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Expanding a State-wide Data Science Educational Ecosystem to Meet Workforce Development Needs

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Expanding a State-wide Data Science Educational Ecosystem to Meet Workforce Development Needs

Abstract

The University of Arkansas has been developing a State-wide Data Science (DS) Educational Ecosystem over the last five years. A new project, funded by a HIRED grant from the Arkansas Department of Higher Education, builds on this existing DS Ecosystem. The program components include: 1) DS Ecosystem Expansion integrating more Arkansas colleges into the Data Science Ecosystem with a focus on consistent, high-quality curricula across the state with a "start anywhere, finish anywhere" model with off-ramps at any point, 2) Stackable Certificates offering modular, flexible training to rapidly upskill the workforce, including non-degree holders, and 3) Workforce Alignment collaboration with industry to ensure curricula and training programs match real-world needs, preparing students for in-demand jobs.

This project aligns with Arkansas's economic and workforce strategies, fostering partnerships across education, industry and community organizations. With data-driven decision-making increasingly vital for businesses, this effort is preparing a new generation of skilled professionals and supporting career development in this high-growth field.

This paper outlines the methods employed to identify workforce development needs, the specific requirements articulated by industry, the strategies designed to address those needs, and the successes achieved alongside the challenges encountered throughout the process.

Introduction and Workforce Demands for Data Science in Arkansas

Arkansas faces growing demand for skilled data science (DS) professionals as industries increasingly rely on data-driven insights to stay competitive across sectors such as healthcare and logistics [1]. With job growth expected in data science, investing in workforce training is essential to prepare for these high-growth roles. Data scientists in Arkansas can earn $80,000 to $120,000/year, making it an attractive career for both new graduates and those seeking advancement. [2, 3] There are over 100 data science/analytics roles currently open in Arkansas according to the U.S. Bureau of Labor Statistics, and employment in this field is projected to grow 36% from 2021 to 2031 [4].

The Arkansas Economic Development Commission's Science Advisory Committee submitted the updated Arkansas Science & Technology Plan 2024, approved by Secretary of Commerce Hugh McDonald. This plan aims to "enable the crystallization of focused research and innovation planning and provide a focus for the Arkansas scientific community." Key strategies include aligning research and education with the state's key industries and expanding both traditional and non-traditional credentials and experiential training programs. Plans to support data science education align directly with these strategies.

To meet the demand for data scientists, Arkansas must broaden participation in DS education by increasing accessibility through community colleges, offering pathways for 2-year, 4-year, or

graduate degrees, and upskilling current workers. A DART grant funded by NSF established a Data Science Educational Ecosystem [5, 6], allowing students to begin an associate of science (AS) degree or a bachelor of science (BS) degree at any participating school and seamlessly transfer to a 4-year institution for a BS degree. Expanding this "start anywhere, finish anywhere" model statewide will boost the number of trained data scientists entering the workforce.

Short-term training for current workers is essential for quickly gaining skills needed for DS roles. Joint initiatives help close the talent gap by fostering new DS talent and upskilling the existing workforce, keeping Arkansas competitive in this fast-changing sector. Data from the Northwest Arkansas (NWA) Council highlights a significant gap between open jobs and qualified applicants.

In October 2024, a survey was developed by the authors to gage interest and needs related to data science. This survey was conducted as a pilot study within a short, two-week timeframe during the HIRED planning grant, which had a condensed schedule dictated by the funder. While the number of responses was limited due to this timeline, the results provided valuable initial insights into workforce needs and skills gaps in data science across Arkansas. Recognizing the need for broader input, outreach efforts will be expanded, and the survey will be refined as part of the funded implementation grant. This revised version will reach a larger and expanded pool of industry and educational stakeholders, ensuring a more comprehensive dataset. Survey results, conducted alongside listening sessions in Northwest and Central Arkansas with participants from industry, educational institutions, government, and community leaders, highlighted a strong demand for data scientists at the AS, BS, and MS levels, along with a need to upskill current employees. Seventeen Arkansas corporate representatives participated, with 100% identifying data-driven decision-making as a key goal for employing data scientists. Additionally, 84% planned to hire at least six data scientists over the next three years, and 93% indicated data science was critical for achieving strategic goals, despite 73% experiencing challenges finding candidates with the necessary technical or business skills.

Regarding educational preferences, 87% of corporate respondents sought 4-year BS graduates, 27% sought 2-year AS graduates, 13% were interested in certificate holders, and 7% considered high school graduates. For upskilling, 53% favored stackable certificate programs, 47% sought 4-year BS programs, 27% opted for AS programs, and 20% sought 2-year AS programs transitioning seamlessly to 4-year degrees. Skills gaps were noted, with 73% identifying data literacy and 47% citing difficulty in translating data into actionable insights. Key skills needed included statistical analysis and modeling (100%), business understanding (93%), programming (87%), data visualization (80%), machine learning and AI (73%), and cloud computing and big data tools (53%). Regarding company goals, 80% prioritized developing predictive models, 67% focused on automating processes through machine learning, 47% aimed to improve operational efficiency, and 40% sought customer behavior analysis.

In summary, Arkansas employers face a growing need for skilled data science workers. The proposed strategies align with state workforce and economic goals by addressing this shortage through expanded university pipelines for DS education and upskilling programs that offer rapid-entry pathways to the workforce.

The Ecosystem Model and Its Application to Data Science Education

Lord et al. [7] provide a comprehensive review of student progression models, contrasting the limitations of the traditional pipeline model [8] and the more flexible pathway model [9]. Their work also explores the ecosystem model, which acknowledges institutional structures, student agency, and the dynamic interactions that shape educational experiences [10, 11]. This discussion builds on these perspectives to examine how the Data Science Educational Ecosystem aligns with an ecosystem approach.

Building upon pipeline and pathway models, the ecosystem model presents a holistic perspective, viewing education as an interconnected system where multiple factors influence student success. Instead of assuming a fixed route, the ecosystem model accounts for both bottom-up and top-down interactions that shape student experiences. Bottom-up interactions reflect students' choices, engagement with their institutions, and interactions within their networks. Top-down interactions include institutional structures and policies, both formal and informal, that influence student migration, retention, and overall experiences [10, 11].

By situating students within an ecosystem, this approach helps institutions identify patterns of student progression, better understand the diverse experiences of non-traditional students, and adapt educational offerings to meet students' needs. Institutions using an ecosystem framework have successfully introduced flexible degree structures, interdisciplinary perspectives, and specialized programs to support a broader range of students, including military veterans and adult learners [12, 13, 14]. These innovations demonstrate that an ecosystem-based approach fosters an environment where students with varied experiences and learning styles can thrive.

The Arkansas Data Science Educational Ecosystem: A Practical Application

The Arkansas Data Science Educational Ecosystem embodies this model by integrating various educational institutions, industry partners, and community organizations to create a cohesive network. This integration facilitates seamless transitions for students, supports diverse educational pathways, and aligns curricula with real-world demands, thereby enhancing both accessibility and relevance in data science education.

The Data Science Educational Ecosystem being developed in this project aligns closely with Lord et al.' s [7] ecosystem model, as it recognizes the need for structured yet flexible educational pathways that account for student agency. Rather than assuming a linear pipeline approach, this Ecosystem provides multiple entry and exit points, supports non-traditional learners by integrating stackable certificates and enrolling in local 2-year colleges, and will allow credit for prior learning (CPL). This Ecosystem bridges the gap between institutions through faculty training workshops, ensuring that 2-year college instructors can use existing University of Arkansas (UA) teaching materials to deliver high-quality instruction. It recognizes institutional structures and barriers, working to minimize credit transfer obstacles and reduce gaps in instructor preparedness.

Much like the ecosystem framework in engineering education, this model acknowledges that students do not always follow traditional pathways. By embracing flexibility while maintaining a

structured progression of coursework, the Data Science Educational Ecosystem aligns with emerging research advocating for student-centered, system-wide educational models [15, 16].

Ultimately, the ecosystem approach presents an inclusive, scalable framework for data science education. By creating articulated pathways, faculty support mechanisms, and credit recognition structures, this project ensures that students, regardless of where they enter the system, can successfully navigate their education and career trajectories.

The Arkansas Data Science Educational Ecosystem Program Components

The authors have recently been funded by a HIRED grant [17] from the Arkansas Department of Higher Education, to build on the existing DS Ecosystem. The program components include: 1) DS Ecosystem Expansion integrating more Arkansas colleges into the Data Science Ecosystem with a focus on consistent, high-quality curricula across the state with a "start anywhere, finish anywhere" model with off-ramps at any point, 2) Stackable Certificates offering modular, flexible training to rapidly upskill the workforce, including non-degree holders, and 3) Workforce Alignment collaboration with industry to ensure curricula and training programs match real-world needs, preparing students for in-demand jobs.

Ecosystem Expansion: The Data Science Educational Ecosystem in Arkansas provides a structured, articulated pathway for students to pursue data science credentials while maintaining flexibility in where they begin and complete their education. The University of Arkansas (UA) launched a comprehensive data science degree program with multiple tracks from the outset, while the University of Central Arkansas (UCA) developed its program by gradually expanding tracks from existing courses to align with workforce needs and enrollment growth. Many Arkansas institutions, however, lack the resources to implement full-scale programs, making the Ecosystem model an effective approach for expanding access to data science education statewide.

Figure 1 illustrates how students progress through the Ecosystem following a required 8-semester degree sequence. While they may start at different institutions, course articulation ensures consistency across programs, allowing for seamless transitions between participating colleges.

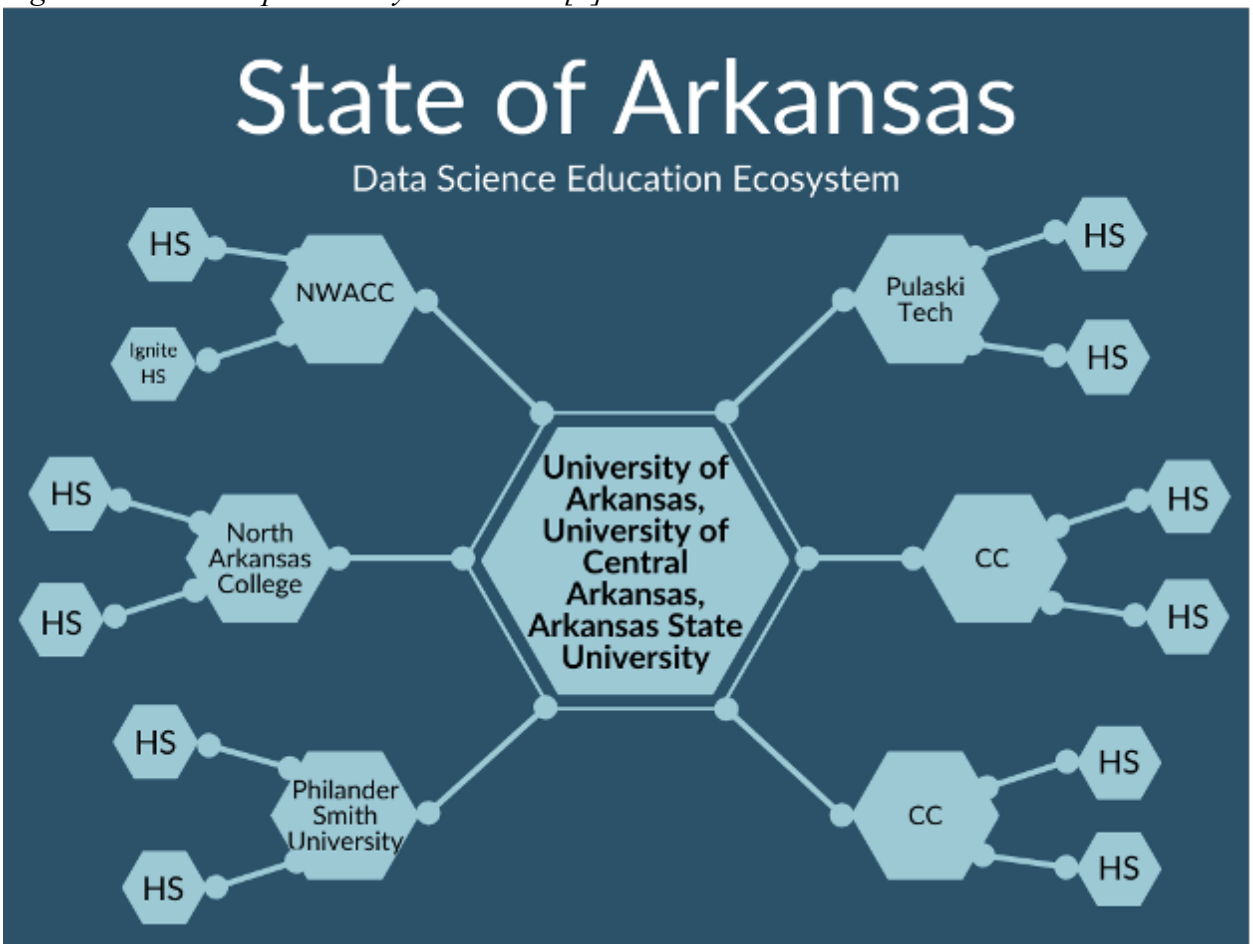
At the outermost level, high school (HS) partners currently serve as the primary recruitment pools, with workforce partners now being incorporated as part of this grant to expand opportunities for working professionals seeking data science training. Some high school students may enter with prior exposure to data science concepts, but this is not a requirement.

2-year colleges serve as the primary entry points for students beginning their data science education. This grant will support the development of stackable certificates, which are not yet available but will provide additional credentialing options. While students cannot yet enroll in certificate courses, they can begin coursework at any participating 2-year college, working toward an AS degree. Those who complete the AS degree may choose to transfer to a 4-year institution for a BS degree. Instructor training workshops at 2-year colleges will upskill faculty to effectively teach the articulated curriculum and ensure consistency in course delivery.

At the center of the Ecosystem, the 4-year institutions (University of Arkansas, University of Central Arkansas, and Arkansas State University) serve as the final stage for students pursuing a BS degree. Articulation agreements guarantee smooth credit transfer from 2-year colleges, preserving academic progression without loss of coursework.

The Ecosystem is designed to provide multiple exit points, enabling students to earn a certificate, AS degree, or BS degree based on their educational and career goals. However, all students must follow the prescribed course sequence to ensure a structured skill-building progression. The flexibility in entry and exit applies to where a student enrolls, not the order in which courses are taken. This model maintains accessibility while ensuring academic rigor and alignment with industry needs.

Figure 1. Hub and Spoke Ecosystem Model [6]



A critical component of the Data Science Educational Ecosystem is the development of articulation agreements between 2-year colleges and 4-year institutions, ensuring that students can seamlessly transfer their credits without loss of coursework. This structured alignment provides students with a clear roadmap to complete their AS degree at a community college before transitioning to a BS degree at a university. The articulation process involves extensive collaboration to align curricula, assess instructor needs, and establish a shared framework for delivering high-quality data science education across institutions.

As an example, the 8-semester degree plan below illustrates a specific articulation agreement between North Arkansas College (NorthArk), a 2-year institution, and the UA, a 4-year institution. Students complete their first four semesters at NorthArk, fulfilling foundational data science, mathematics, programming, and general education requirements, before transferring to UA for the final four semesters to complete advanced coursework and capstone experiences.

To support seamless integration, instructors at participating 2-year colleges can utilize existing UA teaching materials, ensuring consistency in course delivery. Additionally, faculty training workshops are conducted to close knowledge gaps among instructors at 2-year colleges, equipping them with the skills needed to teach the articulated curriculum effectively.

Although articulation is time-intensive, requiring institutional collaboration and state approval, the result is a highly structured, reliable academic pathway. Students can confidently follow the 8-semester degree plan, knowing that their coursework will transfer smoothly and that they will receive a consistent, high-quality education across institutions. This model provides a scalable approach for expanding data science education to other institutions within the Ecosystem, ensuring that more students have access to seamless, high-impact learning opportunities.

Table 1. 8-Semester Plan of Study for UA and NorthArk 2+2

Year 1 – Fall (NorthArk)			Year 1 – Spring (NorthArk)	
MAT 1233	Pre-Calculus		MAT 2204	Analytic Geometry & Calculus I
ENGL 1013	Composition I		ENGL 1033	Gen Ed, Technical Composition II
DVSC 1003	Intro Data Science		GNED NNN3	Gen Ed, History or Government
DVSC 1104 Or CIS 1603 + CIS 2011	Programming Languages for Data Science, OR Intro to Programming AND R for Data Science		DVSC 1013 GNED NNN3	Intermediate Data Science Gen Ed, Fine Arts Elective
13 hours	Total		16 hours	Total

Year 2 – Fall (NorthArk)			Year 2 – Spring (NorthArk)	
MAT 2304	Analytical Geometry & Calculus II		GNED NNN3	Gen Ed, Social Science Elective
DVSC 2213	Data Visualization & Communication		GNED NNN4	Gen Ed, Science Elective
DVSC 2113	Principles & Techniques of Data Science		CIS 2203	Data Structures & Algorithm Design
GNED NNN3	Gen Ed, Social Science Elective		DVSC 2203	Data Management & Data Base
GNED NNN4	Gen Ed, Science Elective		GNED NNN3	Gen Ed, Fine Arts Elective
17 hours	Total		16 hours	Total

Year 3 – Fall (UA)			Year 3 – Spring (UA)	
DASC 2594	Multivariable Math for Data Scientists		SEVI 2053	Business Foundations
INEG 2313	Applied Probability and Statistics for Engineers I		INEG 2333	Applied Probability and Statistics for Engineers II
DASC 2133	Data Privacy & Ethics		DASC 3203	Optimization Methods in Data Science
DASC 3103	Cloud Computing & Big Data		DASC 3213	Statistical Learning
RRRR NNN3	Required Concentration Course		RRRR NNN3	Required Concentration Course

16 hours	Total		15 hours	Total

Year 4 – Fall (UA)			Year 4 – Spring (UA)	
DASC 4892/H	Data Science Practicum I		DASC 4993/H	Data Science Practicum II
DASC 4123	Social Problems (Issues) in DASC & Analytics		ECON 2143/H	Gen Ed, Basic Economics: Theory and Practice
DASC 4113/H	Machine Learning		CCCC NNN3	Concentration Elective
RRRR NNN3	Required Concentration Course		CCCC NNN3	Concentration Elective
CCCC NNN3	Concentration Elective		CCCC NNN3	Concentration Elective
14 hours	Total		16 hours	Total

The process to bring 2-year colleges into the Ecosystem is to: 1) recruit Arkansas 2-year colleges, 2) discuss participation interest and timing, 3) identify the needed courses and course numbers for each interested 2-year school, and determine if they will adopt the UAF syllabi for new courses, adapt existing courses, or use a combination of both, 4) develop course equivalencies, 5) assess instructor knowledge gaps, 6) conduct Workshop #1 to address these gaps, 7) create a gap-free 8-semester degree plan, 8) conduct Workshop #2 to train instructors on effective data science delivery, 9) finalize an articulation agreement, and 10) submit the 8-semester degree plan for legal review and state approval.

In the October 2024 survey with 10 respondents from two-year colleges, 100% emphasized the importance of establishing formal transfer or articulation agreements with 4-year colleges for DS programs. Additionally, 90% expressed interest in creating 2-year AS programs that seamlessly transition to 4-year degrees, and 80% were interested in offering stackable certificate programs. Professional development in DS education for 2-year college faculty was rated as very to extremely important by 90%, partially addressed by proposed workshops. Furthermore, 80% indicated student interest in DS courses, while the same percentage cited lack of awareness as a major barrier to enrollment.

In a parallel survey with 16 respondents from 4-year colleges, 91% supported stronger collaboration with 2-year colleges to align DS curriculum. All respondents (100%) were interested in increasing collaboration to improve DS teaching with 2-year institutions. Identified knowledge gaps among students transferring from 2-year to 4-year colleges included statistical analysis (60%), data analysis and visualization (50%), programming and software tools (40%), and machine learning basics (40%). Additionally, 75% expressed interest in upskilling current workforce employees through 2-year AS programs that transition seamlessly to 4-year degrees.

Stackable Certificates: Currently, most students in the data science Ecosystem program begin as first-time, first-year students. The HIRED program aims to also attract participants with work experience, requiring a standardized method for awarding CPL in data science instead of ad hoc evaluations. Once established, this assessment process will be available across all Ecosystem institutions.

Industry seeks to rapidly upskill employees in data science and analytics, including those without prior proficiency or college degrees. This grant proposes a series of stackable certificates to upskill employees, which can initially be taken for no credit but may later be converted to CPL upon demonstrating proficiency. Participants enrolling at Ecosystem institutions will be able to undergo

an assessment process, such as an open-ended case study or an ALEKS-type evaluation, to earn academic credit. This assessment tool for awarding CPL has not yet been developed, so will be presented in the future.

The Arkansas LEARNS Act [18] emphasizes Success-Ready Pathways for high school graduation, focusing on early post-secondary credential attainment. High school students can participate in the stackable certificate program, gaining proficiency and a head start on AS or BS degrees.

Stackable certificates will be developed from existing online courses, broken into smaller stand-alone modules taken in sequence for workforce training. Participants can exit at any stage, with a certificate awarded after each module. Completing all course modules allows for consideration of prior learning proficiency. The initial courses divided into stackable modules will be the first two courses in the Data Science common curriculum: DASC 1003 Introduction to Data Science and DASC 1104 Programming Languages for Data Science (Python and R). These courses must be taken in sequence, with DASC 1003 completed first. If the grant is extended, additional courses will be added to the stackable certificate structure, but a structured sequence will always be required to ensure a logical progression of skills.

The steps to develop stackable certificates will be: 1) splitting two existing courses into 8 modules (6 lecture modules and 2 assessment modules), 2) validating the modules with industry to ensure they meet needs, 3) in consultation with the course developer, redesigning and rebuilding the courses into the certificate modules, 4) piloting the modules with industry employees, 5) revising based on participant feedback, 6) marketing and launching the first four modules to the public and collect additional feedback, 7) revising all modules, and 8) marketing and publicly releasing all modules.

Workforce Alignment: To ensure the program remains closely aligned with industry needs, an Advisory Council is being established, comprising representatives from industry, education, workforce development, and government. This council will provide strategic guidance and insights, meeting quarterly to review progress and advise on program enhancements. Additionally, annual listening sessions with industry stakeholders will offer a platform to gather broader input and stay responsive to emerging workforce trends. The stackable certificate modules will be piloted with partner companies, whose feedback will directly inform revisions, ensuring the training remains relevant and effective for addressing real-world skills gaps. These efforts will create a dynamic feedback loop between education and industry, keeping the program adaptable and aligned with workforce demands.

Project Leadership and Phased Implementation Timeline

The program timeline, activities, and milestones are detailed in Table 2 below.

The Principal Investigator (PI) will oversee the project vision, ensure alignment with industry needs, define the stackable certificate content, and lead the development of the CPL assessment. Additionally, he will spearhead industry recruitment and co-lead the instructor workshops.

The Co-Principal Investigator (Co-PI) will serve as the program manager, supervise the Project Support Coordinator (PSC) and Graduate Research Assistant (GRA), support industry and participant recruitment, co-lead the instructor workshops, develop and analyze industry and 2-year college surveys, and manage reporting requirements.

The PSC and GRA will be hired to assist with daily operations, industry and workforce outreach, workshop coordination, and administrative tasks. Additional team members will contribute to expanding connections with 2-year colleges and industry partners, leading instructor upskilling workshops, facilitating engagement with community organizations, and providing workforce guidance to support the development and implementation of the Data Science Educational Ecosystem. Their collective efforts will ensure seamless collaboration across institutions and alignment with industry needs.

The Ecosystem Expansion efforts focus on statewide recruitment, course articulation, and faculty training to support the seamless transfer of students across institutions. Stackable Certificates will be developed and implemented through Global Campus, which will handle infrastructure, instructional design, assessment tools, marketing, and partnerships. Other Initiatives, such as the Advisory Council, will provide oversight and stakeholder engagement throughout the project.

Global Campus plays a pivotal role in the development and implementation of online and non-credit courses, providing instructional design expertise, faculty support, and student recruitment strategies. By collaborating with faculty, industry partners, government agencies, and educational institutions, Global Campus helps expand workforce training opportunities and ensures that course offerings remain aligned with industry needs.

As part of this project, Global Campus will design, develop, and refine the stackable certificate modules, piloting them with industry employees before a full public launch. In coordination with its national marketing team and under the oversight of the Co-PI, Global Campus will also lead targeted outreach efforts, utilizing digital and print materials, webcasts, emails, and workshops to effectively engage students and industry stakeholders. Through its expertise in course design, marketing, and workforce engagement, Global Campus will help bridge the gap between education and industry, ensuring that the certificates provide practical, high-value learning opportunities.

Table 2. Overview and Timeline

Quarter 1	Quarter 2	Quarter 3	Quarter 4

Ecosystem:
• Central AR Recruitment
	Ecosystem:
	• South AR recruitment
	• With interested 2-yr colleges:
	  • Discuss courses & 2+2
	  • Develop course equivalencies
		Ecosystem:
		• Continue recruitment
		• With interested 2-yr colleges:
		  • Discuss courses & 2+2
		  • Develop course equivalencies
		  • Determine instructor knowledge gaps
		  • Hold a WS #1 for DS knowledge
			Ecosystem:
			• Continue recruitment
			• With interested 2-yr colleges:
			  • Develop course equivalencies
			  • Determine instructor knowledge gaps
			  • Hold WS #1 for DS knowledge
			  • Create 8-semester degree plans

		• Create 8-semester degree plans	• Hold a WS #2 for teaching methods
Stackable Certificates: • Envision splitting 2 online courses into 8 stackable certificates (6 lecture modules and 2 assessment modules) • Validate with industry that certificate modules meet their needs	Stackable Certificates: • Global campus creates infrastructure to offer stackable certificate modules • Begin finding/developing an assessment tool for determining credit for non-credit certificate work • Global Campus begins process of getting certificate program through ADHE • Create partnerships and awareness for the certificates	Stackable Certificates: • Global campus redesigns and rebuilds courses into certificate modules • Formalize process to track completion of non-credit certificates • Continue assessment tool work for non-credit to credit • Collaborate with marketing firm to develop marketing plan • Create partnerships and awareness for the certificates	Stackable Certificates: • Global campus redesigns and rebuilds courses into certificate modules • Continue assessment tool work for non-credit to credit • Collaborate with marketing firm to develop marketing plan • Create partnerships and awareness for the certificates • Pilot the first certificates with select company employees
Other: • Advisory Council Start	Other: • Advisory Council mtg	Other: • Advisory Council mtg	Other: • Advisory Council mtg

Quarter 5	Quarter 6	Quarter 7	Quarter 8
Ecosystem: • East AR recruitment • With interested 2-yr colleges: • Discuss courses & 2+2 • Develop course equivalencies • Determine instructor knowledge gaps • Hold WS #1 for DS knowledge • Create 8-semester degree plans • Hold a WS #2 for teaching methods • Service an articulation agreement • Submit an 8-semester plan for legal review	Ecosystem: • Northeast AR recruitment • With interested 2-yr colleges: • Discuss courses & 2+2 • Develop course equivalencies • Determine instructor knowledge gaps • Hold WS #1 for DS knowledge • Create 8-semester degree plans • Service articulation agreement • Submit an 8-semester plan for legal review	Ecosystem: • With interested 2-yr colleges: • Develop course equivalencies • Create 8-semester degree plans • Hold a WS #2 for teaching methods • Service an articulation agreement • Submit an 8-semester plan for legal review	Ecosystem: • With interested 2-yr colleges: • Create 8-semester degree plans • Service an articulation agreement • Submit an 8-semester plan for legal review
Stackable Certificates: • Pilot the first certificates with select company employees • Begin marketing widely • Revise certificate modules based on feedback • Finalize assessment tool for non-credit to credit • Create partnerships for the certificate program	Stackable Certificates: • Pilot the second certificates with select company employees • Market & offer first certificates to the public • Gain feedback and revise • Create partnerships for the certificate program	Stackable Certificates: • Market & offer all 8 certificate modules to the public • Gain feedback and revise • Create partnerships for the certificate program • Revise modules based on feedback	Stackable Certificates: • Market & offer all 8 certificate modules to the public • Gain feedback • Revise modules based on feedback

Other • Advisory Council mtg	Other: • Advisory Council mtg	Other: • Advisory Council mtg	Other: • Advisory Council mtg

Potential Challenges in Scaling and Implementation

Scaling the Ecosystem presents several key challenges that must be addressed for long-term success. Maintaining and revising various aspects of the program will be critical as it expands. At 2-year colleges, shifts in curricula, faculty expertise, and institutional policies may affect adoption and continuity. Faculty and administrative turnover could lead to changing institutional priorities and teaching loads, impacting program integration.

Sustained collaboration with industry partners is essential to ensure course content remains relevant, workforce needs are continually assessed, and skill competencies are validated. Without ongoing engagement, there is a risk of curriculum stagnation or misalignment with industry expectations. In addition, long-term industry participation in internships, mentorships, and hiring pipelines must be maintained to ensure workforce connections remain strong.

The authors have recently gained approval to award credit for prior learning, requiring the development and validation of assessments that will be widely accepted across Ecosystem institutions. Establishing a streamlined and standardized process for prior learning credit will be crucial for scalability.

Securing long-term funding beyond the grant period is another major challenge. Sustainable financial support is needed to continue program growth, strengthen industry partnerships, and support ongoing curriculum development.

Addressing these challenges requires coordinated efforts among academic institutions, industry partners, and workforce agencies to build a scalable and sustainable model that aligns with both educational and economic development goals. Previous work by the first authors [6] has also identified scalability challenges, which continue to be key considerations as the Ecosystem evolves.

Conclusion

The development and expansion of the Arkansas Data Science Educational Ecosystem represent a significant step toward meeting the state's workforce development needs. By integrating 2-year colleges into the Ecosystem, creating stackable certificates, and aligning curricula with industry demands, this initiative addresses the growing demand for skilled data science professionals. The "start anywhere, finish anywhere" model ensures flexibility for learners, while the emphasis on upskilling and CPL makes data science education accessible to a broader audience, including current workers and non-traditional students.

The collaboration between educational institutions, industry partners, and community stakeholders has already highlighted critical skills gaps and workforce needs. Surveys and listening sessions have reinforced the importance of statistical analysis, programming, and data visualization, while also emphasizing the need for practical, business-aligned training. The program's focus on modular, flexible learning pathways ensures that participants can rapidly gain the skills needed for

in-demand roles, supporting Arkansas's economic growth and competitiveness in data-driven industries.

As this initiative moves forward, its successes and lessons learned can serve as a model for other states seeking to build similar educational ecosystems. By fostering partnerships and leveraging innovative educational strategies, Arkansas is positioning itself as a leader in addressing the workforce challenges of the data-driven economy.

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