Univ.	15	2.50	0.84	9

Table 3 presents descriptive statistics by variable across all institutions. This table shifts the analysis from program-level comparison to variable-level comparison by showing which areas of emergency management education were most strongly developed and which remained less developed.

Agency partnerships and experiential learning received the highest mean scores, indicating that most programs strongly emphasized internships, practitioner engagement, applied projects, field experiences, or other forms of professional exposure. Ethics and policy instruction also appeared moderately strong across programs.

AI and analytics received the lowest mean score, suggesting that formal instruction in artificial intelligence, machine learning, predictive analytics, and related technologies remains limited. GIS and decision tools had a moderate mean score but the highest standard deviation, showing that GIS integration varied considerably across institutions. Overall, Table 3 supports one of the central findings of the study: Emergency management programs have widely adopted experiential learning and practitioner collaboration, while advanced analytical technologies remain unevenly integrated and still developing.

Table 3. Descriptive Statistics by Variable

Variable	Mean	Std. Dev.	Interpretation
AI / Analytics	2.55	1.04	AI instruction remained relatively limited overall
Simulation Training	3.00	0.89	Simulation use was moderate across programs
Agency Partnerships	4.45	0.93	Strong agency collaboration was common
GIS / Decision Tools	3.27	1.27	GIS integration varied considerably
Experiential Learning	4.27	1.01	Experiential learning was strongly emphasized
Ethics / Policy	3.73	0.90	Ethics and policy instruction appeared moderately strong

Utah Valley University Compared to Benchmark Emergency Management Programs

Table 4 compares Utah Valley University's results across the six study variables with the benchmark established from the combined results of the other ten university programs. The benchmark scores represent the average level of integration among the comparison programs, while the UVU scores show how UVU performed using the same five-point rating scale.

UVU scored below the benchmark average in most areas. The largest difference appeared in simulation training, where benchmark programs demonstrated moderate-to-strong integration, and UVU showed limited evidence of structured simulation-based instruction. UVU also scored lower in agency partnerships and experiential learning, both of which were strong among benchmark programs but moderate at UVU.

UVU was closer to the benchmark in GIS and decision tools, where UVU showed moderate integration compared with the benchmark's moderate to strong score. UVU also showed moderate evidence in ethics and policy, although benchmark programs scored somewhat higher. AI and analytics remained limited to moderate at UVU, compared with moderate integration across the benchmark programs.

Overall, the benchmark programs had a mean score of 3.61 across the six variables, compared with UVU's mean score of 2.50. This placed UVU in a tie for ninth among the programs reviewed. These findings suggest that UVU has a foundation for technology-related emergency management education, but additional curriculum development may be needed in simulation

training, GIS application, experiential learning, practitioner engagement, and AI-supported emergency management preparation.

Table 4. Benchmark Comparison Between Top Ten Programs and Utah Valley University

Comparison Area	Benchmark	UVU	Interpretation
AI / Analytics	3.0	2.0	Benchmark programs showed moderate integration; UVU showed limited–moderate integration.
Simulation Training	4.0	1.0	Benchmark programs showed moderate–strong integration; UVU showed limited integration.
Agency Partnerships	5.0	3.0	Benchmark programs showed strong integration; UVU showed moderate integration.
GIS / Decision Tools	4.0	3.0	Benchmark programs showed moderate–strong integration; UVU showed moderate integration.
Experiential Learning	5.0	3.0	Benchmark programs showed strong integration; UVU showed moderate integration.
Ethics / Policy	4.0	3.0	Benchmark programs showed moderate–strong integration; UVU showed moderate integration.
Overall Mean Score	**3.61**	**2.5**	Benchmark programs showed stronger overall integration across the comparison areas.

Note. Scores are based on a five-point scale: 1 = Limited, 2 = Limited–Moderate, 3 = Moderate, 4 = Moderate–Strong, and 5 = Strong.

The UVU Emergency Management program aligned with benchmark institutions in leadership, planning, policy, and moderate experiential learning opportunities. However, the benchmark institutions more frequently incorporated simulations, operational exercises, and hands-on GIS instruction directly into coursework. UVU addressed many of these topics conceptually within online instruction but offered fewer opportunities for operational technology application within the curriculum itself.

Overall, the findings suggest that emergency management education strongly emphasizes applied learning, operational coordination, and practitioner collaboration. Technology integration continues to expand, particularly in GIS and decision-support concepts, but formal AI and advanced analytics instruction remains limited and uneven across programs. The results also identify opportunities for future curriculum development related to simulations, GIS applications, technology literacy, and AI-supported decision-making.

DISCUSSION

This study examined how selected university emergency management and homeland security programs integrate technology, artificial intelligence, analytics, experiential learning, and practitioner collaboration into their curricula. It identified a growing concern: Emergency management practice increasingly depends on GIS, predictive analytics, decision-support platforms, dashboards, and AI-supported tools, yet it remains unclear how fully university programs are preparing students for these technology-rich professional environments. The findings addressed this problem by showing that emergency management education has made substantial progress in experiential learning, agency collaboration, and applied professional preparation, but integration of AI, advanced analytics, and technology-supported decision-making remains uneven across programs.

The findings aligned with the literature reviewed earlier in the study. Emergency management education has evolved from operational training toward a broader academic discipline that emphasizes leadership, planning, technology, policy, and interagency coordination (Waugh & Goss, 2019; Waugh & Sadiq, 2011). Most benchmark programs reflected these priorities through experiential learning, practitioner partnerships, disaster planning activities, and applied coursework. These findings also supported research identifying collaboration, professional preparation, and applied learning as core elements of emergency management education (Bergeron, 2019; Knox & Harris, 2016; Waugh & Goss, 2019).

The first research question asked how selected university emergency management programs incorporate technology-related competencies, including GIS, data analytics, and decision-support tools, into their curricula. The findings showed that most programs included some level of technology integration, especially through GIS, hazard analysis, planning, mitigation, and decision-support concepts. Several universities offered dedicated GIS instruction or embedded geospatial analysis within broader emergency management coursework. These findings reflected the increasing reliance on digital situational awareness, geospatial tools, technological literacy, and data-supported decision-making in emergency operations (Feldmann-Jensen et al., 2019; Haworth et al., 2018; Nadj et al., 2020). However, the depth of technology integration varied considerably across institutions. Some programs treated technology as a central part of professional preparation, while others addressed it only indirectly.

The second research question asked the extent to which programs include instruction related to AI or advanced analytics in disaster management education. This was one of the clearest gaps identified in the study. Few programs offered explicit instruction in AI, machine learning, or advanced analytics. Most addressed analytics indirectly through planning, GIS, information systems, or hazard analysis courses. This finding supported the research gap identified in the literature review regarding limited preparation for emerging technologies in emergency management education (Khorram-Manesh et al., 2025; OECD, 2023; Rinaldi et al., 2025). The findings suggest that AI literacy remains underdeveloped in many emergency management programs, even though AI-supported systems are increasingly used for damage assessment,

predictive modeling, resource allocation, social media monitoring, and operational decision-making.

The third research question asked what types of experiential learning activities are used in emergency management programs. The findings showed that experiential learning was one of the strongest areas across the benchmark programs. Many programs used internships, simulations, applied projects, field experiences, tabletop exercises, scenario-based assignments, and operational exercises to connect classroom learning with professional practice. This finding aligned with the literature emphasizing experiential learning as a way to bridge the education-practice gap (Bergeron, 2019; Fisher et al., 2014; Knox & Harris, 2016; Kolb, 1984). Experiential learning was especially important because students need opportunities to apply emergency management concepts under realistic conditions involving uncertainty, time pressure, incomplete information, and multi-agency coordination.

The fourth research question asked how emergency management programs collaborate with government agencies or practitioner organizations to provide applied learning opportunities. The findings showed that agency partnerships were the strongest overall variable across the programs reviewed. Many benchmark programs demonstrated partnerships with emergency management agencies, homeland security organizations, public safety agencies, or related practitioner groups. These partnerships supported internships, guest lectures, exercises, field-based projects, applied research, and professional networking. This finding aligned with prior research showing that practitioner partnerships can strengthen emergency management education by connecting students to current operational practices and workforce expectations (Knox et al., 2021; Knox & Harris, 2016; Waugh & Goss, 2019).

The fifth research question asked how the Utah Valley University Emergency Management program compares with benchmark programs in technology integration, experiential learning, and practitioner collaboration. The findings showed that UVU reflected many national patterns but scored below the benchmark average overall. UVU aligned with benchmark institutions in leadership, planning, policy, and risk analysis, which matched competencies identified in the literature (Feldmann-Jensen et al., 2019; Waugh & Sadiq, 2011). Its online format also increased accessibility for working professionals. However, simulations, GIS applications, and operational technology instruction appeared less integrated within the curriculum than in higher-ranked benchmark programs. AI instruction also remained limited, reflecting the broader national pattern identified in this study and in the literature on technology gaps in emergency management education (Khorram-Manesh et al., 2025; OECD, 2023; Rinaldi et al., 2025).

The findings also highlighted limited discussion of AI ethics. Most programs addressed leadership, public accountability, and ethical decision-making in general terms, but few specifically examined algorithmic bias, data privacy, transparency, explainability, or the risks associated with automated decision-support systems. This gap is important because AI-supported systems can process large volumes of information quickly, identify emerging patterns, and

support faster decisions during complex incidents. However, these systems may also reproduce bias, rely on incomplete or low-quality data, or produce recommendations that are difficult for practitioners to evaluate. Researchers have therefore emphasized the need for human oversight, ethical safeguards, transparency, and clear accountability in AI-supported disaster management (Khorram-Manesh et al., 2025; OECD, 2023; Rinaldi et al., 2025). The limited attention given to these issues suggests that emergency management programs may need to more directly prepare students to evaluate, question, and responsibly use AI tools in operational settings.

Taken together, the findings answer the central problem addressed in this study. Emergency management programs are not ignoring technology, but technology integration remains inconsistent. Programs have generally been more successful in adopting experiential learning, practitioner partnerships, and applied emergency management activities than in integrating AI, analytics, simulation-based technology, and advanced decision-support tools. This pattern suggests that the education-practice gap is not simply a lack of professional preparation. Rather, it is a specific gap between traditional emergency management education and the emerging technological demands of modern emergency operations.

These findings suggest several implications for emergency management education. Programs should strengthen technology literacy, GIS exposure, and analytical decision-making. Students do not necessarily need advanced programming skills, but they should understand how digital dashboards, predictive analytics, GIS platforms, and AI-assisted systems function in emergency operations (Feldmann-Jensen et al., 2019; Haworth et al., 2018; Nadj et al., 2020; OECD, 2023). Experiential learning should also remain central because simulations, internships, applied projects, and practitioner partnerships help bridge theory and practice, consistent with experiential learning theory and emergency management education research (Bergeron, 2019; Fisher et al., 2014; Knox & Harris, 2016; Kolb, 1984).

The findings also support expanding ethics instruction related to technology. Future emergency managers will increasingly work with automated systems for hazard prediction, logistics, situational awareness, and resource allocation. Programs should therefore address transparency, bias, human oversight, data privacy, explainability, and responsible technology use (Khorram-Manesh et al., 2025; OECD, 2023; Rinaldi et al., 2025).

For UVU, the findings suggest opportunities to expand GIS instruction, simulations, internships, interdisciplinary exercises, and introductory AI literacy within existing coursework. Low-cost approaches could include publicly available disaster datasets, mapping platforms, tabletop exercises, scenario-based assignments, and case studies focused on data-supported decision-making and technology ethics (FEMA, 2020; Leidig & Teeuw, 2015; Siebeneck et al., 2019). These approaches would allow UVU to strengthen technology-related competencies without requiring immediate access to expensive proprietary platforms.

Overall, emergency management education continues to move toward greater integration of technology, analytics, and applied learning. However, implementation remains uneven across institutions. Programs that combine leadership education, experiential learning, practitioner collaboration, technology literacy, and ethical AI preparation will likely be better positioned to prepare future emergency managers for increasingly data-driven disaster environments (Feldmann-Jensen et al., 2019; Knox et al., 2021; Waugh & Goss, 2019). The study therefore contributes to the literature by showing where emergency management programs appear to be aligned with professional practice and where additional curriculum development is needed.

CONCLUSION

This study examined how selected emergency management and homeland security programs incorporate technology, experiential learning, and practitioner collaboration into their curricula. The findings showed that most programs emphasized experiential learning, agency partnerships, leadership development, planning, and operational coordination. GIS and decision-support concepts appeared in many curricula, reflecting the growing role of technology in disaster management practice. However, formal instruction in artificial intelligence, advanced analytics, and AI-supported decision-making remained limited across most programs.

The findings also showed that technology integration remains uneven. Many programs appear constrained by limited access to proprietary systems, software costs, rapidly changing technologies, and varying levels of faculty expertise. As a result, some programs emphasize conceptual knowledge rather than direct operational application. Even so, the benchmark programs demonstrated that simulations, internships, GIS instruction, practitioner partnerships, and applied projects can help bridge the gap between academic preparation and professional practice.

The Utah Valley University Emergency Management program aligned with benchmark programs in several foundational areas, including leadership, planning, policy, and risk analysis. The comparison also identified opportunities for UVU to strengthen simulation-based learning, GIS exposure, interdisciplinary exercises, practitioner engagement, and introductory AI literacy.
This study has several limitations. The analysis relied on publicly available curriculum materials, which may not fully capture classroom instruction, informal learning, faculty practices, or internal program activities. The study also used researcher-assigned ratings and a relatively small sample of institutions. Therefore, the findings should be interpreted as exploratory and comparative rather than statistically generalizable.

Future research should expand the number of institutions studied and include interviews with faculty, students, practitioners, employers, and program administrators. Additional studies should also examine student learning outcomes related to technology literacy, GIS competencies, simulation-based decision-making, and AI-supported emergency management practice.

Overall, the study suggests that emergency management education is moving toward greater integration of technology, analytics, and applied learning, but implementation remains uneven. The comparative framework used in this study provides a useful approach for evaluating individual emergency management programs, identifying curriculum gaps, benchmarking against peer institutions, and guiding program improvement. Programs that combine experiential learning, practitioner collaboration, leadership development, technology literacy, and ethical AI preparation will be better positioned to prepare future emergency managers for increasingly complex and data-driven disaster environments.

REFERENCES

Barr, J. L., Burtner, E. R., Pike, W. A., Peddicord, A. M. B., & Minsk, B. S. (2010). *Gap assessment in the emergency response community* (PNNL-19782). Pacific Northwest National Laboratory. https://doi.org/10.2172/993345

Bergeron, W. P. (2019). Building the bridge between education and experience: The case for experiential learning in emergency management education. *Journal of Emergency Management, 17*(3), 177–179. https://doi.org/10.5055/jem.2019.0416

Blaya, J., & Otzoy, D. (2019). *Buy, build, or adapt: How to decide? A guide to electronic health records (EHRs).* Inter-American Development Bank. https://doi.org/10.18235/0001773

Curnin, S., & Owen, C. (2014). Spanning organizational boundaries in emergency management. *International Journal of Public Administration, 37*(5), 259–270. https://doi.org/10.1080/01900692.2013.830625

Dadson, Y. A., & Bennett-Gayle, D. (2026). State of the emergency management academic programs: 5-year longitudinal trend analysis (2019–2023). *Journal of Emergency Management, 24*(3). https://doi.org/10.5055/jem.0948

Darlington, J. D. (2008). *The profession of emergency management: Educational opportunities and gaps*. Defense Technical Information Center. https://apps.dtic.mil/sti/tr/pdf/ADA483900.pdf

Federal Emergency Management Agency. (2020). *Homeland Security exercise and evaluation program doctrine*. U.S. Department of Homeland Security. https://www.fema.gov/sites/default/files/2020-04/Homeland-Security-Exercise-and-Evaluation-Program-Doctrine-2020-Revision-2-2-25.pdf

Feldmann-Jensen, S., Jensen, S. J., Smith, S. M., & Vigneaux, G. (2019). The next generation core competencies for emergency management. *Journal of Emergency Management, 17*(1), 17–25. https://doi.org/10.5055/jem.2019.0393

Fisher, J. R., Means, L., & Corson, M. (2014). Engaging students in disaster relief training exercises. *Journal of Applied Learning in Higher Education, 6*, 61–87. https://doi.org/10.57186/jalhe_2014_v6a3p61-87

Haworth, B. T., Bruce, E., Whittaker, J., & Read, R. (2018). The good, the bad, and the uncertain: Contributions of volunteered geographic information to community disaster resilience. *Frontiers in Earth Science, 6*, Article 183. https://doi.org/10.3389/feart.2018.00183

Khorram-Manesh, A., Johannessen, M. R., Nielsen, L. R., , E., Berntzen, L., Sandberg, L., & Sørensen, J. L. (2025). Cultivating disaster preparedness: Scoping review of technology's contribution to situational awareness and disaster mindset in disaster medicine. *Online Journal of Public Health Informatics, 17*, Article e75404. https://doi.org/10.2196/75404

Knox, C. C., & Harris, A. S. (2016). Evolution of an experiential learning partnership in emergency management higher education. *Journal of Emergency Management, 14*(3), 201–211. https://doi.org/10.5055/jem.2016.0286

Knox, C. C., Classen, J., Sharif, M. N., & Lerner, S. (2026). Wrestling with ethical dilemmas: A study of instructional design and tabletop exercises. *Journal of Emergency Management, 24*(3). https://doi.org/10.5055/jem.0931

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice-Hall.

Leidig, M., & Teeuw, R. M. (2015). Free software: A review, in the context of disaster management. *International Journal of Applied Earth Observation and Geoinformation, 42*, 49–56. https://doi.org/10.1016/j.jag.2015.05.012

Meng, Q. J., & Ritchie, M. A. (2026). Case studies in disaster management education: Bridging higher education and local practice. *Journal of Emergency Management, 24*(2), 223–228. https://doi.org/10.5055/jem.0987

Montano, S., Hackerott, C. S., McEntire, D. A., Cooper, T. D., Willett, S., Stacy, J., & McAleavy, T. (2026). The future of emergency management higher education. *Journal of Emergency Management, 24*(3), 277–287. https://doi.org/10.5055/jem.1027

Nadj, M., Maedche, A., & Schieder, C. (2020). The effect of interactive analytical dashboard features on situation awareness and task performance. *Decision Support Systems, 135*, Article 113322. https://doi.org/10.1016/j.dss.2020.113322

OpenAI. (2026). *ChatGPT* [Large language model]. https://chat.openai.com/

Organisation for Economic Co-operation and Development. (2023). *Artificial intelligence in science: Challenges, opportunities and the future of research*. OECD Publishing. https://doi.org/10.1787/a8d820bd-en

Rinaldi, M., Caterino, M., Riemma, S., Macchiaroli, R., & Fera, M. (2025). Emergency supply chain resilience enhanced through blockchain and digital twin technology. *Logistics,9*(1), Article 43. https://doi.org/10.3390/logistics9010043

Siebeneck, L. K., Schumann, R. L., & Kuenanz, B. (2019). GIS applications in emergency management: Infusing geographic literacy in the classroom. *Journal of Emergency Management, 17*(2), 119–135. https://doi.org/10.5055/jem.2019.0404

Waugh, W. L., Jr., & Goss, K. C. (2019). The history of higher education in emergency management: The Emergency Management Institute, the National Science Foundation, and the William Averette Anderson Fund. *Journal of Emergency Management, 17*(1), 7–12. https://doi.org/10.5055/jem.2019.0391

Waugh, W. L., Jr., & Sadiq, A. A. (2011). Professional education for emergency managers. *Journal of Homeland Security and Emergency Management, 8*(2), Article 9. https://doi.org/10.2202/1547-7355.1891