2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC

Host Sponsor UNC Charlotte

ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

Paper ID #50093

Embedding Credentials in Computer Science Curricula: Challenges, Methodologies, and Opportunities

Prof. Mehdi Mekni

Dr. Mehdi Mekni is a seasoned academic and technology leader whose career bridges rigorous scholarship and high-impact industry innovation. He began his academic journey at the University of Tunis, earning a degree in Computer Engineering (1995–2000), and later pursued advanced studies at Laval University in Québec, Canada, where he completed both his MSc (2006) and Ph.D. (2010) in Computer Science and Software Engineering. His postdoctoral research at INRS (2010–2012) focused on cutting-edge applications of intelligent systems and immersive technologies.

Dr. Mekni transitioned seamlessly into industry, holding senior R&D and management roles at global tech firms including Vermeg, Ubisoft, and Fujitsu. His portfolio spans enterprise software development, game design, and extended reality (XR), with a strong emphasis on innovation, team leadership, and strategic transformation.

Currently based in Connecticut, Dr. Mekni serves as a professor and program director, where he leads curriculum design and workforce-aligned initiatives in game development, applied AI, and immersive computing. He is a passionate advocate for embedding industry-recognized credentials into computer science education, preparing students for emerging roles in XR, simulation, and interactive environments.

His professional career includes further highlights as a professor of computer science and game development at the University of Minnesota and later at St. Cloud State University serving as the director of the BS in software engineering and the Professional Science Master of Software Engineering (2015-2020). His main research interests include game development, mixed reality, and the application of AI techniques to software development.

Kaitlin Iris Singer
Candace Williams

Embedding Industry Recognized Credentials in Curricula to Catapult Connecticut Workforce in Game Design and Development

Mehdi Mekni[1], Kaitlin I. Singer[2], Candace Williams[3]
[1]Connecticut Institute of Technology
University *of* New Haven
West Haven, CT 06516
{mmekni}@newhaven.edu
[2]Department of Elementary & Secondary Education
Commonwealth of Massachusetts
{katie.singer}@mass.gov
[3]Business-Higher Education Forum
{candace.williams}@bhef.com.org

Abstract

The rapid pace of technological change has pushed higher education to adapt more quickly, particularly in fields tied to innovation and digital production. Connecticut has responded by leveraging its education ecosystem to strengthen its talent pipeline, with the The Connecticut Higher Education Tech Talent Accelerator (TTA) initiative designed to expand access to emerging credentials through industry partnerships and applied learning. Despite growing interest in Industry-Recognized Credentials (IRCs), institutions lack clear, replicable models for embedding them into academic programs. To address this gap, our project integrates Unity Technologies' credentials into the Bachelor of Science in Computer Science with Game Design and Development concentration (BSCS-G2D) program at The University *of* New Haven (UNewHaven). The initiative aims to establish a practical methodology for curriculum integration, identify implementation challenges, evaluate the role of industry collaboration, and support a sustainable workforce

development strategy for Connecticut's game development sector.

1 Introduction

The landscape of higher education is shifting rapidly, especially in technology-driven fields[17,18,4]. To remain competitive, Connecticut has mobilized its full postsecondary ecosystem—including community colleges and four-year institutions—to expand the state's tech talent pipeline[15]. Each sector contributes to preparing graduates and supporting the reskilling of incumbent workers[5]. Through coordinated employer partnerships and regional sector initiatives, the state is advancing programs that align academic offerings with emerging credential and workforce needs.

This project focuses on strengthening pathways into technology fields within Connecticut's higher education system, with a particular emphasis on game design and development. Its objectives are to develop a practical methodology for integrating Industry-Recognized Credentials (IRCs) into curricula, identify implementation challenges, examine the effects of credential integration, assess the role of industry collaboration, and determine the conditions necessary for a sustainable workforce development strategy.

To study our approach, we selected our BSCS-G2D program at UNewHaven to integrate IRCs provided by Unity Technologies. Unity, the leading platform for Real-Time 3D (RT3D) creation, is crucial for upskilling the workforce to meet the demands of the rapidly evolving immersive economy, driven by technologies like Augmented Reality (AR) and Virtual Reality (VR). The growth of RT3D technology is transforming diverse industries including architecture, automotive, healthcare, and film, creating a significant demand for skilled professionals. This demand is growing 601% faster than the overall labor market and offers a 57% salary premium. Unity's partnership with UNewHaven aims to bridge the digital skills gap by providing cutting-edge training and certification, thereby enhancing job opportunities and economic growth.

The remainder of the paper is organized as follows: Section 2 elicits the research questions associated with our project. In addition, Section 3 provides an overview of workforce development in Connecticut. Sections 3 and 4 provide an overview of the workforce development in Connecticut and a summary of the TTA program. Moreover, Section 5 presents the structure and the curriculum design of the BSCS-G2D. Section 6 details the proposed methodology for IRCs integration in curricula for workforce development. Finally, Section 7 outlines the implementation results of the proposed project and Section 8 discusses its limitations, and concludes with future work.

2 Research Questions and Objectives

The research questions guiding this study focus on understanding how IRCs can strengthen tech talent development in Connecticut, particularly in game design and development.

First, the study examines the challenges and opportunities higher education institutions face when preparing students for technology careers. This includes identifying barriers to skill development and opportunities to improve curriculum alignment.

Second, the research investigates the impact of integrating game development practices and real-world competencies into academic programs. This question explores how credential-based learning influences student skill acquisition and career readiness.

Third, the study considers the role of industry collaboration. It evaluates how partnerships with game studios, technology firms, and related employers support curriculum design and enhance pathways from education to employment.

Finally, the research seeks to outline the elements of an effective workforce development strategy tailored to Connecticut's needs. This includes considerations of curriculum design, faculty preparation, resource allocation, and sustained industry engagement.

Together, these questions frame a comprehensive inquiry into how credential integration, industry partnerships, and strategic planning can strengthen the state's capacity to develop a competitive, industry-aligned tech workforce.

3 Workforce Development in Connecticut

Connecticut's workforce development efforts aim to close the gap between industry needs and available skills, particularly in fast-moving technology fields. Key sectors—from advanced manufacturing to financial services—depend on workers with competencies in areas such as data analytics, cybersecurity, and software engineering. Yet the state continues to face a shortage of tech talent, limiting growth and innovation. Through targeted investments in education, training, and employer partnerships, Connecticut is working to build a stronger pipeline of technology professionals who can support both individual career advancement and the state's long-term economic competitiveness.

Figure 1 presents a comparative analysis of per capita production of tech talent-related degrees in Connecticut versus neighboring states. The data reveals that Connecticut generally lags behind its neighbors in this area, with only two exceptions: engineering

associate degrees and bachelor's and associate degrees in health professions. In these categories, Connecticut matches or exceeds the degree production of nearby states. This disparity highlights a potential gap in the state's ability to produce a sufficient number of tech professionals, which could impact its competitiveness in the tech industry.

CIP Code	Program	Completions (2017)	Completions (2018)	Completions (2019)	Completions (2020)	Completions (2021)
52.0201	Business Administration and Management, General	3,288	3,325	3,459	3,407	3,464
24.0102	General Studies	1,826	1,693	1,605	1,372	1,123
24.0101	Liberal Arts and Sciences/Liberal Studies	1,415	1,339	1,115	1,163	1,077
26.0101	Biology/Biological Sciences, General	857	835	847	856	879
52.0101	Business/Commerce, General	752	763	908	774	783
52.1401	Marketing/Marketing Management, General	495	532	674	647	602
11.0101	Computer and Information Sciences, General	596	590	425	520	582
43.0104	Criminal Justice/Safety Studies	420	420	405	477	512
52.1301	Management Science	316	376	333	349	450
27.0101	Mathematics, General	405	377	385	366	342

Figure 1: Connecticut Degree Completion (2017-2021) [Data Source: Lightcast][9]

The New England Board of Higher Education (NEBHE) and The Business-Higher Education Forum (BHEF) were designated by the Connecticut Office of Workforce Strategy (OWS) to direct a higher education innovation challenge: TTA. Through the state's initial investment in TTA, seven partnerships between business and higher education institutions have been built. In this paper, we focus on a new BSCS-G2D at UNewHaven. This program integrates industry-recognized credentials provided by Unity Technologies to catapult Connecticut's workforce in the field of game development.

The collaborative efforts of the BHEF and NEBHE in supporting workforce development pilots in Connecticut since 2020. These initiatives aim to enhance skill development and job readiness, with a particular focus on aligning educational outcomes with industry needs. Figure 2 highlights the progress and success of these pilot programs, showcasing their potential for broader implementation across the state in 2024, ultimately contributing to a more robust and adaptable workforce in Connecticut.

The overview of the tech job market in Connecticut from January to March 2023 showcases approximately 9,500 unique job postings during this period. Figure

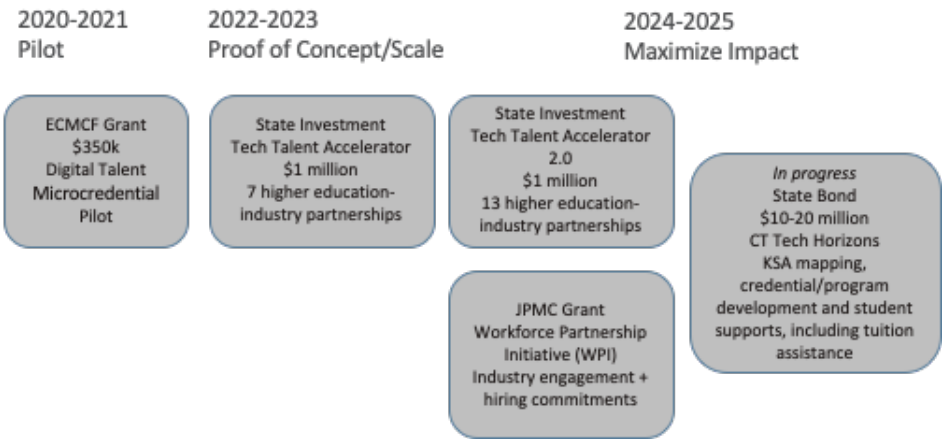

Figure 2: Design and deploy Connecticut state workforce pilots designed to yield a more robust talent ecosystem with greater economic mobility

3highlights the leading companies driving these postings and the most sought-after job titles in the tech sector. This data offers valuable insights into the demand for tech talent in Connecticut, identifying key employers and specific roles that are in high demand, which can inform workforce development strategies and educational programs aimed at aligning with market needs.

Top Companies	Unique Postings
Travelers	406
Cigna	376
Lumen	258
Randstad	204
Raytheon Technologies	180
Robert Half	137
CTG	123
CVS Health	117
KPMG	114
CyberCoders	113

Top Job Titles	Unique Postings
Software Engineers	161
Data Engineers	125
Systems Engineers	91
Scrum Masters	69
Data Scientists	68
Data Analysts	58
Systems Administrators	54
DevOps Engineers	53
Business Systems Analysts	52
Help Desk Analysts	52

Figure 3: Connecticut's Tech Labor Market Needs (January-March 2023) [Data Source: Lightcast][11]

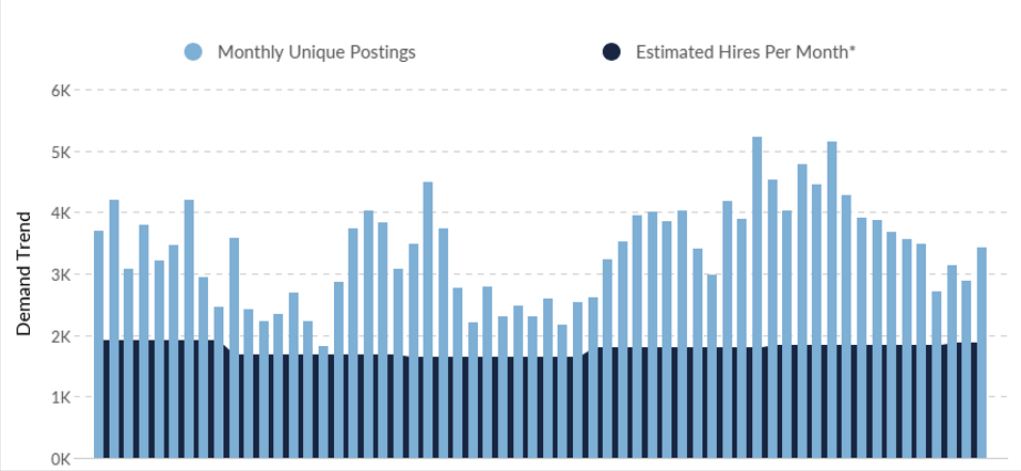

Figure 4: Connecticut's Tech Labor Market Demand (2018 - 2023) [Data Source: Lightcast][10]

Moreover, the fluctuation in unique tech job postings over the past year highlights key trends in the technology job market. Figure 4 reveals that May 2022 saw the highest number of postings, reaching a peak of 5,149. However, there was a significant decline, with postings dropping to 2,719 by December 2022. By March 2023, the number of unique job postings had risen again to 3,429, yet the actual number of hires lagged, with only an estimated 1,876 hires. This discrepancy between job postings and hires underscores potential challenges in meeting the demand for tech talent.

4 Tech Talent Accelerator

The mission of TTA is to enhance the availability of competitive, high-tech talent across the state by focusing on emerging tech skills fields. We aim to develop customized credential pathways that address the specific needs of industries such as software development and cybersecurity, utilizing industry-recognized certificates to expedite students' entry into the workforce. Our approach includes creating regionally tailored Knowledge, Skills, and Abilities (KSA) frameworks that reflect high-demand tech skills required for local tech jobs. Additionally, we offer newly developed reskilling and upskilling programs in high-skill tech fields like virtual modelling, digital analytics, full-stack development, and cybersecurity, all tailored to meet the unique demands of various industry sectors. By aligning these pathways seamlessly with talent retention and recruitment efforts, we help businesses recruit well-trained, diverse talent more quickly and efficiently, ensuring a robust and dynamic workforce for the future.

5 BSCS-G2D Structure and Curricula

5.1 Program Overview

UNewHaven, in partnership with Unity Technologies, is integrating Unity's curricular framework and certifications into the fast-growing BSCS-G2D program (Figure 5). Demand for real-time interactive development skills continues to rise, and Unity remains one of the most sought-after platforms across gaming and adjacent industries such as architecture, engineering, construction, automotive, manufacturing, and digital media. Working with Connecticut game development partners—including SpherGen, Arsome, and Pleiadian Systems Corporation—the program will incorporate industry-aligned instructional materials and credentials.

The project aims to: (1) help students in computing majors rapidly acquire in-demand game development skills that lead to competitive employment, (2) align academic programs with industry expectations in Connecticut, and (3) foster a sustainable, diverse, and inclusive environment in which all students, including those from underrepresented groups, can thrive in game development.

Figure 5: The original BSCS-G2D curriculum

5.2 Purpose and Priorities

The early years of gaming industry date back to 1970s with the introduction of arcade machines and game consoles. As computer components became more affordable, companies began to explore such market opportunities in game design and development. Video games are a generic term for all types of digital games, played and used on some type of screen for entertainment, training, simulation, and decision-making purposes. During the 1990s, with the development of the internet and further multiplayer capabilities, video games experienced significant growth, making it possible to not only connect but to compete with external players.

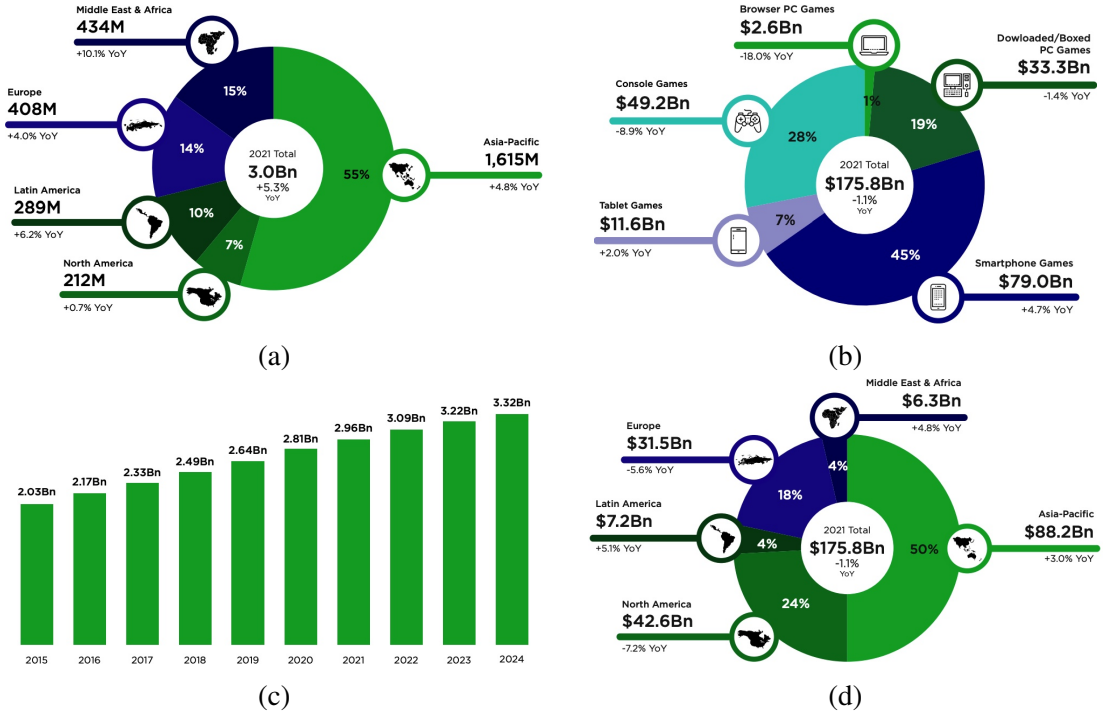

Figure 6: An Overview of the global gaming market [NewZoo: Global Games Market Report 2021]

North America is 2021's second-biggest region, boasting game revenues of $42.6 billion (mainly from the U.S.) (See Figure 6a). Compared to mobile, console and PC games tend to have bigger teams, higher production values, and more cross-country collaborations (See Figure 6b). There will be close to 3.0 billion players across the globe by the end of 2022 (See Figure 6c). Looking ahead, the global number of players will continue to grow at a 5.6% of the compound annual growth rate (2015–2024) to 3.3 billion by 2024 (See Figure 6d).

The modern workplace is changing faster than the education and government sectors. If we fail to recognize the shift happening and take appropriate actions we will be letting down current and future generations of workers and their families and stifling the growth and innovation of the Connecticut economy. The game development sector in Connecticut has a unique opportunity to benefit from the global growth of this strategic computing field and play a key role in developing qualified talents. Now, more than ever, our state's education and workforce systems need to embed high-demand industry-recognized credentials developed by global technology leaders into their

curricula to support graduates' work readiness.

In 2020, UNewHaven initiated an ambitious plan to prepare graduates for the workplace, and reskill and upskill incumbent workers in game development. In 2020, UNewHaven hired a Game Design and Development expert faculty to lead the curriculum design and development of a new Game Design & Development (G2D) concentration to consolidate its growing Bachelor of Science in Computer Science (BSCS) program. This faculty brought several years of industrial experience in software engineering and video-games development while working with Ubisoft and Fujitsu. In addition, in his past academic appointments, he has designed, developed, and directed undergraduate and graduate curricula at the University of Minnesota and later with St. Cloud State University. He systematically aligned curricula with the workplace requirements and integrated credentials to meet employers' needs. Since its launch in 2021, the BSCS-G2D program achieved a 46% annual growth rate (See Figure 7).

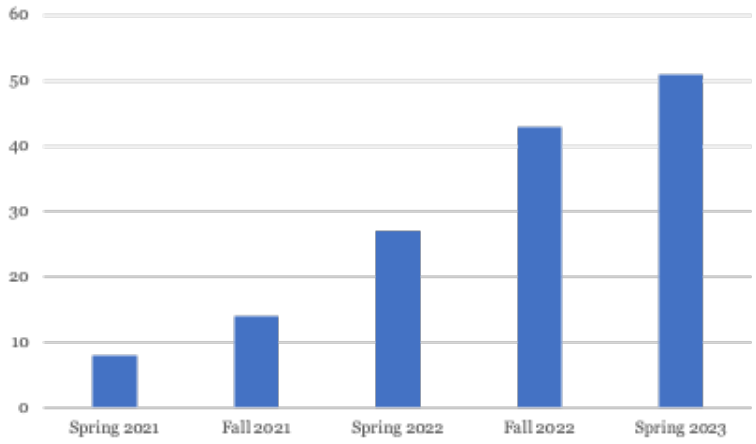

Figure 7: BSCS-G2D program growth (2021-2023)

The proposed project aims to integrate curricular framework and embed high-demand IRCs developed by Unity Technologies, a leader in real-time interactive software development, into the existing growing BSCS-G2D at UNewHaven. The goals of this project are: (1) assist Connecticut students with computing-related majors to quickly acquire in-demand game development skills leading to jobs that provide competitive wages, (2) align existing academic programs with industry standards to better meet Connecticut market requirements and expectations, (3) develop a sustainable, diverse, and inclusive environment where all talents including underrepresented minorities can thrive in game development.

5.3 Planning

To meet the project objectives, the proposed work was mapped to the phases detailed in Figure 8.

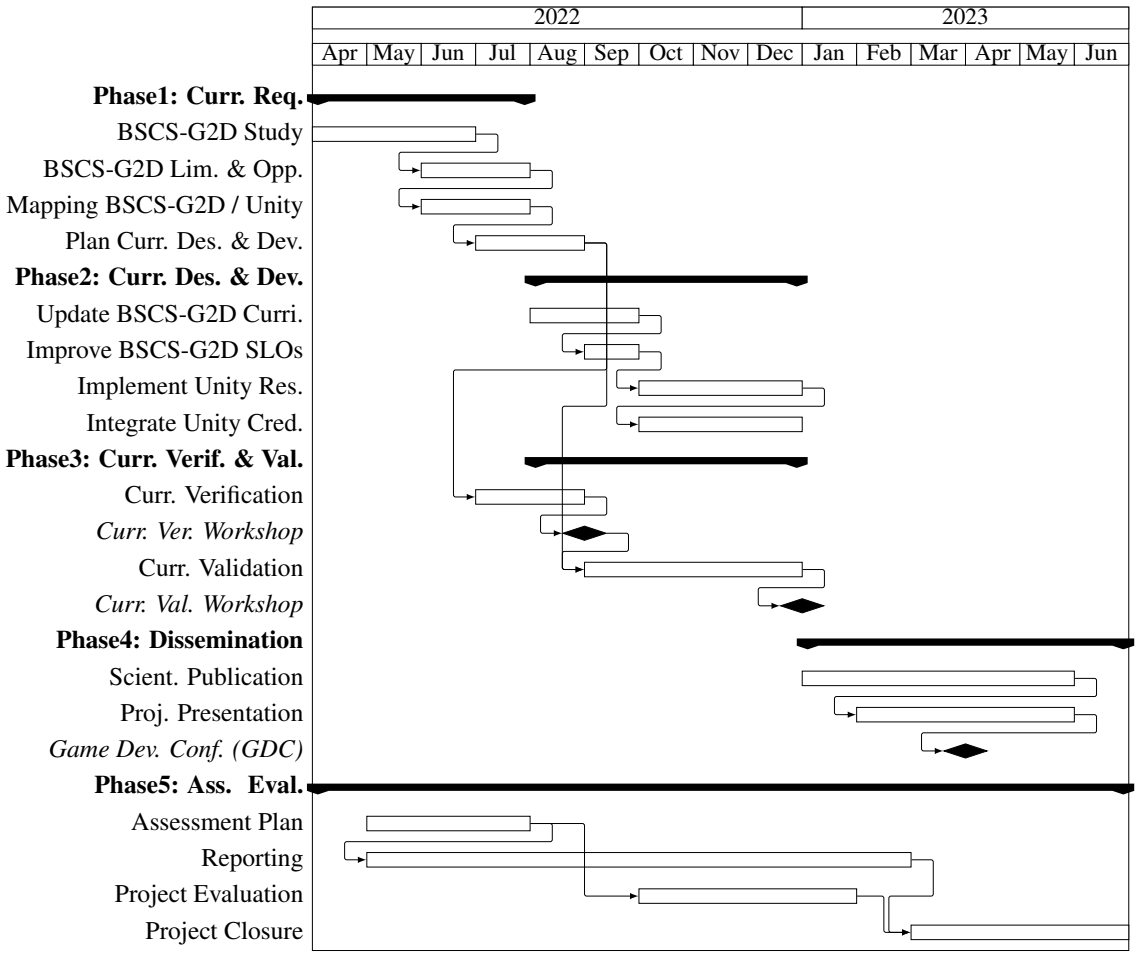

Figure 8: Project Gantt Chart

- **Phase 1 - Curriculum Requirements Analysis:** This phase started in Q2 (2022). It involved the participation of the project collaborators and includes the following activities: (a) study the existing BSCS-G2D curriculum and associated instructional materials and resources, (b) identify and prioritize limitations and improvement opportunities, (c) Map curriculum needs with Unity's framework curricular and certifications, and (d) elaborate a plan to design and develop the

target BSCS-G2D including Unity's curricular framework and certifications.

- **Phase 2 - Curriculum Design & Development:** This phase was executed in Q3 and Q4 (2022). According to the approved curriculum design and development plan, we: (a) updated the BSCS-G2D curriculum, (b) revised the program educational objectives, (c) improved the student learning outcomes associated with each G2D-related course, and (d) overhauled the BSCS-G2D program assessment plan. In this phase, we also: (1) implemented the Unity curricular framework, (2) developed the associated infrastructure to on-board faculty, staff and students, and (3) integrated the Unity certifications and associated credentials to enable training, assessment, and examination.
- **Phase 3 - Curriculum Verification & Validation:** This phase was performed in late Q2 and Q4 (2022). This phase aimed to address the tactical and strategic planning of the project. Typically, tactical planners tend to focus on "*doing things right*," and strategic planners are concerned with "*doing the right things*". This phase combined the tactical and strategic dimensions for a comprehensive quality control of the project execution. First, a curriculum verification workshop was organized (late Q2-2022) to ensure the proposed curriculum revision plan is aligned with the market requirements ("doing things right"). This workshop convened the project stakeholders (representatives from NEBHE, BHEF, Unity Technologies, SpherGen, Arsome, Pleiadian Systems Corporation, and academia) to present, discuss, suggest potential adjustments, and approve the curriculum revision plan. Second, a curriculum validation workshop was organized (late Q4-2022) to ensure the curriculum revisions: (1) have been performed according to the verified and approved plan, and (2) are aligned with the market requirements ("doing the right things"). This second workshop convened the project stakeholders as well as broader participants from the public and private sectors.
- **Phase 4 - Dissemination:** This phase focused on documentation, data collection, and communication materials development to share our project context, objectives, methodology, plan, and potential outcomes with the project stakeholders, the academic community, and the public and private sectors. We worked with Unity Technologies as well as SpherGen, Arsome, and Pleiadian Systems to participate in the annual Game Developers Conference (GDC) to showcase the proposed project and its impacts. This participation is both a professional development opportunity related to the proposed project and a dissemination approach to share the project outcomes with the community.
- **Phase 5 - Program Assessment & Evaluation:** This phase was performed throughout the project planning and execution. It included quantitative and qualitative assessment activities and reporting.

5.4 Design

The proposed project aims to revise the existing BSCS-G2D program and specifically the set of credit-bearing real-time interactive development courses described in Figure 5. Since its launch in 2021, the BSCS-G2D program achieved a 46% annual growth rate. The program received over 95 applications for Fall 2022. We anticipate a total of 60 students to benefit from the new Unity credential-based BSCS-G2D program. Connecticut employers leading the game development sector, including SpherGen, Arsome, and Pleiadian Systems Corporation are supporting the proposed project and committed to overseeing its implementation and benefit from its expected outcomes.

5.5 Transfer, Academic Articulations and Agreements

UNewHaven collaborates with a number of Connecticut community colleges and academic providers to create opportunities for courses, exams, and certifications to properly transfer towards undergraduate degree requirements. UNewHaven has agreements with the following Connecticut institutions: College of Technology, Gateway Community College, Housatonic Community College, and Three Rivers Community College. Students completing their computing-related Associate's degree under an agreement with one of the above institutions can enroll in the BSCS-G2D program. UNewHaven also recognizes a variety of college-level exams, including Advanced Placement (AP) and International Baccalaureate (IB), to transfer towards the BSCS-G2D degree requirements.

5.6 Assessment Plan

The proposed project will adopt two mechanisms for evaluating the success of our objectives, a formative evaluation, and a summative evaluation. It will also include a set of *stakeholders* and *partners* surveys collected quarterly to gauge the quality of the planning, execution and coordination of the project and associated activities, and what changes need to be done to improve its quality.

5.7 Dissemination

There are six key audiences for the proposed project: (A) NEBHE, (B) BHEF, (C) OWS, (D) State of Connecticut Department of Labor (SCDL),(E) Connecticut State Department of Education (CSDE), (F) Industry Partners, (G) academia. The project outcomes have been disseminated using multiple vehicles with face-to-face interaction. In addition to giving written feedback, dissemination activities included:

- Interactive workshops on curriculum requirement analysis, design validation, and verification of good practice guidelines (audiences A, B, D, E, F) as shown in Figure 12.
- Development of links with key organizations such as NEBHE, BHEF, OWS, SCDL, and CSDE to contribute to and capitalize on their networks (A-E).
- Use of electronic media such as websites and social media such as Twitter (All)
- Webinar (A, B, C, D, E) and video (Youtube) (All)
- Publications including Full, Executive Summary and Plain English summary reports of the project (All), peer review journals (A, B, C, G).

Table 1: BSCS-G2D Knowledge, Skills, and Abilities (KSA) mapping

Course	Student Learning Outcomes	Knowledge	Skills	Abilities
CSCI 2254 Introduction to Game Development	Synthesize elements from the past and present of gaming		✓	
	Characterize the fundamentals of game engines	✓		
	Explain the lifecycle of game project management		✓	
	Recognize game design patterns	✓		
	Synthesize the fundamentals of game development		✓	✓
CSCI 3354 Intermediate Game Development	Apply game design patterns, game mechanics, and game balancing		✓	✓
	Design games with advanced complexity	✓		
	Apply game design and development lifecycle techniques to create games		✓	✓
	Apply common techniques to support game development and deployment		✓	✓
CSCI 4444 Applied Artificial Intelligence for Games	Apply software development lifecycle to an AI-based game		✓	✓
	Analyze AI techniques designed for digital gaming	✓		✓
	Solve typical game design problems using common AI techniques		✓	✓
	Improve the performance in games using AI techniques		✓	✓
CSCI 4476 Extended Reality Development for Games	Analyze XR technology and its impacts on human perception and cognition	✓	✓	✓
	Identify applications of XR to support immersive training	✓		
	Apply the fundamental aspects of designing games using XR		✓	✓
	Use multimodal virtual displays to present information		✓	✓
	Assess XR interfaces from a user-experience perspective	✓		✓
CSCI 4476 Interactive Virtual Environments in Games	Evaluate tools and resources for 3D-models creation and integration	✓		
	Apply common techniques to manipulate objects in virtual environments		✓	✓
	Integrate 3D models with animation capabilities to compose 3D scenes			✓
	Apply object interaction techniques in virtual environments	✓	✓	✓
	Analyze the challenges of Massively Multiplayer Online Role-Playing Games	✓		✓

6 Our Proposed Methodology

Our proposed methodology to embed Unity credentials in curricula aims to revolutionize the landscape of game design and development education in Connecticut by strategically aligning curricula with the evolving demands of the industry (See Figure 9). We will begin by defining the critical components of KSA required for success in the field (Sub-section 6.1). Subsequently, a comprehensive Job Market Analysis & Skills Trends

assessment will be conducted to identify the current and future needs of the game design and development sector (Sub-section 6.2). Following this, we will profile essential Skills & Competencies sought by employers and aspiring professionals alike (Sub-section 6.3). Through rigorous Skills Mapping & Curricular Gap Analysis, we will pinpoint areas where existing educational programs may fall short in meeting industry requirements (Sub-section 6.4). Based on these insights, we will carefully select Credentials and Pathways that best equip students with the necessary expertise and qualifications (Sub-section 6.5). Finally, our methodology will emphasize the Integration of High Impact Practices to ensure students receive practical, hands-on experiences that mirror real-world scenarios, thus preparing them for successful careers in game design and development (Sub-section 6.6).

Figure 9: Our methodology to enriched curricula with IRCs

6.1 Knowledge, Skill, and Aptitude (KSA)

In the context of workforce development and performance optimization, the KSA model serves as a foundational framework to delineate the critical components necessary for job success[7,12]. **Knowledge** encompasses the essential subjects, topics, and information that employees must possess upon entering or transitioning within a role. **Skills** represent the technical or manual proficiencies, often gained through training, that are both measurable and observable. **Abilities**, on the other hand, reflect an individual's demonstrated capacity to effectively integrate knowledge and skills to accomplish tasks and exhibit behaviors that are critical to job performance. By clearly defining these elements, the KSA model provides a comprehensive blueprint for understanding the competencies required to excel in specific roles, ultimately driving organizational effectiveness and employee development.

6.2 Job Market Analysis & Skills Trends

In the step "Analyze the Job Market & Skills Trends," we conduct a comprehensive examination of past trends and emerging patterns to forecast future demands in the industry[16,3]. This involves analyzing current skills and job requirements to ensure alignment with industry needs. We delve into demographic data, hiring trends, and graduation rates to understand the workforce pipeline and its dynamics. Additionally, we

explore regional patterns and nuances to identify geographical disparities and opportunities. By identifying existing educational and training programs, we can leverage these resources while pinpointing gaps where demand for certain skills outstrips supply, ensuring our initiatives are strategically targeted to address these deficiencies and foster a robust, skilled workforce in game design and development.

6.3 Profile Skills & Competencies

In the step "Profile Skills & Competencies," we identify the elements that constitute an ideal job candidate[2,1]. This process involves a comprehensive articulation of these elements as specific knowledge, skills, abilities, and credentials (KSA), ensuring a clear and detailed profile. By doing so, we provide a robust framework that delineates the precise competencies required for success. Furthermore, we aim to clarify these expectations for both industry partners and higher education stakeholders, fostering a mutual understanding and alignment. This alignment ensures that educational programs are tailored to meet industry demands and that graduates possess the KSACs necessary to thrive in their careers.

6.4 Skills Mapping & Curricular Gap Analysis

The step "Skills Mapping and Curricular Gap Analysis," is essential for aligning academic programs with industry demands. By meticulously analyzing existing course and degree offerings, we gain insight into their relevance to current business needs[13,8]. Through this process, we map these offerings to the Knowledge, Skills, and Abilities (KSAs) required by businesses, effectively bridging the gap between academia and industry. Our method identifies areas where curriculum enhancements or the introduction of industry-recognized credentials can enhance student preparedness for the workforce. Additionally, it establishes standardized tools and language to guide the development of learning outcomes, ensuring consistency and coherence across curricula. This step serves as a cornerstone in fostering dynamic, responsive educational ecosystems that produce job-ready graduates equipped with the skills demanded by the market.

6.5 Selection of Credentials and Pathways

In selecting the optimal credential or pathway—whether it be a degree program, badge initiative, or another form of certification—it's essential to conduct a comprehensive assessment that harmonizes the demands of the business landscape, the requisite skill sets, and institutional preparedness[19]. This entails an evaluation of factors such as the time required for completion, training prerequisites, and the integration of credit for prior

learning and industry certifications. Moreover, a nuanced understanding of the diverse learner profiles, encompassing both adult and traditional students, is imperative to tailor the pathway effectively. Collaborative engagement with businesses is paramount in ensuring alignment with real-world applications and sustainability. By establishing clear and mutually beneficial expectations, we pave the way for a credentialing strategy that not only meets the needs of all stakeholders but also fosters a culture of shared accountability and success.

6.6 Integration of High Impact Practices

In this step, we aim to integrate High Impact Practices into our educational framework, leveraging several key strategies[14,6]. Firstly, we will expand beyond traditional classroom experiences, fostering experiential learning opportunities that bridge theory with real-world application. To ensure sustainability and continuous improvement, we will establish a shared feedback structure, encouraging collaboration and accountability among students and faculty. Mentorship programs, networking events, and industry partnerships will be seamlessly integrated into the curriculum, providing students with invaluable guidance and exposure to professional environments. By welcoming industry experts as guest or adjunct faculty, we enrich our educational ecosystem with practical insights and current industry trends. Identifying both on and off-campus opportunities, we offer students diverse pathways for growth and exploration. Ultimately, our goal is to cultivate a well-rounded experience that equips our students with the skills and mindset necessary to thrive in their chosen fields, ensuring they emerge as confident and capable contributors to the workforce.

7 Results and Discussion

The implementation of embedded Industry-Recognized Credentials (IRCs) within the BSCS-G2D curriculum produced a set of outcomes that extend well beyond credential counts or employment percentages. While the quantitative indicators remain compelling, the most meaningful impact emerges from the lived experiences of the students who progressed through the credentialing pathway. Their reflections, combined with institutional and ecosystem-level developments, provide a fuller picture of how credential integration reshapes both learning and workforce readiness.

During the 2022–2023 academic year, 52 students were enrolled in the BSCS-G2D program, with 19 selected to participate in the TTA-supported credentialing initiative (Figure 10, left). These students collectively earned 71 Unity credentials spanning introductory, intermediate, and advanced levels. Although most students completed

multiple associate-level certifications, only two achieved the highly demanding Unity Certified Professional Programmer Academic credential, underscoring the rigor of the pathway and the depth of mastery required (Figure 10, right). The integration of these credentials into the curriculum (Figure 11) ensured that credential preparation was not an extracurricular burden but a structured, scaffolded component of academic progression.

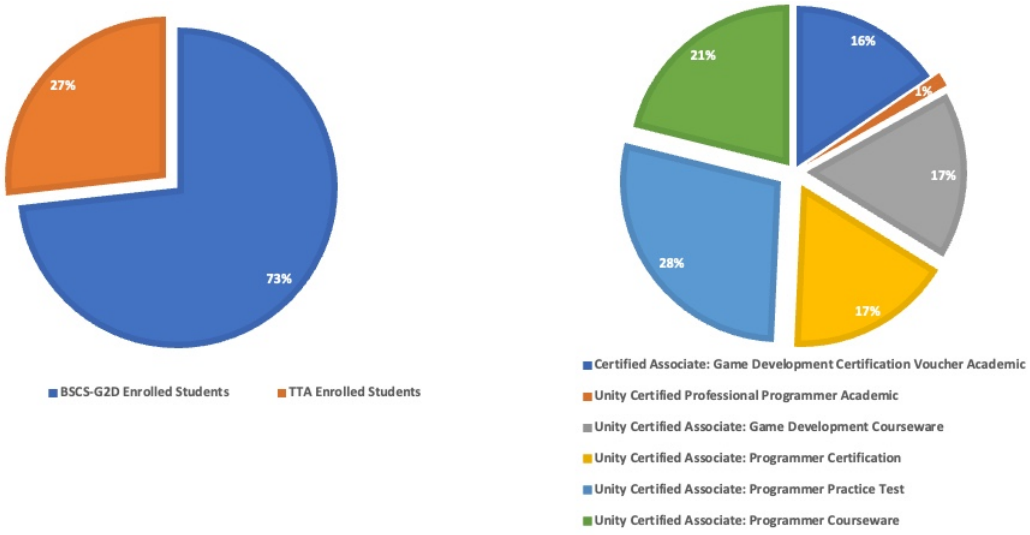

Figure 10: (Left) Distribution of total students enrolled in BSCS-G2D and students selected to participate in the TTA program. (Right) Distribution of the accomplished IRCs provided by Unity Technology.

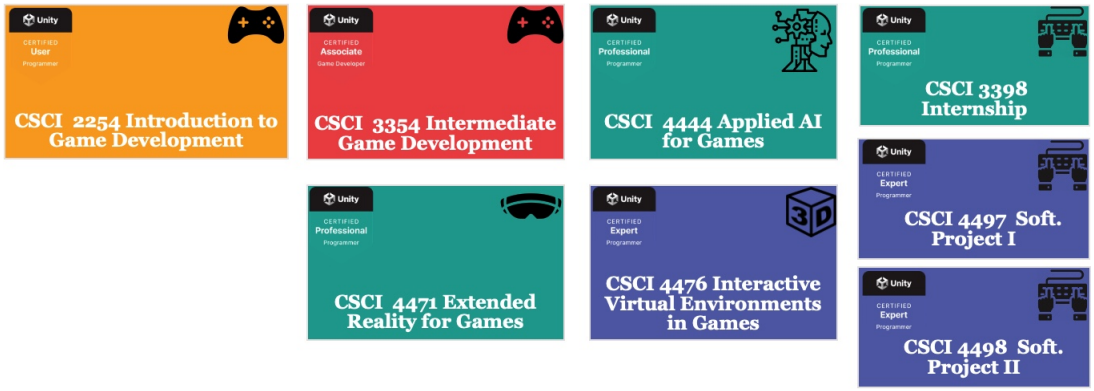

Figure 11: The enriched BSCS-G2D curriculum with Unity IRCs integration.

Quantitatively, the outcomes were significant: credentialed students achieved an 82% employment rate within six months of graduation, a 34 percentage point increase over a concurrently tracked comparison cohort. Yet these numbers only partially capture the transformation students experienced. Semi-structured interviews with 11 credentialed graduates revealed a consistent narrative of increased confidence, professional identity formation, and accelerated entry into the workforce.

Many students described the credentialing experience as the moment they began to see themselves as legitimate developers rather than learners experimenting with tools. One student reflected, *"Before the certification process, I felt like I was just following tutorials. After passing the Unity Programmer exam, I finally felt like a real developer who could build systems from scratch."* Another echoed this sentiment, noting that the credential *"forced me to understand the engine at a deeper level. It wasn't just about passing a test—it changed how I approach problem-solving."* These reflections highlight how the credentialing pathway served not only as a technical benchmark but also as a catalyst for self-efficacy and professional identity.

Students also emphasized the credibility that Unity certifications provided during job searches. Recruiters and hiring managers frequently recognized the credentials as evidence of validated, standardized skill sets. As one graduate explained, *"Every recruiter I spoke with asked about the certification. It immediately signaled that I had real, validated skills—not just class projects."* Another student shared that studios explicitly referenced the credential during interviews, stating, *"They told me they trusted the Unity credential because it's standardized. It gave me legitimacy that a GPA alone never could."* These accounts reinforce the value of IRCs as a signaling mechanism in competitive hiring environments.

Perhaps most striking were the stories of accelerated job placement. Several students attributed their first interviews—and in some cases their first offers—directly to the presence of Unity credentials on their resumes. One graduate recounted, *"I got my first interview because the hiring manager filtered applicants by Unity certification. Without it, I don't think my resume would have made it through."* Another described how the credential opened the door to a technical art internship that ultimately became a full-time position: *"It literally changed my career trajectory."* These narratives illustrate how embedded credentials can reshape not only skill development but also access to opportunity.

Beyond individual outcomes, the initiative contributed to broader ecosystem development. On May 4th, 2023, the University of New Haven hosted *The Constitution State of Play*, the first game design and development conference in Connecticut and the

Northeast (Figure 12). The event convened industry leaders, community organizations, and academic institutions, creating a shared space for dialogue on workforce needs, educational innovation, and regional growth. Panels on game education, workforce upskilling, and the state of Connecticut's gaming industry underscored the growing recognition of immersive technology as a strategic economic sector.

Figure 12: The Constitution State of Play Conference held at UNewHaven on May 4, 2023.

Despite these successes, the initiative faces challenges related to scalability and sustainability. The program currently relies on a small team of faculty and assistants to guide students through credential preparation, a structure that may become strained as enrollment grows. Maintaining up-to-date curriculum modules in rapidly evolving fields such as AI, cloud computing, and real-time 3D development requires ongoing investment in faculty development and technological infrastructure. Similarly, sustaining deep, reciprocal partnerships with industry and community colleges demands consistent

coordination and shared commitment—conditions that can be difficult to maintain over time.

Long-term sustainability will depend on diversifying funding sources beyond the initial TTA support, expanding the instructional team, and institutionalizing processes for curriculum renewal. Without these measures, the program risks losing momentum as technologies evolve and personnel change. Nonetheless, the early outcomes—quantitative, qualitative, and ecosystem-wide—demonstrate the transformative potential of embedding IRCs within computer science curricula and offer a compelling model for institutions seeking to align academic programs with the demands of the digital economy.

8 Conclusion and Future Work

In this paper, we presented to integrate Unity's curricular framework and certifications in its fast-growing BSCS-G2D at UNewHaven, in partnership with Unity Technologies. The proposed methodology is innovative and aims to fill the existing gap and guide integration of IRCs in curricula to boost workforce development. This project is a transformative opportunity to enhance the game design and development curriculum through strategic industry collaboration and targeted student engagement.

Our future work will focus on several strategic initiatives to enhance the program's effectiveness and sustainability. We plan to expand the support team by increasing the number of research assistants and support staff to provide adequate student assistance as the program grows. A comprehensive funding strategy will be developed to secure financial sustainability through diverse sources, including government grants, private-sector partnerships, and philanthropic contributions. Curriculum development will be standardized and streamlined into a modular framework, allowing for easy adaptation and broader implementation across institutions. Strengthening industry partnerships with clear roles and long-term commitments will ensure consistent engagement. Additionally, we will invest in technological infrastructure to equip all participating institutions with the necessary tools to support advanced Unity technology. Finally, a robust administrative structure with well-defined roles and responsibilities will be established to effectively manage the project's various components and ensure continuity despite potential staff changes.

Acknowledgement

The authors would like to express their sincere gratitude to the New England Board of Higher Education and the Business-Higher Education Forum, designated by the Connecticut Office of Workforce Strategy to lead the Tech Talent Accelerator and are funded by the State of Connecticut's Technology Talent Fund. This research would not have been possible without their generous contributions. It is important to note that the content of this paper only reflects the opinions of the authors and does not necessarily represent the views of the funding agencies mentioned above.

References

[1] Mohamed Ally. 2019. Competency profile of the digital and online teacher in future education. *International Review of Research in Open and Distributed Learning* 20, 2 (2019).

[2] John Michael Aquino, Rowena Naga, and Erwin Napiza. 2024. The Upshot of Bs Industrial Technology Graduates' Acquired Competencies Aligned to Employment Opportunities. *e-Jurnal Penyelidikan dan Inovasi* 11, 1 (2024), 62–81.

[3] Hsia-Ching Chang, Chen-Ya Wang, and Suliman Hawamdeh. 2019. Emerging trends in data analytics and knowledge management job market: extending KSA framework. *Journal of Knowledge Management* 23, 4 (2019), 664–686.

[4] Connecticut Public. 2024. *U.S. House OKs Bill to Help Grow CT Workforce, Manufacturing Sector*. https://www.ctpublic.org/news/2024-04-10/u-s-house-oks-bill-to-help-grow-ct-workforce-manufacturing-sector Accessed: 2024-05-29.

[5] Connecticut Workforce Development Council. 2024. CT Workforce. https://workforcect.org/ Accessed: 2024-05-29.

[6] Elma Groenewald, Coenrad Adolph Groenewald, Osias Kit Kilag, Glenn Andrin, Mary Jane Pernites, and Maria Katrina Macapaz. 2024. Talent Management in the 21st Century: A Comprehensive Review and Prospects for Innovation. *International Multidisciplinary Journal of Research for Innovation, Sustainability, and Excellence (IMJRISE)* 1, 3 (2024), 93–99.

[7] Jim Hlavac. 2023. Knowledge, skills and abilities (KSAs) as a metric to re-conceptualise aptitude: a multi-stakeholder perspective. *The Interpreter and Translator Trainer* 17, 1 (2023), 29–53.

[8] Kevin KC Hung, Makiko K MacDermot, Theresa SI Hui, Suet Yi Chan, Sonoe Mashino, Catherine PY Mok, Pak Ho Leung, Ryoma Kayano, Jonathan Abrahams, Chi Shing Wong, et al. 2024. Mapping study for health emergency and disaster risk management competencies and curricula: literature review and cross-sectional survey. *Globalization and health* 20, 1 (2024), 15.

[9] Lightcast. 2023. Connecticut Degree Completion, 2017–2021. Labor market analytics report from Lightcast.

[10] Lightcast. 2023. Connecticut's Tech Labor Market Demand, 2018–2023. Labor market analytics report from Lightcast.

[11] Lightcast. 2023. Connecticut's Tech Labor Market Needs (January–March 2023). Labor market analytics report from Lightcast.

[12] James W Lloyd, Lonnie J King, Andrew T Maccabe, and Lawrence E Heider. 2004. Skills, knowledge, aptitude, and attitude colloquium. *Journal of Veterinary Medical Education* 31, 4 (2004), 435–440.

[13] Olha Nahorniuk and L Levytska. 2024. INTEGRATING PROFESSIONAL AND EDUCATIONAL STANDARDS FOR DEVELOPING IT CURRICULUM. *UNIVERSUM* 4 (2024), 160–168.

[14] Eka Nurhidayat, Januarius Mujiyanto, Issy Yuliasri, and Rudi Hartono. 2024. Technology integration and teachers' competency in the development of 21st-century learning in EFL classroom. *Journal of Education and Learning (EduLearn)* 18, 2 (2024), 342–349.

[15] Office of Governor Ned Lamont. 2020. *Governor Lamont Launches State Workforce Development Unit Focused on Building the Nation's Strongest Talent-To-Jobs Pipeline*. `https://portal.ct.gov/office-of-the-governor/news/press-releases/2020/07-2020/governor-lamont-launches-state-workforce-development-unit` Accessed: 2024-05-29.

[16] Oleksii Romanko, Mary O'Mahony, et al. 2022. The use of online job sites for measuring skills and labour market trends: A review. *Economic Statistics Centre of Excellence (ESCoE) Technical Reports (ESCOE-TR-19)* (2022).

[17] Eleanor Shoreman-Ouimet, James DiCairano, Kenneth Lachlan, Christopher Burton, Ashley Walters, William Ouimet, and Juliana Barrett. 2024. On the brink: Examining preemptive indicators of preparedness inequity and social vulnerability to climate change hazards in Connecticut, USA. *International Journal of Disaster Risk Reduction* 101 (2024), 104276.

[18] Stephanie Welsh, Jenna A LoGiudice, Eliza Holland, and Melissa Rendeiro Gregorio. 2024. Workforce Survey of Connecticut Midwives. *Journal of Midwifery & Women's Health* 69, 1 (2024), 127–135.

[19] Erin K West, Rachel Nelson, Katherine Chesnutt, and James Beeler. 2024. Supporting Beginning Teachers in STEM Content Areas Through Self-Directed Learning and Micro-Credentials. In *Using STEM-Focused Teacher Preparation Programs to Reimagine Elementary Education*. IGI Global, 86–110.