Analytical Demonstration

Strengthening STEM Pathways from Education to Workforce: Evidence from Arkansas

Task 3

STEM Attrition Report: Finalize Accompanying Policy Brief (Deliverable 9)
STEM Subgroup Report: Finalize Accompanying Policy Brief (Deliverable 11)

for

Coleridge

Project No. ADC-STEM-24-N8

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First Submission: 06/19/2026
Final Submission: 07/27/2026

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Strengthening STEM Pathways from Education to Workforce: Evidence from Arkansas

Overview

Understanding how students move through Science, Technology, Engineering, and Mathematics (STEM) (STEM) education and into the workforce requires more than measuring entry or completion at a single point in time. It requires a longitudinal view of pathways. Specifically, how students enter, persist, and exit STEM fields during postsecondary education, and how these trajectories relate to labor market outcomes.

This project addresses the main study objective to better understand the impact of STEM attrition that occurs within educational and workforce pathways on the supply of STEM talent required to meet future workforce demand. Findings to this study support the National Secure Data Service Demonstration project managed in consultation with the National Center for Science and Engineering Statistics.

this study utilizes linked administrative data from Arkansas, encompassing postsecondary enrollment and workforce outcomes, along with supplementary K-12 indicators for a subset of students, to investigate three primary policy questions: (1) the pathways students pursue after entering STEM, (2) the timing and reasons for students' departure from or persistence in STEM fields, and (3) the correlation between postsecondary STEM pathways and workforce outcomes.

The findings show that while entry into STEM is relatively common, persistence remains a central challenge. Attrition predominantly occurs in the initial phases of postsecondary education, with outcomes varying systematically based on academic preparedness, institutional environment, and enrollment patterns. At the same time, STEM degree attainment is associated with improved labor market outcomes, although alignment between education and employment is not uniform.

The findings presented in the final *Technical Report* emphasize the importance of providing support to students beyond their initial entry into STEM, strengthening pathways across institutions, and improving the alignment between education systems and workforce demand.

From Policy Questions to Evidence

This analysis was guided by a set of policy and research questions developed in collaboration with Arkansas state partners, with the goal of understanding how students move through STEM pathways from postsecondary education into the workforce. These questions focused on key points along the pathway, including entry into STEM fields, persistence and attrition during postsecondary education, degree attainment, and transitions into the labor market.

Initial priorities included estimating the proportion of STEM starters who complete degrees, enter STEM-related employment, or exit the pathway, as well as identifying when attrition is most likely to occur and which factors are associated with persistence. Additional questions focused on Arkansas-specific priorities, including the role of non-degree credentials, accelerated coursework, and alignment between education and workforce demand.

As the analysis progressed, the scope of feasible questions was shaped by data availability, linkage coverage, and the structure of administrative records. In particular, while postsecondary enrollment and workforce outcomes could be examined comprehensively within the state, K-12 indicators were available for a subset of students, and occupation-level workforce data were not available. As a result, some questions, such as the role of accelerated coursework or detailed alignment between education and specific occupations, could not be fully addressed within the current analysis.

Despite these constraints, the study provides robust evidence on several core policy questions and data considerations that serve as a framework for future work for understanding STEM entry, persistence and attrition across other geographies at the regional or state levels. Specifically, the analysis identifies when attrition from STEM pathways is most likely to occur, how persistence varies across institutional contexts and student groups, and how postsecondary pathways translate into labor market outcomes. These findings offer a data-driven foundation for strengthening STEM pathways in Arkansas and highlight areas where additional data and analysis would further support policy decision-making at a national level.

Key Findings

1. What pathways do students follow after entering STEM?

Students who begin postsecondary education in STEM follow diverse pathways. While a portion complete STEM degrees, others complete non-STEM degrees or leave postsecondary education without earning a credential. These outcomes vary by institutional entry point, with students beginning at four-year institutions more likely to complete STEM degrees, and those beginning at two-year institutions more likely to experience longer and more complex pathways, including transfers and interruptions.

Implication	Improving pathway clarity and strengthening transfer and progression mechanisms are critical to increasing STEM degree attainment.

2. When are students most likely to exit STEM pathways?

Attrition from STEM is highly concentrated in the early stages of postsecondary education. Across cohorts and degree pathways, the likelihood of exiting STEM is highest during the first several academic terms, after which persistence stabilizes among students who remain enrolled. This pattern is consistent across institutional contexts, underscoring the importance of early academic momentum.

Implication	The first year of postsecondary education represents a critical intervention point for improving STEM persistence.

3. What factors are associated with persistence and attrition in STEM?

Persistence in STEM pathways is shaped by a combination of academic preparation, institutional context, and enrollment patterns. Higher levels of academic preparation, particularly high school GPA, are strongly associated with persistence. Postsecondary experiences, including enrollment continuity, credit accumulation, and multi-institution attendance are also associated with differences in attrition risk. Patterns of persistence vary across student subgroups, including by race and ethnicity, gender, age, and institutional entry point.

Implication	Improving STEM outcomes requires coordinated strategies that address both pre-college preparation and postsecondary experiences, with attention to subgroup-specific barriers.

4. What role does academic preparation prior to college play in STEM persistence?

Among students linked to K-12 data, academic preparation prior to postsecondary entry is strongly associated with persistence in STEM pathways. In particular, a higher high school GPA is associated with a substantially lower likelihood of exiting STEM, highlighting the importance of foundational academic readiness.

Exposure to STEM and career-oriented coursework is widespread among Arkansas students, particularly in career and technical education (CTE) pathways. As a result, CTE participation may function less as a distinguishing factor in explaining differences in postsecondary persistence. The relationship between high school STEM course-taking and persistence is more complex and reflects differences in course rigor and selection into STEM pathways.

These findings are based on a subset of students and should be interpreted as indicative rather than definitive.

Implication	Strengthening academic preparation prior to college, particularly foundational skills, and improving alignment between high school coursework and postsecondary expectations are critical to improving STEM persistence.

5. How do postsecondary STEM pathways translate into workforce outcomes?

Students who complete STEM degrees earn higher wages on average than both non-STEM completers and those who leave without a credential. STEM completers are also more likely to work in industries associated with STEM activity. However, due to data limitations – i.e. being restricted to Arkansas

workforce data and an inability to track specific occupations – industry placement rates should be taken with caution.

Implication	STEM degree attainment is associated with improved labor market outcomes in the form of higher wages.

6. What are the current limitations in measuring STEM workforce alignment?

Workforce outcomes in this analysis are based on industry classifications (NAICS). We selected industries for analysis that engage in activities categorized as STEM activities in previous literature. The NAICS system does not identify specific occupations. Thus, this analysis can only measure whether individuals enter a STEM industry, not a STEM occupation. An analysis of this form can help to serve as proxy for the size and characteristics of the STEM workforce but will necessarily miss individuals in STEM occupation in non-STEM industries, and erroneously count non-STEM occupations in STEM industries. In other words, it is not possible to directly determine whether individuals are employed in STEM occupations, and estimates of workforce alignment rely on industry-based proxies.

Implication	Improved access to occupation-level data would enable more precise assessment of the relationship between STEM education and workforce outcomes.

Strategic Opportunities for Investment

The findings point to several high-leverage opportunities for policymakers and funders:

- Early Momentum Interventions: Expand supports in the first year of postsecondary education, particularly in gateway STEM courses.
- Strengthened Transfer Pathways: Improve articulation and credit transfer between two-year and four-year institutions.
- K-12 to Postsecondary Alignment: Align high school coursework with postsecondary expectations, focusing on preparation and transition.
- Pathway Flexibility: Support re-entry into STEM fields and non-linear pathways
- Data Infrastructure Investments: Enhance longitudinal data systems to better connect education and workforce outcomes.
- Future Research: Exploring the mechanisms between postsecondary experiences, institutional characteristics, and attrition in other fields to inform policy.

Importance of This Study

This analysis demonstrates the value of integrated, longitudinal data systems for understanding education-to-workforce pathways. By linking K-12 preparation, postsecondary experiences, and labor

market outcomes, states can move beyond static metrics and develop a more complete picture of how students progress through the STEM pipeline.

These types of data systems can serve as complements to other systems such as the National Longitudinal Surveys of Youth (NLSY). These systems have two advantages over a system such as the NLSY. First, using linked administrative data does not rely on random sampling techniques. With a linked administrative data system, states can see the educational pathways and workforce outcomes for their entire population. Second, using linked administrative data does not rely on survey techniques, which may be prone to respondent nonresponses. However, we want to stress that these systems should serve as complements rather than replacements for systems such as the NLSY, as using both kinds of systems can reveal additional information, such as comparisons between state and national trends.

The Arkansas case illustrates both challenges and opportunities: while many students enter STEM, persistence remains a key barrier, and workforce alignment is uneven. Addressing these gaps requires coordinated strategies across K-12, postsecondary, and workforce systems.

Future Work

Future work will expand these analyses by incorporating additional measures of academic preparation, refining models of persistence, and strengthening connections to workforce outcomes. These efforts will further support evidence-based decision-making to improve STEM pathways at scale.