

## The Process of Applying to Graduate School as an Undergraduate: A Scoping Literature Review

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# **The Process of Applying to Graduate School as an Undergraduate: A Scoping Literature Review**

## **Abstract**

As engineering graduate programs increasingly adopt holistic admissions strategies to foster diversity and equity, understanding the nuanced experiences of applicants and the evaluation priorities of admissions committees becomes critical. This scoping literature review (ScLR) explores research published since 2000 to examine how the admissions and application processes for engineering graduate school are structured, perceived, and evaluated. Through a systematic search across multiple databases, 16 peer-reviewed publications were selected and thematically analyzed into three domains: admissions process, application package components, and program fit. The review reveals significant disparities in access to admissions information, debates around the predictive validity and equity implications of GRE scores, and inconsistencies in how statements of purpose are assessed. It also highlights emerging practices, such as holistic review rubrics and bridge programs, which aim to align applicant strengths with program goals while reducing systemic barriers. Findings demonstrate the importance of transparent communication between faculty and applicants, the value of mentorship programs for underrepresented students, and the need for admissions models that account for diverse pathways to graduate education. This review concludes with recommendations for future research to support evidence-based reforms in engineering admissions policies and enhance institutional capacity to assess program fit and student potential more equitably.

## **Introduction**

The graduate school application process varies widely, not only by university but also by individual programs within a university. In the field of engineering, institutions have comprehensively reviewed their admissions processes to ensure equity for applicants and to identify qualified students for faculty labs. Studies on admissions tools from the perspective of graduate admissions committees aim to create a fair and equitable selection process. These studies also encourage further investigations into specific components, like the use of the GRE in predicting student success [1, 2, 3, 4]. Since 2000, evaluating applicants with both quantitative metrics and qualitative factors has been a major focus [1, 3, 4, 5]. Metrics such as the GRE and GPA serve as indicators of potential success, along with measures like research productivity and publication records [4, 6]. This dual approach ensures a selection process that captures both academic readiness and the potential for innovation and contribution to the field [6].

The objective of this scoping literature review (ScLR) is to identify existing gaps in the literature regarding what is currently being discussed pertaining to the admission and application process. Additionally, it serves the purpose of proposing recommendations for future research efforts related to the admission and application processes of engineering graduate programs to build on these comprehensive reviews. By highlighting areas that have been previously explored and uncovering those that warrant further investigation, this ScLR aims to enhance our understanding of the selection process and thereby improve the efficacy of admissions practices within engineering graduate programs.

## Methods

### *Scoping Literature Review (ScLR) Protocol*

The Scoping Literature Review (ScLR) protocol [8] was utilized for this literature review, following these steps: (1) identify the research question, (2) identify relevant studies, (3) select studies, (4) chart the data, and (5) collate, summarize, and report the results, as detailed in Table 1. This approach was deemed appropriate due to it fulfilling the three of the four common reasons for the review to take place: (1) examine the range of research activity, (2) summarize research findings, and (3) identify research gaps in literature [8]. The campus engineering education librarian was consulted for assistance in setting the boundaries and ensuring comprehensive coverage of relevant literature to ensure a thorough and well-defined scope for this review.

**Table 1. Scoping Literature Review (ScLR) Protocol Stages**

| ScLR Stage     | 1) Identify Research Questions                  | 2) Identify Relevant Studies             | 3) Study Selection       | 4) Charting the Data                               | 5) Summarize & Report Results                                 |
|----------------|-------------------------------------------------|------------------------------------------|--------------------------|----------------------------------------------------|---------------------------------------------------------------|
| <i>Goal</i>    | Determine scope of project and focus for search | Determine relevant sources of literature | Define screening process | Coding the literature and record vital information | Condense and organize all information collected into a report |
| <i>Outcome</i> | Inclusion and exclusion criteria                | References for study                     | Eligible references      | Literature data for analysis                       | Identify current literature trends and potential gaps         |

### *Stage 1) Identify Research Questions*

The purpose of the study was to understand the current research on the application process to engineering graduate school. The research question that guided the search was the following:

*What research has been conducted since 2000 regarding the process of applying to graduate school?*

This question was intentionally designed to have a broad scope, allowing for a comprehensive exploration of existing literature.

### *Stage 2) Identify Relevant Studies*

Five main inclusion criteria were established to identify relevant literature for this study: (1) admission process, (2) application process, (3) graduate school, (4) engineering, and (5) STEM. Initial exclusion criteria were developed to focus the scope on research articles rather than guidebooks and toolkits. Guidebooks and toolkits were eliminated due to the broad generalization of the application process. These criteria were applied using EBSCOHost databases, specifically Academic Search Complete and ERIC. The selection of these two databases was made in consultation with the engineering education librarian, who provided valuable expertise in designing precise search queries and identifying the most relevant databases

for this research, maximizing the resources available through the university's access. In addition, two databases specific to engineering education were also used: the American Society for Engineering Education (ASEE) Peer Document Repository and the Journal of Engineering Education (JEE) via Wiley Online Library. These databases were selected because the literature search focuses on the field of engineering education.

### *Stage 3) Study Selection*

To identify studies, we used the following search query:

Admission process or application process AND graduate school or graduate students or doctoral students or masters students AND engineering or stem

**Table 3. Screening Levels**

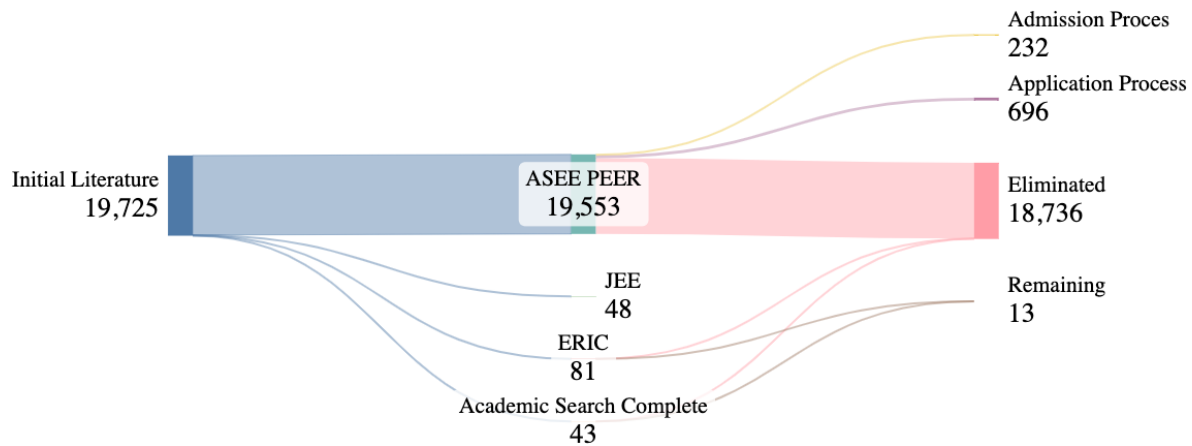
| Screening Level     | Definition                                                                |
|---------------------|---------------------------------------------------------------------------|
| Database search     | Utilizing the database search function to restrict the publications shown |
| Initial Screening   | Reviewing the abstract and keywords of the publications to eliminate      |
| Secondary Screening | Reviewing the overall publication to eliminate                            |

**Table 4. Inclusion Criteria Boundaries**

| Inclusion Criteria     | Definition                                                       | Implementation                  |
|------------------------|------------------------------------------------------------------|---------------------------------|
| Publication Type       | Published in an academic journal                                 | Database search restriction     |
| Publication Year       | Published between January 1st, 2000 and June 30th, 2024          | Database search restriction     |
| Publication Language   | Published in English                                             | Database search restriction     |
| Institutional Level    | Higher Education institutes of undergraduate and graduate levels | Initial and Secondary Screening |
| Institutional Location | United States of America                                         | Initial and Secondary Screening |

There were two levels of screening that took place as seen in Table 3 with details pertaining to how these screening levels were implemented seen in Table 4. The database search restriction, seen in Table 3, was applied to each database and resulted in: (1) 43 publications from Academic Search Complete, (2) 81 publications from ERIC, (3) 19,553 publications from ASEE PEER, and (4) 48 publications from JEE. This initial literature search can be seen in Fig 1. Database Search Results below.

**Fig. 1. Database Search Results**



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Due to the large number of publications from the initial search from ASEE PEER, the search was split into two different search queries utilizing quotation marks to collect exact phrase matching in the database:

- 1) ASEE PEER **Admission** Process: “Admission process” or “application process” AND graduate school or graduate students or doctoral students or masters students AND engineering or stem
- 2) ASEE PEER **Application** Process: “Admission process” or “application process” AND graduate school or graduate students or doctoral students or masters students AND engineering or stem

This specialized search resulted in: (1) 232 publications from the ASEE PEER Admission Process and (2) 696 publications from the ASEE PEER Application Process.

An initial screening to review the abstracts and keywords of each publication took place as the secondary step in the study selection process. This step, as seen in Table 3, resulted in: (1) 9 publications from Academic Search Complete, (2) 14 publications from ERIC, (3) 9 publications from ASEE PEER Admission Process, (4) 6 publications from ASEE PEER Application Process, and (5) 6 publications from JEE. This step can be seen in Fig 2. Initial Screening Results below.

**Fig. 2. Initial Screening Results**

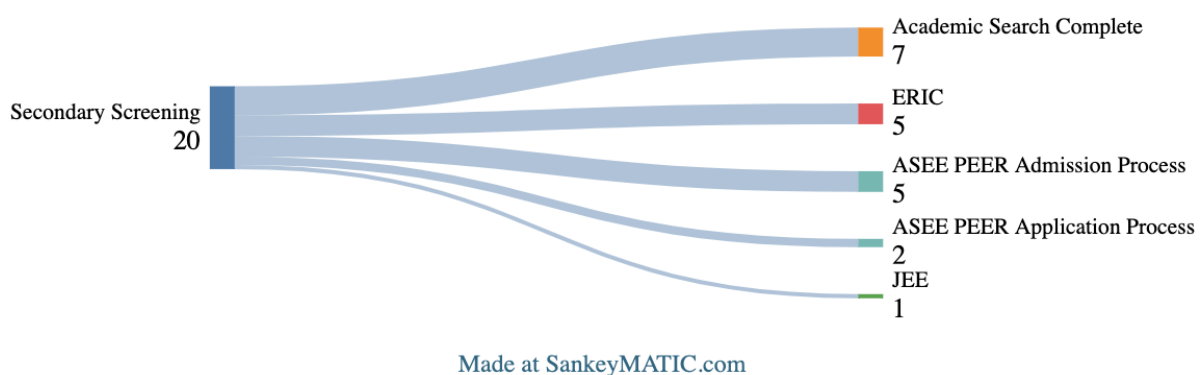


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**Table 5. Exclusion Criteria Boundaries**

| Exclusion Criteria      | Definition                                                                                                                       | Implementation                                                         |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Duplicates              | Appearing more than once within a single database and between all databases                                                      | Database search restriction, initial screening and secondary screening |
| Guidebooks and Toolkits | Explicitly stated as a general guide for all graduate school applications                                                        | Secondary Screening                                                    |
| Brochures               | Explicitly formatted as a non-academic journal article                                                                           | Secondary Screening                                                    |
| Returner Students       | Explicitly written about students who did not immediately enter graduate school after completion of their undergraduate degree   | Secondary Screening                                                    |
| Reports                 | Explicitly stated as a report consisting of a majority of metrics restricted to a singular institution, organization, or program | Secondary Screening                                                    |

A secondary screening to review the overall publication in depth took place as a tertiary step in the study selection process. This final step, as seen in Table 3 using the exclusion criteria detailed in Table 5, resulted in: (1) 7 publications from Academic Search Complete, (2) 5 publications from ERIC, (3) 5 publications from ASEE PEER Admission Process, (4) 2 publications from ASEE PEER Application Process, and (5) 1 publications from JEE. A final visualization of the search appears below in Fig 3. Secondary Screening Results. After removing the duplicates between all of the databases, only 16 publications remained.

**Fig. 3. Secondary Screening Results**

#### Stage 4) Charting the Data

A thematic analysis was used to find 3 broad categories amongst the 15 articles: *Admissions process*, *application package*, and *program fit* as seen in Table 6 [9]. The admissions process category includes discussions on the overall admissions procedure and the evaluation of scoring methods used in admissions. The application package category involves the components of an application; within this review, the GRE and the statement of purpose were the primary focus. Program Fit refers to the ways researchers discuss how students can integrate into a program, either through advisor-advisee pairing or by using prediction models.

**Table 6. Data Display**

| Category                  | Secondary Category                       | Title                                                                                                                                                             | Authors                                                                                                                                                                                    | Year |
|---------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Admissions process</b> | <i>Access to information</i>             | Insights and strategies for improving equity in Graduate School Admissions                                                                                        | Cadena, M. A., Amaya, C., Duan, D., Rico, C. A., García-Bayona, L., Blanco, A. T., Agreda, Y. S., Villegas Rodríguez, G. J., Ceja, A., Martínez, V. G., Goldman, O. V., & Fernandez, R. W. | 2023 |
|                           |                                          | Hispanic/Latinx STEM Majors Applying to Graduate School: The Role of Family, Peers, and Undergraduate Research Programs in Facilitating Community Cultural Wealth | Monarrez, A.,; Frederick, A. , Morales, D. X., Echegoyen, L. E., Wagler, A.                                                                                                                | 2024 |
|                           |                                          | “You’re just not what they’re looking for”: An intersectional collaborative autoethnography exploring pathways to engineering design doctoral programs            | Cantilina, K., & Loweth, R.                                                                                                                                                                | 2022 |
|                           |                                          | The fallacy of “there are no candidates”: Institutional pathways of Black/African American and Hispanic/Latino doctorate earners                                  | Fleming, G. C., Patrick, A. D., Grote, D., Denton, M., Knight, D., Lee, W., Borrego, M., & Murzi, H.                                                                                       | 2023 |
|                           | <i>Evaluation of the scoring process</i> | Review of Racially Equitable Admissions Practices in STEM Doctoral Programs                                                                                       | Roberts, S. F., Pyfrom, E., Hoffman, J. A., Pai, C., Reagan, E. K., & Light, A. E.                                                                                                         | 2021 |
|                           |                                          | Engaging faculty in shifting toward Holistic Review: Changing graduate admissions procedures at a land-grant, Hispanic-serving Institution                        | Wong, A. A., Marrone, N. L., Fabiano-Smith, L., Beeson, P. M., Franco, M. A., Subbian, V., & Lozano, G. I.                                                                                 | 2021 |
|                           |                                          | Work in Progress: A Holistic PhD Admissions Rubric--Design & Implementation                                                                                       | Barker, S., & Clobes, A.                                                                                                                                                                   | 2021 |

|                            |                                |                                                                                                                                                                           |                                                                                        |      |
|----------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------|
|                            |                                | Work in Progress: Aligning What We Want With What We Seek: Increasing Comprehensive Review in the Graduate Admissions Process                                             | Stiner-Jones, L., & Windl, W                                                           | 2019 |
| <b>Application package</b> | <i>GRE</i>                     | A Model for Holistic Review in Graduate Admissions That Decouples the GRE from Race, Ethnicity, and Gender                                                                | Wilson, M. A., Odem, M. A., Walters, T., DePass, A. L., & Bean, A. J.                  | 2019 |
|                            |                                | Faculty Perception of the GRE as a Graduate Admission Requirement                                                                                                         | Paul, A., & Moyaki, D., & Morelock, J. R., & Lewis, R. S.                              | 2023 |
|                            |                                | The GRE in Admissions: Examining the Evidence and Arguments                                                                                                               | Gehringer, E. F.                                                                       | 2024 |
|                            | <i>Statement of Purpose</i>    | The statement of purpose in graduate program applications: Genre structure and disciplinary variation                                                                     | Samraj, B., & Monk, L.                                                                 | 2008 |
|                            |                                | The fisk-Vanderbilt Master's-to-ph.D.. bridge program: Recognizing, enlisting, and cultivating unrealized or unrecognized potential in underrepresented minority students | Stassun, K. G., Sturm, S., Holley-Bockelmann, K., Burger, A., Ernst, D. J., & Webb, D. | 2011 |
| <b>Program Fit</b>         | <i>Advisor-advisee pairing</i> | Doctoral advisor-advisee pairing in STEM fields: Selection criteria and impact of faculty, student and departmental factors                                               | Joy, S., Fen Liang, X., Bilimoria, D., & Perry, S.                                     | 2015 |
|                            | <i>Prediction Models</i>       | Proxies for success: How the application process correlates to Phd pursuit for a small diversity research program                                                         | Whittington, D., Wallace, L. E., & Shadding, C. R.                                     | 2017 |
|                            |                                | Predicting graduate student performance – A case study                                                                                                                    | Nie, J., & Hossain, A.                                                                 | 2020 |

## Results

### Stage 5) Summarize & Report Results

The investigation into graduate school admissions focuses on access to information, scoring evaluations, application components, and program fit. Faculty and research staff largely shape the admissions narrative, highlighting the importance of access to information through mentors and initiatives like the Científico Latino - Graduate Student Mentorship Initiative, which aids underrepresented groups such as Hispanic/Latinx students and women of color. Structural changes, such as diverse admissions committees and the removal of financial barriers, complement these efforts to ensure equitable access. Simultaneously, the evaluation of scoring systems has evolved toward alternative approaches, emphasizing program alignment and

considering alternatives to traditional metrics like GRE scores, particularly in STEM fields. This approach addresses demographic disparities and aims for comprehensive assessments. Additionally, the roles of GRE scores and personal statements are examined, with initiatives like bridge programs working to clarify application processes. Understanding advisor-advisee compatibility and developing prediction models tailored to specific programs are also vital for aligning admissions with unique program needs. This analysis offers insights into current challenges and what suggested pathways exist for more inclusive and effective admissions practices.

### **Admission Process**

The narrative regarding graduate school is predominantly shaped by faculty and research staff. Two primary categories emerge in discussions about the admission process: access to information and the evaluation of the scoring system.

*Access to Information:* A study on Hispanic/Latinx undergraduate student experiences with the graduate school application process found that access to information through research mentors and peers significantly aided students in navigating the application process [10]. This finding was found to be similar pertaining to women of color here mentors and career counselors can provide additional support in applying to graduate programs [11]. Additionally, a volunteer group, Científico Latino - Graduate Student Mentorship Initiative (CL-GSMI), which aims to provide resources on the graduate school admissions process for Latino students, reported similar findings, highlighting one on one mentorship as a critical resource for personalized guidance [12]. CL-GSMI further suggested that online resources, such as example applications, webinars, a professional virtual network, and mock graduate school interviews, could further support students in understanding the nuances of applying to graduate school [12]. While access to information may be considered an initial step in demystifying the application process for potential graduate students, structural changes such as creating bridge programs, forming admissions committees with diverse perspectives, and removing financial barriers should occur concurrently [3, 13]. Minority serving institutions have been found to make contributions to the number of Black graduates, with 12% of earned PhDs for Black students coming from HBCUs and one-third of earned engineering bachelors degrees for Latino undergraduates students coming from HSIs [14]. Students deserve a fair opportunity to develop their application packages, and equally, they deserve a fair evaluation by admissions committees. Overall, emphasizing the provision of comprehensive information about various aspects of the application and admission process is deemed essential for increasing the retention of minority students from undergraduate to graduate degree attainment.

*Evaluation of the Scoring Process:* Admissions have been redefined over the past decade to emphasize program fit rather than selecting the top applicants based on GPA [4, 15]. This new approach has prompted numerous studies to evaluate graduate admissions, with the current study focusing exclusively on STEM graduate programs. To explore ways to make admissions processes changes, the researchers reviewed a case study and identified three key findings [4]. First, they emphasized syncing faculty goals for admissions by aligning shared values, committing to improvement, engaging in consensus-building conversations, and viewing the redesign of admission protocols and evaluation criteria as opportunities for growth. Second, they highlighted the importance of transforming the review process by rethinking pathways from

student to professional, broadening the understanding of servingness, and reevaluating which assets are valued and necessary. Third, they advocated for ensuring equity in high-stakes reviews, strengthening collaborations within the university, providing direct support for underrepresented students, and committing to cultural humility and departmental reflection on diversity, equity, and inclusion [4]. In contrast, the scoring process has relied heavily on GRE scores to determine program fit [3]. However, research over the past 25 years has examined the historic use of the GRE and considered potential metrics to replace it, given its correlations with race, gender, and socioeconomic status [3, 5]. Alternatives proposed include using a composite score that combines the GRE with factors such as undergraduate GPA, research experience, advanced coursework or degrees, conference presentations, and past publications. Additionally, they discussed cautiously employing personality scoring using interviews and the “big-five” personality scoring system as potential supplementary evaluation tools [3]. The “big-five” personality scoring system is defined as using the five traits of extraversion, agreeableness, openness, conscientiousness, and neuroticism [3]. This personality scoring system can be seen as a growth mindset scoring system, adapted from the Fisk-Vanderbilt comprehensive admission approach, in other university systems to measure things such as positive self-concept, support person availability, leadership/community involvement, perseverance, and more [6]. The difference in rubrics, as suggested by one study, is only meant to be a reminder of practices that can be enacted and that it does not work for all programs [15]. The shift towards alternative admissions metrics in the past decade has led to an emphasis on program fit and prompted multiple studies, particularly in STEM graduate programs, to explore more inclusive evaluation processes, including aligning faculty goals, transforming review criteria, and considering alternatives to GRE scores that address equity and diversity [3, 4, 5, 6, 15].

### **Application Package**

The application package includes many different components but the two most discussed in research were the GRE and the statement of purpose.

*GRE:* Over the past five years, engineering faculty admissions committees have discussed the impact of removing the GRE from admissions criteria [3, 5, 16]. Faculty have argued that the GRE is a limiting datapoint for students that cannot afford to invest in and take the GRE [16]. Meanwhile, other STEM programs are already defining student success using applicant GPAs and GRE scores with concerns for students succeeding in course completion [17]. Demographic equity concerns have been raised regarding the use of the GRE score in application packages due to demographic differences in scores on the quantitative and verbal reasoning sections of the GRE [5]. One approach to addressing these concerns is to create an admissions committee that includes diverse perspectives [4, 5]. The case study on the review of admissions processes found that involving faculty members who were new to the admissions process brought fresh perspectives [4]. These newer faculty members helped recognize student strengths by considering the limitations the students had faced within their institutional systems, rather than focusing on their lack of experience [4]. The study on decoupling the GRE found that committees lacking awareness of unconscious bias or clear scoring criteria for a diverse applicant pool can develop internalized preferences, affecting faculty interactions with prospective students [5]. This led researchers to emphasize that holistic review should involve key stakeholders in admission process changes [5]. The researchers recommend bias training,

collaborative scoring reviews, and introducing new committee members to ensure diverse perspectives and prevent dominance in discussions [5].

In addition, researchers have argued that a multitiered approach need not increase the workload of an admissions committee and can enhance the diversity of the applicant pool [5]. The increase in admissions from certain countries and identity groups resulting from the elimination of the GRE could motivate staff and faculty to develop more tailored resource packages for graduate students from these groups [5]. Overall, the use of the GRE as a metric to determining student admission to graduate programs can be seen in an extensive and detailed pro- and anti-format by Gehringer [18]. This approach summarized that research calls for viewing admissions as a holistic review which is defined in relation to GRE scoring as reviewing students using a combination of coursework, community involvement, research experience, GRE and GPA, and future goals in regards to completing a graduate degree [18].

*Statement of Purpose:* The introduction of bridge programs has already been discussed in prior sections concerning creating access to information for underserved populations of students. The personal statement is the starting point for the Fisk-Vanderbilt Master's to Ph.D. bridge program, where they review students' materials to help create their application packages [13]. Although these statements can vary due to differences in what programs ask students to write about, this variation can impact how bridge programs advise students [19]. Providing a transparent explanation of what programs seek in student statements can give students a better understanding of what their application statements should entail [19].

### **Program Fit**

There are nuances to each program and these nuances have been discussed in research in terms of advisor-advisee compatibility and developing a prediction model for success in admissions and graduation rates.

*Advisor-Advisee Pairing:* The advisor-advisee pairing process is important for fostering student success and successful and fast degree completion in doctoral studies [20]. The researchers found that students considered available funding, areas of research, personality, ability to help their students, career prospects, visibility of the faculty, credibility as a scientist, commitment to research, style of interpersonal interactions, career stage, availability, and relationship comfort and collegiality[20]. They determined that faculty considered credentials, ability to contribute to research, influence of student nationality, eligibility for funding, linguistic capabilities, ability to navigate the academic system, and attitude towards graduate education [20]. There were also departmental factors that had to be considered outside of faculty and student considerations such as prevalent pairing practices, quota or limits on student numbers, and rewards for advising [20]. There are many implications that their study found such as enhancing clarity on both the department policy and faculty transparency on what they are looking for in potential students and advisees [20].

*Prediction Models:* Prediction models are highly desirable for any program. However, with the GRE being challenged as a standard for success and admissions being redefined, prediction models cannot be standardized between master's and doctoral programs. In a case study involving master's students in an applied science program, it was found that a holistic approach

is preferred for master's admissions to their program, which utilizes a three-step process to compare applicants [21]. The three-step process to compare applicants consisted of reviewing the applications, faculty recommendation letters, and the interviews with the program director [21]. The definition of holistic admissions within the article must fall within three major categories: prior academic performance, communication skills, and other soft skills [21]. The prior academic performance is defined as undergraduate GPA: undergraduate GPA on technical/engineering courses, ranking of the institution, and merit: awards, scholarships, and achievements [21]. Communication skills are defined as English proficiency and writing skills [21]. The other soft skills are defined as interview and leadership skills, work and research experience, community engagement, and recommendation letter contents [21]. Furthermore, prior academic performance, communication skills, and recommendations were considered the most important factors for their master's program [21].

Conversely, for a PhD program, it was determined that all students must meet the minimum qualifications to be successfully admitted, but there was no significant difference in GPAs among the admitted students [22]. The researchers proposed that a high commitment to completing a PhD, previous research experiences, self-efficacy, and science identity were key predictors of success in a PhD program [22]. Researchers also emphasize that intersectional traumas impact how skills and competencies are framed in applications, and that applicants of color have been socialized to present their skills as valuable in different ways compared to their white peers. [11]. The factors that impact student pathways to graduation between master's and doctoral programs are markedly different; therefore, graduate studies cannot group both master's and doctoral admissions factors into a single student prediction model.

## **Limitations**

### *Inclusion and Exclusion Criteria*

The search was intentionally broad to capture a comprehensive view of the overall application process for engineering graduate schools. Specific terms related to application components—such as GRE, GPA, Statement of Purpose, Research Statement, Teaching Statement, and Diversity Statement—were intentionally excluded from the ECSCOhost and ERIC database searches. This approach aimed to provide a broad perspective on the application process from the viewpoint of graduate students. Upon the suggestion of the engineering education librarian, the search was expanded to include keywords associated with the admission process. This adjustment was made to account for the retrospective descriptions provided by graduate students, who often discuss their experiences in applying to graduate school in the past tense. One limitation of this approach is the potential for missing studies that focus exclusively on specific application components. By not including these narrower terms, the search may have overlooked detailed insights related to individual parts of the application package. Additionally, the broad search criteria could lead to a diverse range of studies, making it challenging to draw precise conclusions about specific elements of the application process.

### *Journal Search*

Other databases, such as Web of Science, were considered; they yielded no results due to the restrictive nature of their search functionalities. This limitation may have restricted the breadth of the literature reviewed. These sources might offer targeted insights into engineering education

but were excluded from this search due to feasibility and scope considerations. A key limitation of this approach is the potential omission of relevant studies that may reside outside the selected databases. By not including these additional sources, the review may not fully capture the nuances and specific discussions occurring in niche areas of engineering education research. Additionally, the focus on a broad search strategy might lead to an overemphasis on general themes while underrepresenting specific, detailed research findings pertinent to the application and admissions processes.

## **Discussion and Future Work**

### *Equitable Regular Review of Application Package Criteria*

#### *Review of Current Metrics in Admissions:*

Institutions have begun conducting equity reviews of engineering application metrics, such as the GRE and GPA, focusing on the perspective of admissions administration [6]. This analysis includes factors such as qualifying exam performance, grants received, and student ranking [3]. Current methods aim to create a more balanced assessment by: using composite scores of the GRE and GPA rather than relying solely on standardized test scores [3], incorporating personality scoring to understand how applicants may interact within a cohort and program [6], and adopting a hybrid holistic approach to application review, evaluating components in parts and sub-committees [5]. Hurdles for implementing these newer metrics have been discussed by adding in bias training [5]. Future directions can explore how current methods and training of admissions committees have aided in the matriculation.

*Defining Holistic Admissions Review:* In the broader STEM graduate education field, there has been a comprehensive review of equitable admissions practices, particularly focusing on racial minorities [6]. Researchers have proposed various steps to make the application and admissions process more equitable [3, 4, 5, 6]. The following alternative methods of application review have been introduced as holistic: maintaining the GRE as an admission metric while acknowledging its correlation with race, gender, and socioeconomic status [3, 5], emphasizing program fit over GPA/GRE scores by positively scoring students that align with the program mission, values, and goals [4], and implementing models like the “big-five” personality scoring system to focus on growth mindset traits [6]. However, it is insufficient to merely adopt these methods; they require ongoing review to ensure sustained racial, gender, socioeconomic, and generational equity.

### *Communication of Application Components*

*Peer and Mentor Guidance:* Prospective engineering graduate students often seek guidance from their peers or mentors when preparing their application packages. The studies that emphasized the importance of access to information suggested or found that peer and mentor guidance affected student perceptions of applying to graduate school [10, 11, 12, 14]. Programs like CL-GSMI provide a structured and personalized approach to mentorship [12]. This mentorship can cover topics such as application components, examples of successful applications for specific programs, and personalized guidance, assisting potential applicants in formatting their application packages effectively. Future research should explore the impact of mentorship on application preparation by defining what constitutes quality mentorship for students and

examining how programs like CL-GSMI measure the success of students' application submissions. Although this topic was beyond the scope of this literature review and not a major finding, it represents a future direction for the field.

*Faculty Recruitment:* Faculty recruitment of applicants involves ensuring transparency in both application requirements and communications with prospective students. While program websites typically outline the basic requirements, additional details—often referred to as the hidden curriculum—can significantly enhance an application but are not always visible [12]. In disciplines like economics, transparent faculty communication about key admissions factors supports fair practices, helping students tailor applications to meet committee expectations [7]. This transparency allows prospective students to better tailor their application packages based on what faculty advisors are looking for such as grades, GRE score, completed courses, personal statement, personality traits, and extracurriculars [7]. The advisor-advisee pairing process, as currently communicated, is limited and future research can investigate how other departments determine pairings [20]. Improving transparency in identifying recruiting faculty and understanding their needs, and displaying this information on graduate school websites, can further strengthen the recruitment processes.

*What Faculty Seek vs. What Committees Seek:* Case studies show that faculty members may value applicant efforts more than standardized test scores [4]. Although faculty can communicate their values, these don't always align with the admissions committee's priorities [4]. Certain programs provide specific guidelines or templates for application components, such as academic statements and personal statements, aiding applicants [23]. Findings hint that transparent communication from admission decision-makers can lead to more effective and targeted efforts by prospective graduate students when curating their application packages. As a future direction, engineering programs could benefit from improved communication between faculty who are recruiting students and admissions committees who are admitting students. Similar research could be conducted to assess if this practice is effective in engineering and how students are preparing their application packages with the knowledge that certain aspects will be weighted more heavily.

## **Concluding Thoughts**

This ScLR underscores the urgent need for ongoing evolution and transparency in graduate admissions processes, particularly in STEM fields. The role of faculty in shaping students' perceptions and the application narrative is pivotal, yet complex, as it intersects with institutional policies and committee evaluations. The findings highlight the impact that access to information, through mentors and peer networks, has on applicants, especially from underrepresented groups. Structured mentorship programs and online resources emerge as critical tools in demystifying the application process. However, structural changes, such as bridge programs and diversified admissions committees, must simultaneously address systemic barriers to achieve comprehensive equity.

The shift from traditional metrics towards a holistic evaluation process acknowledges the limitations of metrics like the GRE, which may disproportionately affect applicants based on race, gender, and socioeconomic status. Programs are gradually adopting composite metrics and

innovative approaches like personality scoring to emphasize program fit. The continuous reevaluation of these processes will be essential to ensure that admissions committees align their practices with the goals of their programs. Diverse application components, particularly the GRE and statements of purpose, remain central to admissions discussions. The trend towards removing or re-evaluating the GRE highlights an increasing awareness of its limitations. Diverse perspectives within admissions committees are essential for mitigating biases and recognizing the varied strengths of applicants. Similarly, standardizing transparency in expectations for statements of purpose could lead to more equitable assessments. Understanding advisor-advisee compatibility and developing prediction models for student success are crucial yet intricate aspects of the admissions process. Institutions must strive for clarity in pairing practices and align faculty expectations with student qualifications.

This review suggests several future research directions, including an investigation into the effectiveness of mentorship in application preparation, exploring more evaluation metrics, and enhancing faculty-student communications. Regular reviews of admissions criteria, integrating peer guidance, and addressing hidden curricula will be important steps in fostering an equitable admissions landscape. While strides have been made toward more equitable admissions, there is a continuous need for reflective practices and innovative strategies to fully realize the potential of diverse graduate student cohorts in STEM.

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