

## Deconstructing School-to-Work Transitions in Engineering: A Scoping Review

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Nyna, born and raised in Durham, North Carolina, obtained her Bachelor's degree in General Engineering with a concentration in Biomedical Engineering in 2022 from Wake Forest University. Following her undergraduate degree, she received her Master's degree in Biomedical Engineering with a focus in Immunoengineering from Johns Hopkins University. Nyna has a strong interest in increasing diversity in biomedical engineering spaces and she intends to research this by focusing on inclusive classroom spaces and diversifying research models.

## Deconstructing School-to-Work Transitions in Engineering: A Scoping Review (WIP)

### Introduction:

This study builds upon the work of (Paul & Lewis, 2024), which examined the workplace transition experiences of undergraduate queer engineering students and revealed a notable gap in the literature concerning transition experiences of these students. To address this gap, we have developed a new research agenda that specifically investigates the school-to-work transition (STW) of undergraduate engineering students. The aim of this project is to analyze and map the existing literature on this topic through a scoping review (ScLR). A scoping review is a type of literature review designed to systematically explore and map the breadth of available evidence on a specific topic (Samnani et al., 2017). It identifies key concepts, research gaps, and the variety of study designs within a field (Grant & Booth, 2009). For the scope of this research, we operationalize our definition of the School-to-Work Transition, drawing inspiration from (Blokker et al., 2023; Ng & Feldman, 2007). The school-to-work transition is the process of moving from education to the workforce, involving both physical shifts (leaving school and entering employment) and psychological adaptation (transitioning from student to worker roles). It shapes long-term career sustainability and is influenced by individual traits, contextual factors, and timing. This paper reports on the methodological rigor and steps taken in the scoping review while presenting early insights into key trends. The overarching goal of this project is to explore student challenges in adapting to workplace demands, the experiences of underrepresented groups, and the need for curriculum reforms to enhance professional preparedness. We address this in our future work by mapping existing knowledge. This study contributes to the ongoing dialogue on how educators and industry professionals can better support engineering students during their transition to the workforce.

Our methodology follows the five-step framework proposed by (Arksey & O'Malley, 2005), which emphasizes iteration, enabling researchers to revisit and refine previous steps. This flexible process, as further supported by, (Peters et al., 2015) to ensure a thorough examination of the literature. We also incorporate enhancements suggested by Levac et al. (2010), which stress the importance of revisiting earlier stages as needed to refine the review process (Borrego et al., 2014). To facilitate transparency and replicability, we include a summary table outlining the objectives and expected outcomes for each stage of the review. This framework serves as both a roadmap for our study and a resource for others conducting similar review.

**Table 1: Stages of ScLR Framework for Exploring Engineering Students' STW Transition**

Stage	Process	Task per the Research Plan
1	<i>Identifying the research question</i>	Define a clear focus on school-to-work transition experiences of undergraduate engineering students.
2	<i>Identifying relevant studies: Database (n = 6)</i>	Comprehensive search on specific databases (ERIC, APA PsycINFO, Web of Science, IEEE Xplore, and EI Village).
3	<i>Selecting studies</i>	Utilizing Rayyan, a software tool designed to support the systematic review process, the studies were chosen according to predetermined inclusion and exclusion criteria.
4	<i>Charting the data</i>	Meticulously examining the data, involving the extraction of essential findings and the identification of recurring themes.
5	<i>Collating, summarizing, and reporting the results</i>	Collecting, condensing, and presenting a summary of the findings. Reporting the number of papers selected for a full abstract and title review.

Based on Arksey and O'Malley's framework, this paper outlines the methodological steps undertaken in this review, providing detailed guidance on conducting scoping reviews. Unlike systematic reviews, scoping reviews take a broader approach, aiming to map the scope and diversity of existing literature. In this study, we applied the inclusion and exclusion criteria outlined below in "stage 3: Study Selection" to guide our review process.

## Methodology:

We conducted this Scoping Literature Review following Arksey and O'Malley's (2005) framework to examine the school-to-work transition experiences of undergraduate engineering students. We constructed and piloted a complete search strategy for one major database (ERIC), adhering to (McGowan et al., 2016) evidence-based guideline for Peer Review of Electronic Search Strategies (PRESS). This guideline underscores the importance of conducting the primary search with a librarian's expertise and peer review by another librarian. To ensure rigor, we engaged three librarians and, in Stage 2, sought input from engineering education graduate students experienced in systematic and scoping reviews. Their insights on library systems, database functionalities, and the Rayyan tool supported our review process. We completed the first three stages and used a PRISMA diagram (*PRISMA Flow Diagram*, 2020) using (*Draw.io*, n.d.) to illustrate the number of studies advancing to the next stages.

### Stage 1: Identify the Research Questions

Building on our previous scoping review of the school-to-work transition for queer engineering students, this current scoping review aims to map the broader literature landscape specifically related to undergraduate engineering students. The guiding research question is: *What is known about the school-to-work transition experiences of undergraduate engineering students?* The primary aim of this review is to determine the current state of scholarly discourse in this area. Following (Premji & Cabugos, 2023) we established three central inclusion criteria to guide the framing of our research question:

1. Literature must focus on undergraduate students.
2. It must address school-to-work transition experiences.
3. It must pertain to students within engineering disciplines.

These three inclusion criteria informed the creation of “concept lines,” as defined by the librarians. A concept line in a search strategy represents a specific search concept, allowing for the testing of various combinations and optimizing the search results. Each inclusion criterion was translated into a concept line, forming the basis for the search strings used in the next phase of the review. Additionally, we applied other inclusion criteria: only peer-reviewed articles in English, published within a defined timeframe, were considered for this review.

### Stage 2: Identify Relevant Studies

We generated the dataset through targeted searches using concept lines in an iterative process, strictly adhering to the central inclusion criteria. Searches were conducted across major databases, including ERIC, APA PsycINFO, Engineering Village, Web of Science, and IEEE Xplore. Search strings were developed based on the concept lines and refined in collaboration with librarians to ensure alignment with the specific terminologies of each database. The review process was managed using Rayyan (Ouzzani et al., 2016), an online tool designed for systematic literature reviews. The concept lines were structured using the PCC framework: P = Population, C = Concept, and C = Context.

**Table 2: PCC Concept with Concept Lines and Search Terms**

<i>Population</i>	Literature must focus on undergraduate students.	("University Student" OR "undergraduate students" OR "college students" OR Student*)
<i>Concept</i>	It must address school-to-work transition experiences.	("school to work" OR "school to career" OR "school-to-work" OR "school to Industry" OR "education to work" OR "college to work" OR "university to work" OR "school to workforce" OR "school to workplace" OR "study to work")
<i>Context</i>	It must pertain to engineering disciplines.	Engineer*

Stage 3: Study Selection

In line with (Bork et al., 2019) this study selection process involved three key phases: title screening, abstract screening, and full-text review. For this paper, we presented the PRISMA flow diagram (Appendix A) to highlight the number of articles selected for full-text analysis. We conducted the title and abstract screening independently, with plans to involve two additional reviewers during the full-text review phase to reduce bias. At each stage, we systematically applied inclusion and exclusion criteria to ensure consistency and rigor, as detailed below in Table 3. At each stage, we applied predefined guidelines to evaluate the articles. If we couldn't confidently exclude a study based on a specific guideline, we marked it as "not sure" and progressed it to the next phase for further review. This approach ensured that no potentially relevant studies were excluded prematurely. We applied a peer-review filter during the search process and utilized the publication date feature to refine the results, ensuring alignment with our review agenda. These steps were instrumental in narrowing our search and retrieving relevant articles. For the scope of the review, we included only articles published between January 2000 and October 2024. We selected the timeframe from January 2000 to October 2024 because students entering the workforce today and in the future were born around 2000. This period allows us to examine how school-to-work transitions have been studied and how these students are being prepared for their careers.

**Table 3: Title/Abstract Screening Guidelines (Inclusion/Exclusion Criteria)**

<i>Relevance:</i>	Is the title/abstract aligned with the focus of this research?
<i>Focus on Population:</i>	Does the study focus on undergraduate students?
<i>Concept of Transition:</i>	Does the title or abstract address school-to-work transitions?
<i>Research Type:</i>	Is this study based on empirical research?
<i>Peer-Reviewed:</i>	Is the article published in a peer-reviewed outlet?
<i>Program Context:</i>	Was the research conducted in the Engineering context?

Stage 4: Charting the data

The charting phase of this scoping review involved systematically extracting, organizing, and synthesizing key information from the selected studies to identify patterns, themes, and gaps in the literature on undergraduate engineering students' experiences of school-to-work transitions. A structured data-charting form was developed iteratively, capturing study characteristics, participant demographics, research focus, methodologies, findings, and gaps or limitations. For the scope of this paper, we report on preliminary coding a subset of data, consisting of 8 full papers out of a total of total 54, which were randomly selected and charted during the first stage of this study. This data extraction was conducted independently, reviewing a subset of studies to validate the form. To maintain consistency, another researcher reviewed the findings and validated the chart based on the data collected. The consolidated data was designed to provide a landscape scan of undergraduate engineering students' school-to-work transition experiences in the United States.

Stage 5: Summarizing the findings

In the final stage of the scoping review, the findings will be collated, summarized, and synthesized to create a comprehensive overview of the literature on undergraduate engineering students' school-to-work transitions. This step will systematically analyze the charted data to uncover recurring themes, identify key factors influencing transitions, and highlight gaps in the research landscape.

**Main Findings:**

To date, we have reviewed 355 unique articles on school-to-work transition research for undergraduate engineering students, identifying 54 relevant studies. From these, 8 articles were randomly selected and coded, as detailed in Appendix B, with a PRISMA diagram in Appendix A summarizing the study progress. To ensure rigor, we replicated the search every 4 to 8 weeks, observing consistent results across databases. Critical insights emerged, including the challenges students encounter in acquiring non-technical skills

essential for professional environments, the pivotal role of internships and cooperative education programs in aligning academic experiences with workplace expectations, and the insufficient attention given to the experiences of underrepresented groups in engineering. A preliminary PRISMA diagram reflects the search results and review process. Moving forward, we will conduct citation tracking to identify additional literature not captured in the initial search, which will also be screened and subjected to full-text analysis. The iterative nature of our methodology allows us to revisit earlier steps as needed.

### Conclusion:

This scoping review outlines the systematic steps undertaken to conduct a literature review on the school-to-work transition for undergraduate engineering students. Our findings present preliminary data based on the study's progress up to the fourth stage of the review process. Future steps will include categorizing and organizing these findings into a taxonomy table, which will group studies into thematic areas such as identity intersections, professional preparedness, and career development. These findings will offer actionable insights for educators, administrators, and industry stakeholders to support engineering students' transitions. They will also guide future research by addressing literature gaps. Visual tools like taxonomy tables and graphs will effectively present trends.

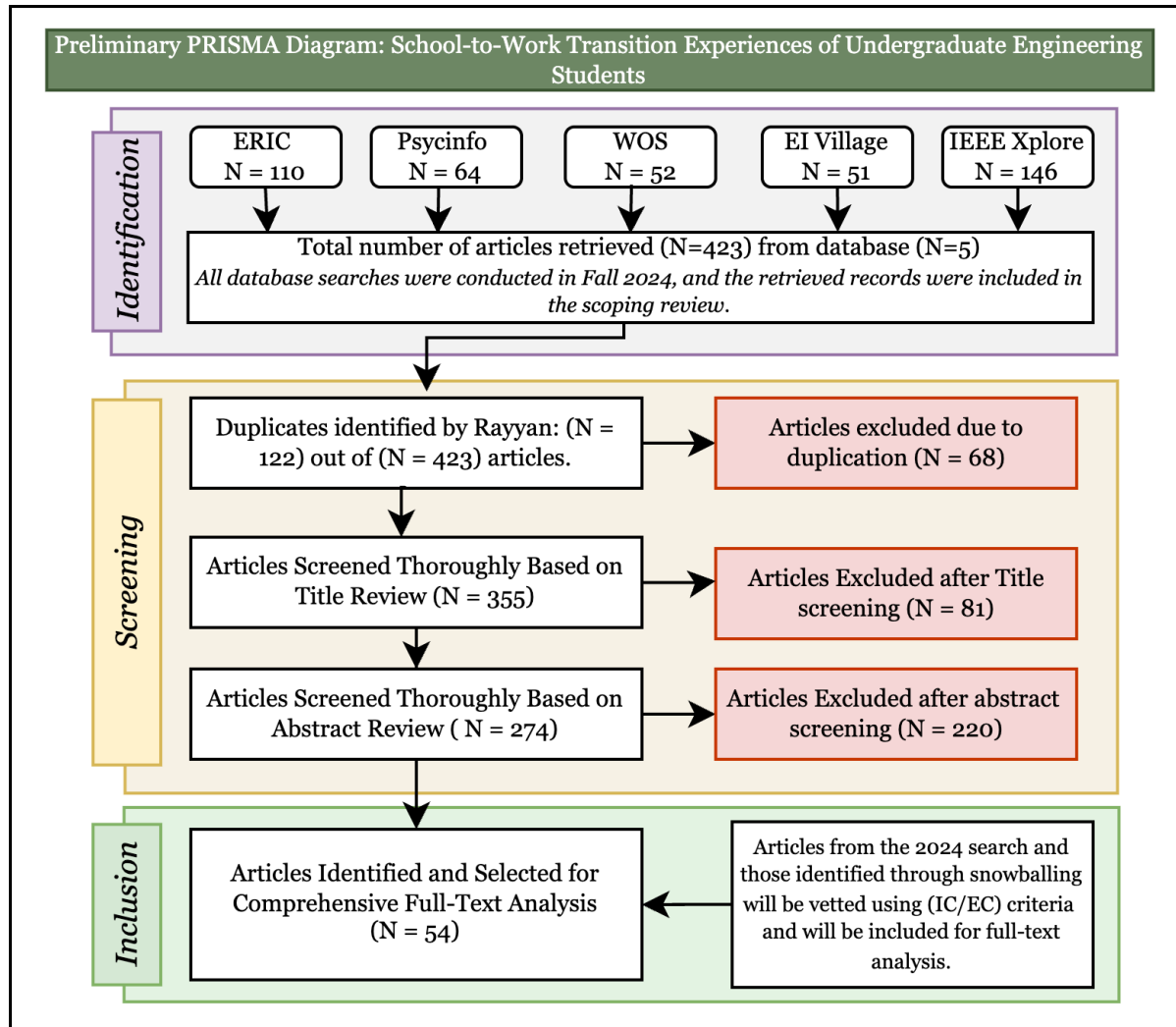
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Appendix A: Preliminary PRISMA Diagram: Scoping Review on the School-to-Work Transition Experiences of Undergraduate Engineering Students



Appendix B: Preliminary Coding sheet for 8 Papers Based on Collected Data

Authors Year, Location	Population	Methodology	Scope	Main Findings	Theory
(Ford et al., 2021), United States	132 recent engineering graduates (52 females, 67 males, diverse racial backgrounds)	Qualitative; thematic analysis	Transfer of communication skills to the workplace	Communication challenges arise from the complex, situated nature of workplaces; classroom prep is insufficient for nuances.	Rhetorical Genre Theory, Activity Theory
(Perron et al., 2006), France	123 graduates transitioning to work	Mixed methods; longitudinal model	Multi-theoretical model of school-to-work transition	Comprehensive model integrates factors	NA

				influencing transitions, highlighting complexity.	
<i>(Paretti et al., 2017), United States</i>	30 engineering students (20 ME, 10 general engineering )	Mixed methods; collaborative research	Impact of capstone design courses on workplace transition	Capstone experiences are critical for industry preparedness, aiding smoother transitions.	Community of Practice (CoP)
<i>(David Lutz et al., 2017), United States</i>	12 recent ME graduates (9 male, 3 female; diverse racial backgrounds)	Qualitative; interviews, observations	Learning experiences of recent graduates transitioning to the workplace	Misalignment between academic prep and workplace demands; emphasizes key workplace learning experiences.	Workplace Learning, Situativity
<i>(Kramer-Simpson et al., 2015), United States</i>	8 students (6 former students, 2 interns)	Mixed methods; interviews, observations	Impact of client projects on workplace preparedness	Client projects enhance communication, audience awareness, and professional integration; organizational understanding remains limited.	Situated Learning (Legitimate Peripheral Participation)
<i>(Stivne &amp; Jungert, 2010), Sweden</i>	20 students (11 female, 9 male)	Qualitative; longitudinal	Employability skills and job readiness	Key skills include problem-solving, time management, stress management; mathematics and subject knowledge are valuable.	Employability
<i>(Sheppard et al., 2011), United States</i>	Cohort 1: 30; Cohort 2: 500	Mixed methods	Early career experiences related to undergraduate education	Co-ops and internships provide industry insights; economic factors affect career paths; workplace differs from	Social Cognitive Career Theory



<i>(Saud &amp; Nyamapfene, 2022), United Kingdom</i>	6 IEP graduates (4 professionals, 2 PhD students)	Qualitative; semi-structured interviews	Early career experiences of IEP graduates	academic processes. IEP's balance of theory and practice equips graduates with technical and soft skills for growth.
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