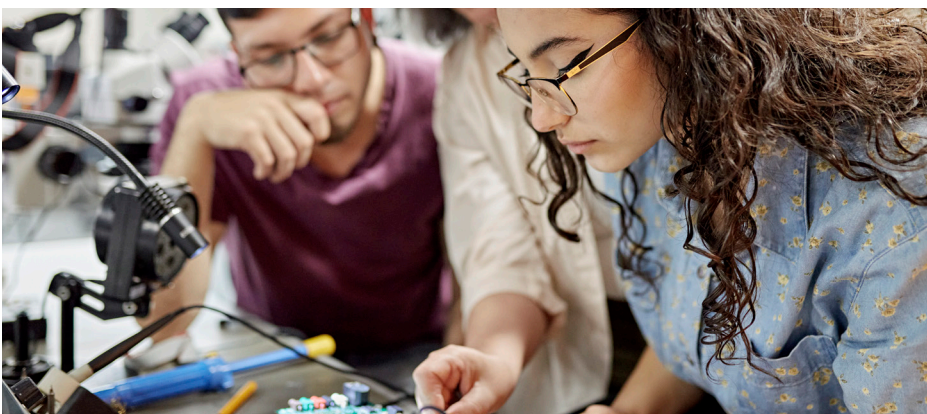




The University of Texas at Austin National Center for STEM Education



Optimizing Teacher Residencies in Texas: Considerations for Secondary STEM Candidates

2024 Report from the Secondary STEM Teaching Residency Advisory Group

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**Secondary STEM Teaching Residency Advisory Group**

We appreciate the contributions of the members of the Secondary STEM Teaching Residency Advisory Group who were convened during the 2023–2024 academic year to provide input and expertise in response to questions around the benefits and challenges related to residency pathways to prepare secondary STEM teacher candidates.

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I. EXECUTIVE SUMMARY

Texas faces a critical shortage of well-prepared teachers, worsened by high attrition rates and an increasing reliance on teachers with no prior public education experience. Over half of new teachers start with minimal or no preparation, leading to lower retention rates and reduced student achievement. In recent years, the longtime shortage of high-quality STEM teachers has only worsened.

In Texas, teachers prepared by universities produce greater student learning gains and are retained at higher rates than those not prepared by universities. Despite this higher teacher quality, production of university-prepared teachers in STEM across the state has declined by more than 40% over the past decade. For-profit, alternative certification programs produce the majority of certified STEM teachers in Texas.

The state of Texas is increasingly prioritizing teacher residency pathways as one potential approach to improving teacher quality. The introduction of the enhanced residency certificate, the first of its kind in the nation, underscores the state's commitment to promoting residency programs. The evidence of effectiveness of teacher residencies is mixed. While they have been shown to attract and retain culturally diverse teachers, they have not consistently proved superior to other pathways when it comes to teacher practice and student achievement. And the research points to a host of challenges related to costs, coordinating governance, and ensuring high-quality classroom mentoring and support for research-based pedagogical approaches. Residency requirements can present unique challenges for college students seeking secondary teaching certification alongside content degrees.

This study employed surveys and interviews of Texas higher education and K–12 stakeholders preparing and supporting STEM teachers to investigate the perceived value of residency approaches, the prevalence of research-based and best-practice program features, and challenges faced by candidates and educator preparation programs (EPPs) in implementing residency structures. Data were collected through a survey administered to higher education EPPs, interviews of K–12 district stakeholders, and Advisory Group meeting discussion notes.

FINDINGS

Through this study, we found that both K–12 and higher education stakeholders valued the high-quality preparation provided by residency approaches to teacher preparation. They recognized the strength of connection that candidates develop with the school community, easing the transition into full-time teaching responsibilities and potentially improving retention in the classroom. They also placed a premium on university and K–12 district partnership and shared governance. Stakeholders also acknowledged that too few STEM candidates are being prepared through residencies. They agreed on challenges to implementing residency approaches for secondary STEM teacher development and identified needs for strengthening residency approaches. Significant challenges arise in preparing undergraduate disciplinary STEM majors to become teachers through residencies. While STEM majors represent the largest pool from which to recruit future STEM teachers in higher education settings, a year-long teaching residency is often not possible to accomplish without adding time and cost to degree due to required coursework.

Funding was also highlighted as a persistent concern, both related to providing residents with sufficient funding to forgo other employment during the residency year and to provide for the additional staffing and administrative resources required to effectively implement residencies in K–12 and higher education contexts. In particular, the value of specific Texas state residency requirements for minimum hours of clinical teaching and co-teaching were questioned by study participants.

RECOMMENDATIONS

In addition to providing sufficient funding to make residency pathways a viable option for more pre-service candidates, policymakers should revisit the specific requirements for clinical experience to allow more flexibility, enabling secondary STEM candidates to attend necessary classes that may overlap with year-long residency requirements. Even further flexibility in residency requirements is unlikely to make them a viable option for all pre-service teacher candidates. For this reason, policymakers should support and invest in all high-quality, clinically intense preparation pathways in Texas.

While residency pathways may provide high-quality teacher preparation, logistical and financial barriers can hinder interest in and completion of these programs — particularly for secondary STEM candidates — potentially exacerbating teacher shortages in critical areas over time. Given the current context of teacher shortages and high attrition rates, care should be given to any decisions that lead to prioritizing the inputs of residency programs over their outputs. Future research should aim to identify the specific components of residency programs that most significantly impact teacher recruitment, production, quality, and retention. Ongoing collection and analysis of data related to the numbers of teacher residents prepared and retained, disaggregated by teaching subjects and grade levels, would provide information on the degree to which these pathways adequately address shortages and serve the pre-service population of candidates.

II. BACKGROUND

Texas faces a critical shortage of well-prepared teachers, worsened by high attrition rates and an increasing reliance on teachers with no prior public education experience. Over half of new teachers start with minimal or no preparation, leading to lower retention rates (59% over nine years compared to 73% for university-prepared teachers) and reduced student achievement (Marder et al., 2024). For about a decade, the number of teachers from for-profit alternative certification programs has surpassed those from traditional university programs (see Figure 1).

This decrease in teachers from traditional programs has been accelerated by the 2015 District of Innovation¹ provision, which allows uncertified individuals to teach. By the 2023–2024 academic year, 55% of new teachers were uncertified, with significant numbers concentrated in small towns, rural, and suburban areas, contributing to lower student achievement (Kirksey, 2024; Marder et al., 2024).

¹Texas House Bill 1842, passed during the 84th Legislative Session, permits Texas public school districts to become Districts of Innovation and to obtain exemption from certain provisions of the Texas Education Code, including certification requirements for teachers.

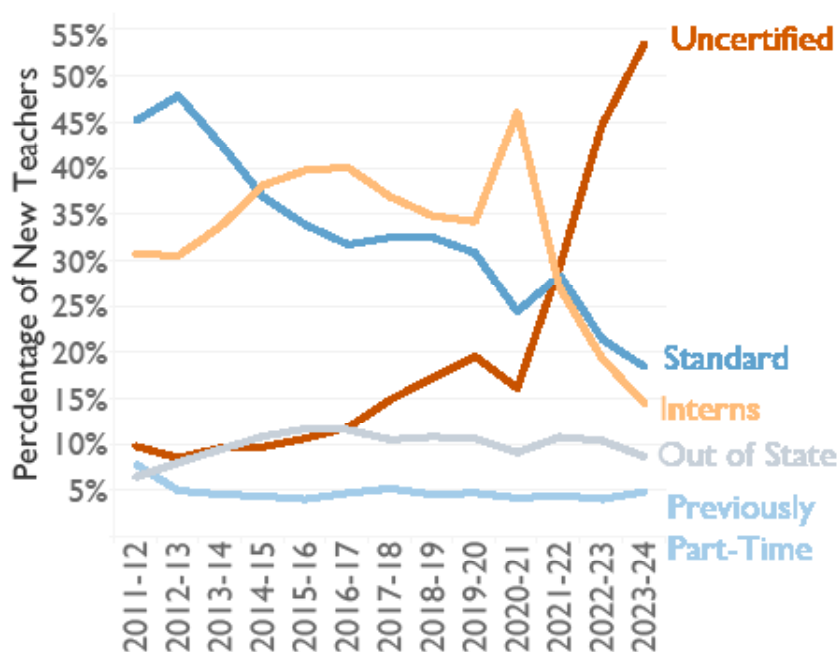
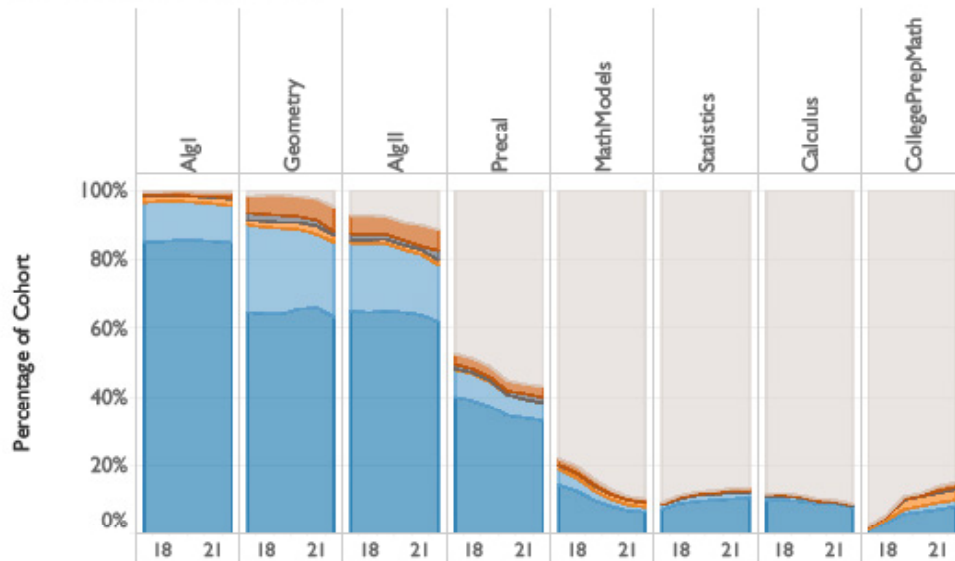


Figure 1. Growth of newly hired uncertified teachers in Texas.

The shortage of well-qualified STEM teachers in Texas increasingly limits student access to critical STEM coursework taught by experienced instructors (Marder, 2024). Texas has seen rapid drops in students taking precalculus and physics, and persistently very low levels of coursetaking in calculus and computer science (see Figure 2).

Math course quality in Texas



Science course quality in Texas

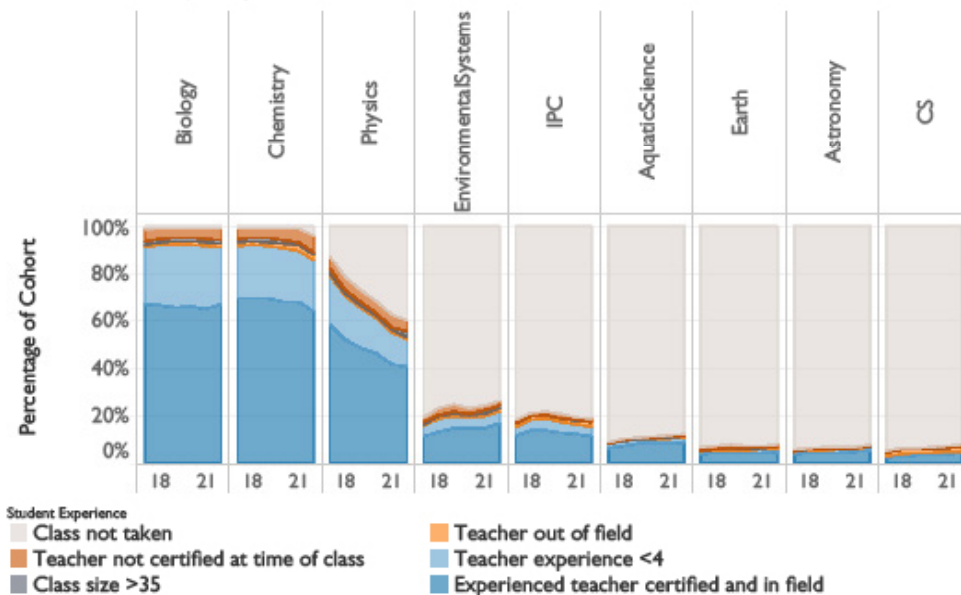


Figure 2. Trends in STEM coursetaking by Texas students.

In Texas, teachers prepared by universities produce greater student learning gains and are retained at higher rates than non-university prepared teachers (Marder et al., 2022). Despite this higher quality, production of university-prepared teachers in STEM across the state has declined by more than 40% over the past decade (see Figure 3).

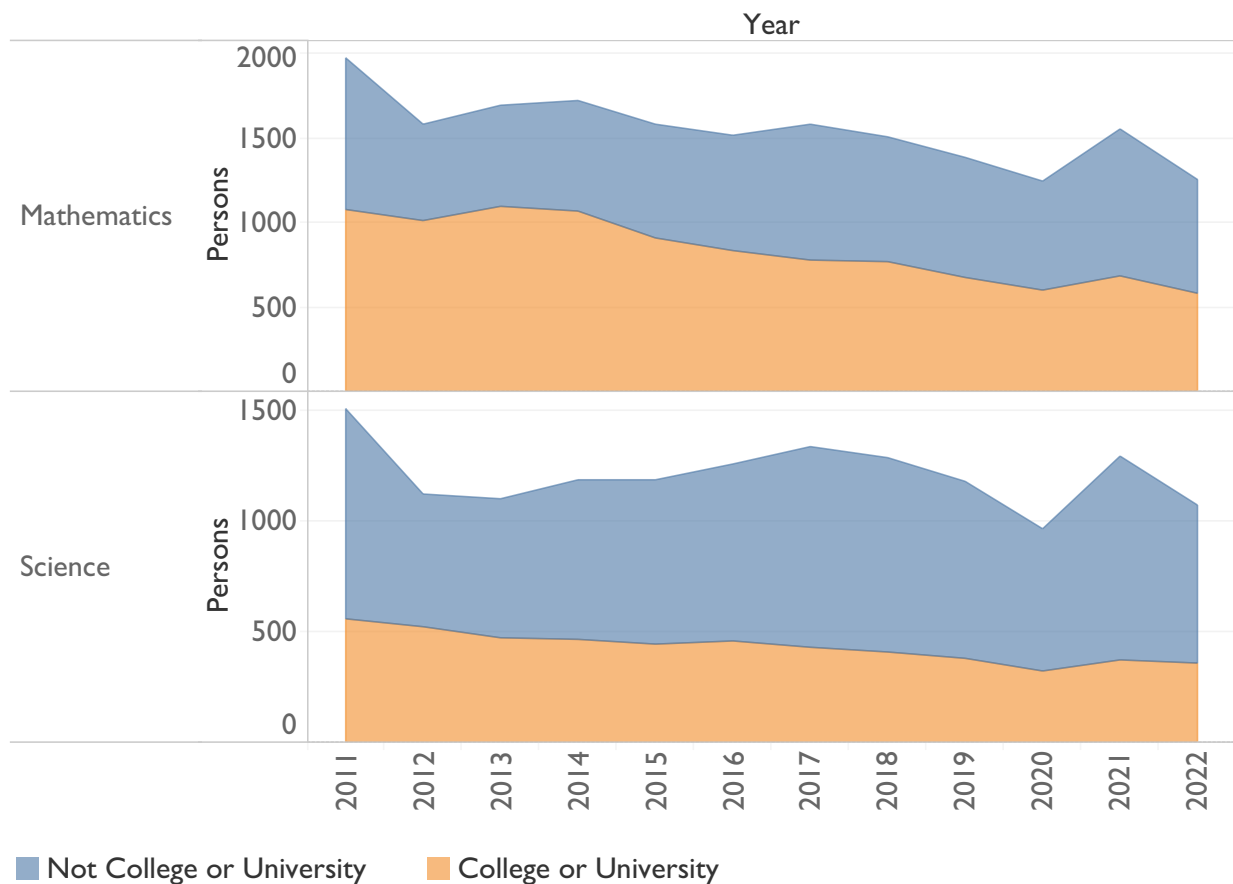


Figure 3. Teacher certificates awarded by source based on State Board for Educator Certification data accessed from the Texas Education Research Center.

Recruitment of STEM teachers has always been challenging due to the perception that teaching offers lower salaries and less prestige compared to other STEM professions. In the years since the COVID pandemic, recruitment has become increasingly challenging due to heightened concerns about health and safety, increased workload and stress of the profession, and a broader reconsideration of work-life balance among potential teacher candidates.

During the 2021–2022 academic year, 2,379 new STEM certifications were awarded by 101 educator preparation programs (EPPs). The top producers included for-profit alternative certification programs like A+ Texas Teachers (718) and iteach Texas (303) which overshadowed top-producing traditional university-based preparation pathways, such as those offered at Texas A&M University (95) and the University of Houston (80). In total, 72 Texas colleges and universities prepared 965 certified STEM teachers, accounting for just 41% of all STEM certificates awarded. Two-thirds of Texas institutions of higher education (IHEs) produced fewer than five total STEM certified teachers in 2021–2022 (Texas Education Agency, 2024a).

While there is a limited body of evidence that residency programs lead to significant improvements in teacher practice and student achievement (Chu & Wang, 2022; Saunders et al., 2024), they have consistently been shown to attract and retain culturally diverse teachers through context-specific, clinically intensive preparation that better addresses the needs of K–12 partners than traditional higher education approaches (Saunders et al., 2024; Yun & DeMoss, 2020). This same body of research points to numerous challenges with teacher residencies, including sustaining the cost structures involved, ensuring adequate training and support for classroom mentors, and negotiating inconsistencies between research-based pedagogical approaches provided through coursework and the classroom practices modeled by K–12 mentors.

The introduction of the enhanced residency certificate in Texas, the first of its kind in the nation, underscores the state’s commitment to promoting residency programs (Texas Education Agency, 2024b). Among many features, this certification pathway requires a minimum two-semester clinical teaching placement, spanning the entire school year, with at least 21 hours per week in a K–12 setting. The residency model emphasizes strong partnerships between EPPs and K–12 schools, shared governance, the role of site coordinators, and co-teaching training for host teachers. Additionally, strategic staffing models, such as utilizing residents as substitute teachers or tutors, are suggested as sustainable funding solutions for residency stipends.

Despite the potential benefits promised by residency models, implementing these programs for university-based STEM and other secondary certification pathways designed for undergraduate students remains challenging.

Despite the potential benefits promised by residency models, implementing these programs for university-based STEM and other secondary certification pathways designed for undergraduate students remains challenging. These secondary candidates, who overwhelmingly are drawn from the significant pool of disciplinary majors, often face constraints due to the scheduling of their major coursework, making it difficult to meet the 21-hour weekly commitment in a K–12 setting without adding time or cost to their degree. Addressing these challenges is critical to leveraging residency programs for a broader range of candidates.

To explore these issues, a diverse group of higher education and K–12 education stakeholders in Texas were convened to examine the implementation of residency pathways for secondary STEM teacher candidates. This report, based on the input of the Secondary STEM

Teacher Residency Advisory Group, a survey of university-based EPPs, and interviews with K–12 school district stakeholders, aims to provide guidance for optimizing residency programs for university-based secondary STEM teacher preparation programs. It investigates perceptions of the value of residency models; identifies challenges faced by candidates, EPPs, and districts; and offers recommendations to make residency programs viable for more candidates.

Through this comprehensive analysis, this summary report seeks to inform policymakers, educators, and other stakeholders about the current landscape of secondary STEM teacher preparation in Texas and potential strategies for providing greater access to residency programs for more teacher candidates.

III. DATA COLLECTION METHODS

This study employed surveys and interviews of higher education and K–12 stakeholders preparing and supporting STEM teachers to investigate the perceived value of residency approaches, the prevalence of research-based and best-practice program features, and challenges faced by candidates and EPPs in implementing residency structures. See Appendices A and B for data collection instruments.

Advisory Group

An Advisory Group was convened, comprised of 13 total stakeholders with experience implementing teacher residencies. Eight (62%) participants represented educator preparation programs from eight distinct Texas universities and five (38%) represented professionals from four distinct Texas K–12 districts and one regional education service center. The Advisory Group was convened three times and reviewed and discussed state STEM teacher production data, provided input on survey construction, reviewed survey and interview data and results, and gave feedback on this summary report.

Data Collection

Data were collected through a survey administered to higher education EPPs, interviews of K–12 district stakeholders, and Advisory Group meeting discussion notes. An electronic Secondary STEM Teaching Residency Survey was sent to 25 Texas IHEs that prepared at least five STEM teachers in 2021–2022, including eight institutions represented on the Advisory Group. One-hour Zoom interviews were conducted with each of the five Texas K–12 district stakeholders of the Advisory Group. Finally, advisory meeting notes and artifacts were collected.

Limitations

The study acknowledges certain limitations. These include potential biases in data collection and interpretation by the stakeholder representativeness of EPPs and K–12 districts, as well as the generalizability of the findings. The Study Team made every effort to mitigate these limitations and ensure that findings and recommendations emerged across multiple data sources. The findings from this study are expected to provide valuable insights into the perceived effectiveness and challenges implementing secondary STEM teacher residency pathways at Texas higher education institutions.

IV. FINDINGS

Secondary STEM Teaching Residency Survey

An 11-question survey was distributed from December 2023 to February 2024 to 25 Texas IHEs, with a 48% response rate (12 of 25 respondents). Six of the 11 questions were open-ended and participant responses were aggregated and thematically categorized. The survey respondents were asked to provide information about their middle and high school pathways in 2022–2023 that led to the certification of STEM teachers. Below are the aggregated secondary pathways' characteristics from the sample.

327 total middle and high school STEM teachers were recommended for certification by 12 university-based EPPs in 2022–2023.

- Four main pathways were represented, each with a residency or non-residency track.
- Undergraduate pathways certified 77% of these secondary STEM teachers.
- Alternative certification pathways certified 19% of these secondary STEM teachers.
- Post-baccalaureate pathways certified 3% of these secondary STEM teachers.
- Master's in teaching pathways certified 1% of these secondary STEM teachers.
- 78% of secondary STEM teachers were prepared through non-residency pathways.
- 22% of secondary STEM teachers were prepared through residency pathways.

Respondents were asked about the degree to which their current STEM teacher preparation pathways align with 18 program features derived from the National Center for Teacher Residencies standards for effective teacher residencies (National Center for Teacher Residencies, n.d.). Overall, respondents reported that nearly all program standards were at least “somewhat implemented,” regardless of whether or not a residency program was in place. Across respondent programs, the highest alignment (depicted by green bars in Figure 4) was reported with the following program standards:

- Program graduates are in demand and successfully secure teaching positions.
- Candidates continuously receive feedback on development throughout the program.
- Pre-service candidate competencies are assessed at multiple points throughout the program.
- Candidates report feeling prepared to enter the workforce upon completion of the program.
- Candidates work with high-need students during preparation.

A small number of respondent programs reported no alignment (depicted by red bars in Figure 4) with these program standards:

- Program provides graduates with ongoing mentoring, support, and professional development during early years of teaching.
- Program attracts a sufficient number of candidates to meet local needs for STEM teachers.
- Adequate funding is provided to support candidate recruitment, retention, and completion.
- Teacher educator/instructor effectiveness is regularly assessed.
- Adequate resources and personnel are in place to prepare high-quality teachers.

To what degree are these program features successfully implemented across your middle and high school STEM teacher preparation pathways?

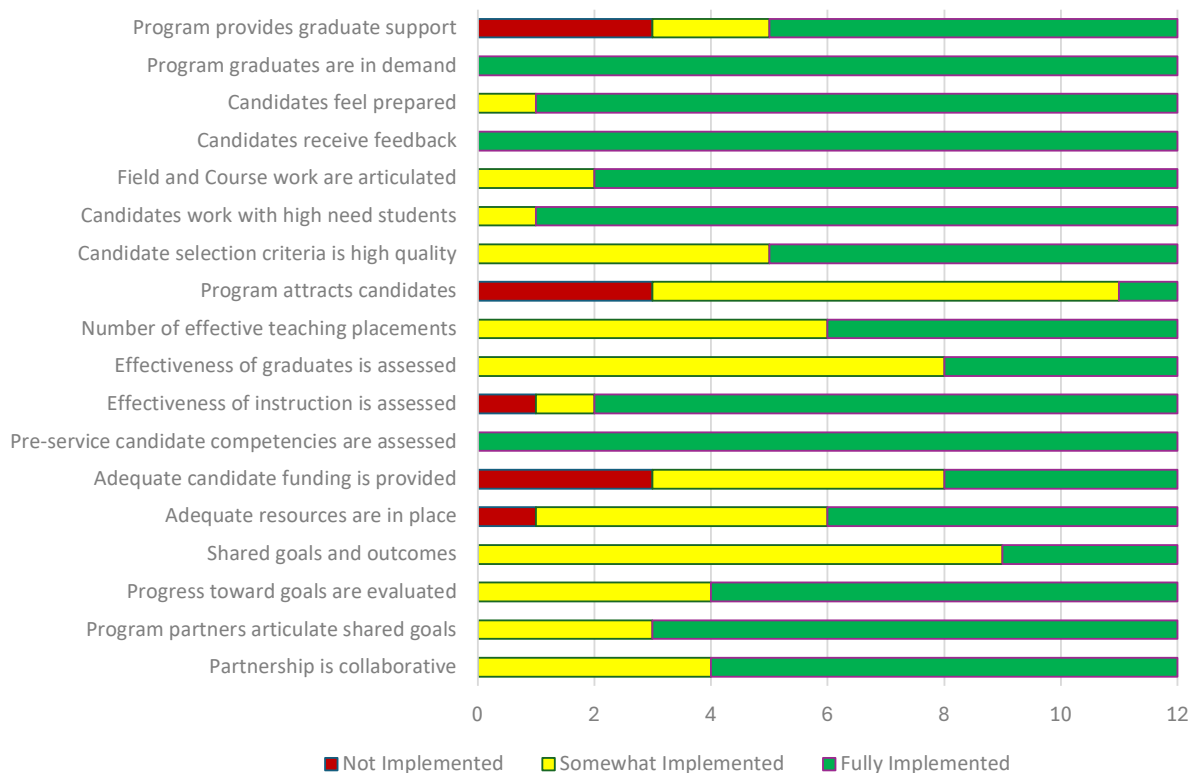


Figure 4. Level of alignment with program features of high-performing residencies.

In an open-ended format, participants were asked what they valued about teacher residency models and approaches. Responses were aggregated and coded into the following three themes. The number denotes the number of respondents who provided similar sentiments.

Hands-on experience and extended classroom time (6)

The responses emphasized the value of residency models that provide pre-service teachers with extended, hands-on experience in the classroom and more time to create theory-to-practice connections and engage in reflective practices.

Collaboration and partnerships (3)

The responses highlighted the importance of collaborative relationships and shared governance between universities, school districts, and other stakeholders. This included governance meetings, co-teaching opportunities, and deeper partnerships with school districts.

Support and funding (3)

The responses mentioned the wrap-around support provided to teacher candidates from both the university and district sides, as well as the financial aspect of residencies, such as payment/funding for candidates.

When asked about the challenges that teacher residencies present for middle and high school STEM teacher candidates, two main themes emerged.

Financial and logistical constraints (5)

The responses highlighted the demanding schedules for candidates that could require night courses in addition to daytime teaching, the structural limitations of STEM degree plans that impede the integration of residency requirements without adding time or cost to their degree, and insufficient pay for candidates.

Quality mentorships and partnerships (6)

Respondents mentioned the lack of pedagogical preparation and understanding of available mentors and that testing and accountability systems may limit willingness of mentors/district partners to participate. Additionally, standardized instructional

University-based EPPs struggle to recruit sufficient STEM candidates. They identified the need for more funding and resources to recruit, prepare, and provide mentoring and induction support to new graduates.

University-based EPPs value hands-on experience, extended classroom time, district collaboration, and financial supports provided by residencies.

Residency requirements present unique logistical challenges to students earning STEM degrees that could increase time and costs to completion.

methods imposed by districts may not align with inquiry-based pedagogies.

Similarly, participants were asked about the challenges that teacher residencies present for educator preparation programs. Three themes emerged from this prompt.

Logistical challenges and demands on time (8)

By far, the top challenges of a residency program for EPPs were focused on scheduling related to accommodating major coursework during a residency year; program set-up challenges including establishing MOUs, setting up shared governance, defining new roles, and program redesign; monitoring to ensure partner and candidate compliance with agreements and expectations; deploying campus supervisors; high numbers of candidates who cannot be accommodated by a single district, creating the need for multiple partnerships to manage; and required frequency of advisory meetings with multiple stakeholders.

Program administration costs and funding (4)

This theme included the constraints of time and resources for additional advising of students; adding an additional seminar for fall semester residents; additional program costs, especially for field supervisor time; and insufficient financial support for candidates.

Securing high-quality mentors and partners (3)

A few respondents offered insight on the challenges around establishing and maintaining district partnerships due to extreme pressures being felt by K–12 schools and districts; current teacher shortages potentially making schools reluctant to wait a year for a candidate to pass through the full year-long experience; and limited access to high-quality placements for candidates.

Participants also shared their ideas for how teacher residencies might be designed to make them viable for more middle and high school STEM candidates. They were asked to consider, for example, what flexibility, support, or resources are needed.

Increased funding and implementation support (6)

Sufficient funding is needed to make residencies at least cost-neutral for candidates, inclusive of tuition costs and the need to forego work; more funding is needed to offset increased costs of program administration; and additional third-party implementation supports may be helpful.

Increased flexibility of requirements and collaboration across campus and with districts (6)

Respondents mentioned broadening the definition of residency to be more inclusive of other effective, clinically intensive preparation modes; offering more flexibility to meet required days/hours given students' course and other commitments; having increased flexibility and collaboration with departments in terms of content course offerings and encouragement to pursue teaching; and having better collaboration between EPPs and district partners to better meet the needs of local schools.

Improved access to high-quality STEM teaching placements (3)

Professional development is needed to ensure high-quality mentor and instructional coaching support for residents. STEM candidate placements that model inquiry-based pedagogies are also needed.

Listed below are selected quotes from respondents who offered additional feedback about secondary STEM residencies.

"We serve over 70 small districts. Logistics are problematic."

"I think there are enough positives to try it for financial reasons, however I don't feel that enough forethought has gone into preparation for a successful launch."

"Residencies are easier to implement in elementary certification programs where the requirements of the major are more flexible than they are for middle and high school teachers. Unless residencies are introduced very carefully to the middle and high school context they will pull production numbers further down, which is very worrisome during a teacher vacancy crisis, and with production numbers already too small everywhere in Texas and the country."

Increased flexibility in residency requirements could make these pathways accessible for more pre-service candidates pursuing secondary certification.

“Overall, residencies are a positive step in secondary STEM teacher preparation. However, they do not work for all students because of the number of degrees in STEM (~25).”

“Overall, I view residencies as a positive move for educator preparation in general.”

Participants were asked, “Overall, what are the biggest challenges you are currently facing in preparing middle/high school STEM teachers (irrespective of residencies)?” All (12) mentioned the recruitment of candidates as the greatest challenge. Reasons stated for the difficulty recruiting enough candidates included:

- negative perceptions of teaching, both in the public and on campus,
- poor working conditions for teachers, and
- pay is perceived as not sufficient for increased responsibilities or commensurate with cost of living.

Finally, participants were asked to consider which of the requirements for residency programs — as defined in the proposed new residency certification (State Board for Educator Certification, 2023) — they considered important or unimportant and which are less challenging or more challenging to implement in their EPP certification program. These residency program requirements included:

- Eliminating some educator certification exam requirements
- Minimum of four formal observations of candidate teaching (45 minutes each with pre- and post-conference)
- Minimum of six informal observations of candidate teaching
- Minimum co-teaching between candidate and classroom teacher of 400 hours
- Co-training of mentor teachers with district partners
- Co-selection of a site supervisor with district partners
- Minimum of three meetings per semester between campus supervisor and EPP field supervisor
- Shared governance with K–12 school partners, including quarterly meetings
- Full year of clinical teaching defined as a total of 750 hours in the residency, including a minimum of 21 hours per week and first and last day of instruction with students

A four-quadrant matrix was developed and is depicted in Figure 5. Of note are the quadrants “Higher Challenge, Higher Importance” and “Higher Challenge, Lower Importance.” Respondents identified the requirements for 750 total residency hours and 400 co-teaching hours as both lower in importance and challenging to implement. Respondents also agreed that while it is challenging to establish shared governance with district partners, it is an important component to pursue.

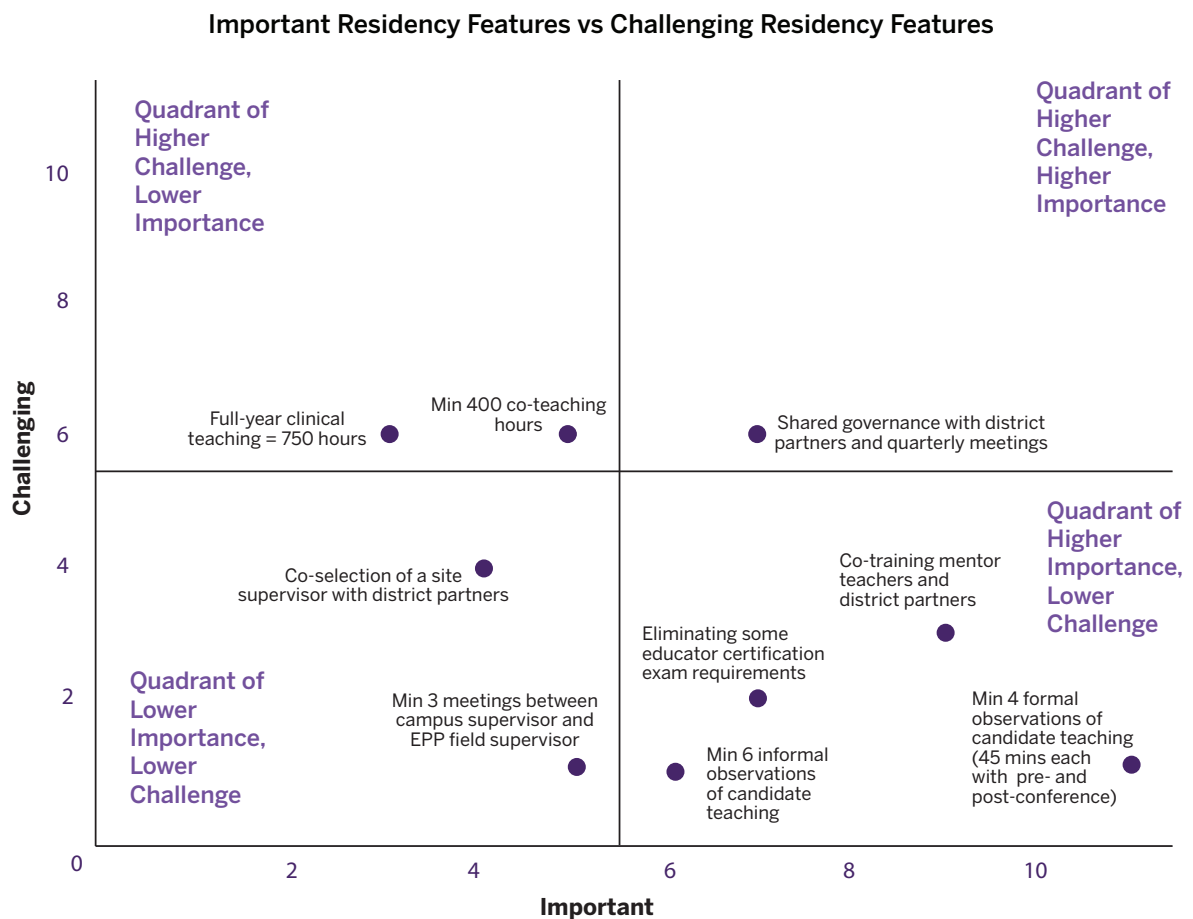


Figure 5. Degree of importance and challenge of residency requirements.

K–12 District Stakeholder Interviews

Participant interviews lasted 30–60 minutes each and were conducted remotely with five Texas K–12 district stakeholders in December 2023. The participants represented four districts and one education service center with experience implementing or supporting implementation of teacher residencies. Each interviewee was asked to reflect on four questions. Responses were transcribed, aggregated, and thematically categorized.

The first prompt asked, “What do you believe are the benefits of middle and/or high school STEM residencies?”

Preparation and training (4)

The residency programs provide comprehensive preparation and training for residents. They get more training and feel more prepared than they would with a regular student teaching approach. The year-long residency provides a clear idea of what it truly takes to serve as an educator.

Familiarity and connection with the school community (3)

The residents get to know the principals, staff, families, and students. They become familiar with the district procedures and curriculum. This familiarity can create a seamless transition into a teaching role.

Retention: The residency programs help to retain the teachers (3)

The residents feel like they’re already part of the school community and are more likely to stay. This is beneficial for the school district, especially considering the high retention rate of residents after five years.

Residents develop valuable connections with the K-12 school communities where they are prepared, leading to better retention.

The second prompt asked, “What do you believe are the challenges of middle and high school STEM residencies?”

Recruitment and interest in teaching as a career (5)

STEM majors who want to teach secondary often don’t want to spend the time to do a residency program because a district will hire them anyway (due to demand for hard-to-fill positions). Additionally, it is extra challenging to recruit undergraduate STEM majors to consider teaching due to the draw of higher-paying STEM careers.

Program structure and funding (4)

There are challenges related to the structure of residency programs, especially considering scheduling challenges related to accommodating coursework. There are also concerns about funding programs long term if grant funds are not available, and whether the innovative staffing model is feasible at a large scale.

Third, the district professionals were asked, “Based on your experience, what suggestions do you have for EPPs for leveraging residency opportunities for middle and high school STEM teaching candidates?”

Partnerships and collaboration (4)

Strong partnerships and collaboration between districts and universities were seen as crucial. This included advisory-type boards and Local Education Agency (LEA) partners. These partnerships can help in advertising the need for secondary STEM educators and the opportunities that exist for them to be well prepared. They can also help tailor the program to district needs, ensure relevance of coursework, and allow for open dialogue and continual refinement. There is value in working deeply with fewer universities rather than spreading efforts thinly across many.

K–12 district stakeholders voiced a need for better collaboration with EPPs to ensure that instructional theory is better aligned with the practicalities of the classroom.

Alignment of theory and practice (3)

Participants suggested a need for better alignment between what residents are learning in their preparation programs and the practicalities of the classroom. When there is a gap, strong partnerships provide the opportunity for district professionals to work with faculty regarding the realities of the classroom to ensure that practical aspects are addressed in coursework.

Outreach (5)

Participants identified a need for targeted advertising and outreach efforts to make potential STEM candidates aware of teaching opportunities. This includes not only focusing on undergraduates pursuing STEM degrees, but also on community members who already have degrees. The aim is to make them aware that serving as a teacher of record is a real option for them.

Course scheduling and flexibility (3)

EPPs should consider arranging course schedules to accommodate residencies as an option. Offering courses in more flexible formats, such as in the evenings and/or online could be viable options.

Lastly, interviewees were asked, “What support do K–12 systems need to leverage residency opportunities for middle and high school STEM teaching candidates?”

Funding (5)

There is a need for funding to support residency opportunities. This includes funding for coordinators, residents, mentors, and other program costs. The challenge of securing funding, especially in the context of other financial pressures on districts, was mentioned in all five interviews.

Time (3)

There is a need for time to design and implement innovative teaching models, professional learning, and other aspects of a residency program. The issue of time also comes up

in the context of the residency model itself — whether there is enough time for residents to gain the necessary experience and understanding.

Professional development (3)

There is a need for guidance and support on how to secure and allocate funding for residencies, particularly for decision-makers in the district. Professional learning around research-based practices and policies is also needed. Training opportunities and sharing can help principals, mentors, and other stakeholders better support residents.

High-quality mentors (3)

The availability of high-quality mentors at the campus level is a significant need. These mentors play a crucial role in the preparation and development of the residents. However, finding mentors who are willing to put in the extra time and effort can be a challenge.

K-12 district stakeholders need additional professional learning on research-based practices and policies to implement effective residencies.

V. IMPLICATIONS

Teacher residency programs are increasingly promoted, despite limited empirical evidence, as an effective strategy for enhancing teacher preparation and addressing persistent shortages in the profession. Both K–12 and higher education stakeholders valued the high-quality preparation provided by residency approaches to teacher preparation. They recognized the strength of connection that candidates develop with the school community, easing the transition into full-time teaching responsibilities and potentially improving retention in the classroom. They also placed a premium on university and K–12 district partnership and shared governance.

Stakeholders acknowledged that too few STEM candidates are being prepared through residencies. They agreed on challenges to implementing residency approaches for secondary STEM teacher development and identified needs for strengthening residency approaches. In particular, significant challenges arise in preparing undergraduate disciplinary STEM majors to become teachers through residencies. While STEM majors

represent the largest pool from which to recruit future STEM teachers in higher education settings, a year-long teaching residency is often not possible to accomplish without adding time and cost to degree due to required coursework. Funding was also highlighted as a persistent concern, both related to providing residents with sufficient funding to forgo other employment during the residency year and to provide for the additional staffing and administrative resources required to effectively implement residencies in K–12 and higher education contexts.

Stakeholders also highlighted the need for professional development and support around best practices in designing and funding residency programs; targeted outreach and recruitment for the highest-shortage teaching positions; additional time needed for planning and residency program development; and high-quality classroom mentors. K–12 district representatives called out the need for better balancing of program emphasis on teaching theory versus practice, harkening back to the importance of collaborative partnership in the design and implementation of residencies. Higher education EPPs preparing STEM teachers articulated concerns about limited access to high-quality classroom teacher mentors who are knowledgeable and skilled in inquiry-based and other research-informed pedagogies.

In Texas, state-supported residency programs are structured to require immersive clinical experiences, substantial co-teaching opportunities, and collaborative governance between EPPs and school districts. However, stakeholders highlighted the specific residency requirements that pose challenges, especially for candidates pursuing middle and high school STEM certification:

- Completing 750 hours in the clinical placement
- Co-teaching for 400 hours
- Shared governance, including quarterly meetings, between educator preparation programs and school districts

Residency requirements should be adjusted to retain the benefits of year-long classroom exposure and also allow the flexibility needed to accommodate undergraduate course schedules for STEM majors.

Of these factors, the first two were perceived as having lower importance. Shared governance was identified as a feature with higher importance. During the final convening, Advisory Group members suggested strategies for addressing concerns and highlighted potential pitfalls to avoid based on experience.

Higher Challenge/Lower Importance: 750 hours of clinical experience with 400 hours of co-teaching

Suggested strategies:

Reexamine the number of hours required for residency placements to retain the benefits of year-long classroom exposure but allow needed flexibility to accommodate the course scheduling needs of undergraduate secondary STEM candidates. Allowances are currently made for illness (up to 50 hours). Students taking advanced STEM coursework could be given similar consideration so that they can pursue a residency certificate.

Other suggestions addressed strategies for ensuring that clinical experience and co-teaching hours are successfully achieved. They include:

- District and EPP partners should co-create a year-long calendar to ensure clinical experience and co-teaching hours are met within the individual context of the partners' residency program.
- Partners should develop and share a residency pacing schedule for residents and host teachers with co-teaching checkpoints.
- District partners should provide protected planning time for residents and host teachers to align on co-teaching practices and monitor completion of required residency hours.
- EPP advisors must be well-versed in scheduling constraints and/or opportunities for the STEM content courses at the university.

- EPPs should ensure that campus administrators are aware of the certification requirements for residency hours and ensure that this time is protected. For example, residents should not be called upon to substitute during hours that are scheduled for the certification program.

Higher Challenge/Higher Importance: Shared governance with quarterly meetings

Not involving key personnel in early planning can impact how successful EPPs and school districts are at creating a residency program with shared governance. Among others, site coordinators/field supervisors from the EPP and campus principals from the school district should be part of the planning process since they are integral to the implementation of the program.

Suggested strategies:

- Consider the number of partners based on capacity and available funding. It is better to have fewer, high-quality partnerships and ensure a positive experience for everyone.
- Designate someone who will be able to attend all meetings.
- Designate points of contact who will meet separately prior to the shared governance meetings to identify topics for discussion.
- Maintain running agendas from meetings to reference past conversations and inform future agendas.
- Create a regular newsletter/update with information for human resource teams, mentor teachers, and principals.

While challenging, shared governance is overwhelmingly valued by both EPPs and K-12 district stakeholders.

Policy Implications

Residency programs emphasize intensive field experiences, requiring substantial investments in terms of residency placement hours. Residency programs also require significant stipends for residents and host teachers, and preparation programs must account for increased administrative costs. Secondary STEM teacher candidates often face challenges completing these programs in four years due to scheduling conflicts with required coursework in their majors. Policymakers should allocate funds to school districts for stipends and to educator preparation programs to cover administrative expenses, thereby expanding access to residency programs. Additionally, policymakers should revisit the requirements for clinical experience to allow more flexibility, enabling secondary STEM candidates to attend necessary classes that may overlap with year-long residency requirements. Even further flexibility in residency requirements is unlikely to make them a viable option for all pre-service teacher candidates. For this reason, policymakers should support and invest in all high-quality, clinically intense preparation pathways in Texas.

Further Research

Residency programs provide high-quality teacher preparation. Nevertheless, logistical and financial barriers may hinder interest in and completion of these programs — particularly for secondary STEM candidates — potentially exacerbating teacher shortages in critical areas over time. Given the current context of teacher shortages and high attrition rates, care should be given to any decisions that lead to prioritizing the inputs of residency programs over their outputs. Future research should aim to identify the specific components of residency programs that most significantly impact teacher recruitment, production, quality, and retention. Ongoing collection and analysis of data related to the numbers of teacher residents prepared and retained, disaggregated by teaching subjects and grade levels, would provide information on the degree to which these pathways adequately address shortages and serve the pre-service population of candidates.

Residency requirements should be adjusted to retain the benefits of year-long classroom exposure and also allow the flexibility needed to accommodate undergraduate course schedules for STEM majors.

Policymakers should support and invest in all high-quality, clinically intensive preparation pathways in Texas.

Future research should aim to identify the specific components of residency programs that most significantly impact teacher recruitment, production, quality, and retention.

The unprecedented and worsening shortage of qualified STEM teachers across Texas, combined with declining teacher production by institutions of higher education, necessitates careful assessment of the benefits and constraints associated with proposed new preparation pathways and approaches. Designing new pathway requirements to allow for increased flexibility will ensure that more high-quality candidates across all grades and subjects are successfully recruited, prepared, and retained in teaching through these pathways.

Guidelines and requirements for Texas teacher residencies leading to a new enhanced residency certificate are still new and largely untested across the state. Given the concerns and constraints identified by stakeholders in this study, program requirements should be regularly reviewed and refined in light of data on access and evidence of effectiveness, and in consultation with a diverse group of EPPs who prepare middle and high school STEM and other secondary level teachers in Texas.

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APPENDIX A: SECONDARY STEM TEACHING RESIDENCY SURVEY

Survey Introduction:

The Bill and Melinda Gates Foundation has provided funding to the UTeach Institute (now the National Center for STEM Education) at the University of Texas in Austin to assess the unique needs and features of university-based middle and high school STEM teacher preparation pathways and explore the ways that residency models might be optimized for these pre-service candidates.

An advisory group representing a diverse collection of university-based educator preparation programs and other education stakeholders across Texas has been formed. The group will gather and examine data from university-based educator preparation programs in Texas who prepared middle or high school STEM teachers in 2021-22. A Secondary STEM Teaching Residency Report will be produced that will summarize the input received from this survey and to offer suggestions for optimizing residencies to prepare middle and high school STEM teachers.

Please complete this survey so that we can learn more about your work to prepare middle and high school STEM teachers. The information gathered will be recorded confidentially and data or summarized results will not be released in any way that could identify you or your institution. We estimate that the survey can be completed in 20-30 minutes. We thank you for your time.

- 1. Click here to access the required study consent form.
 - a. I agree to participate in this study (goes to next question)
 - b. I do not agree to participate in this study (exits)
- 2. Your Name [text field]
- 3. Your Title [text field]
- 4. Your Institution [text field]
- 5. Please select all middle and high school pathways that you offered in 2022-2023 that led to the certification of STEM teachers. [this is represented by a matrix to select all that apply; leave selections unchosen if not applicable]

	With residency	No residency
Undergraduate leading to standard certification		
Alternative certification		
Post-baccalaureate leading to standard certification		
Master's in Teaching (MAT)		

If/for each/any selected choice, respondents would see the following corresponding with Pathway x Residency or No Residency, THEN a series of these fill-in-number fields will follow [text field; forced numeric value]

6. To what degree are these program features successfully implemented across your middle and high school STEM teacher preparation pathway(s)? [There is a 3-point Likert scale per each bullet: Not implemented, Somewhat Implemented, Fully Implemented]

- A collaborative partnership with local schools and districts who contribute to the design and implementation of the program
- Shared goals and outcomes related to teacher preparation are articulated by program partners
- Progress toward shared goals and outcomes are continuously evaluated and reported
- Shared goals and outcomes are being met
- Adequate resources and personnel are in place to prepare high quality teachers
- Adequate funding is provided to support candidate recruitment, retention and completion
- Pre-service candidate competencies are assessed at multiple points throughout the program
- Teacher educator/instructor effectiveness is regularly assessed
- Effectiveness of program graduates is assessed
- Adequate number of high-quality clinical teaching placements with effective classroom teachers are in place
- Program attracts sufficient number of candidates to meet local needs for STEM teachers
- Candidate selection criteria results in admission, retention, and production of high-quality STEM teachers
- Candidates work with high-need students during preparation
- Clinical field work and coursework are tightly articulated
- Candidates continuously receive feedback on development throughout the program
- Candidates report feeling prepared to enter the workforce upon completion of the program
- Program graduates are in demand and successfully secure teaching positions
- Program provides graduates with ongoing mentoring, support, and professional development during early years of teaching

7. To what extent do you understand teacher residency models?

[3-point Likert scale: Not at all, Somewhat, Significant Understanding]

8. What do you value about teacher residencies?

[text field]

9. What challenges do teacher residencies present for middle and high school STEM candidates?

[text field]

10. What challenges do teacher residencies present for educator preparation programs?

[text field]

11. How might teacher residencies be designed to make them viable for more middle and high school STEM candidates? What flexibility, support, or resources are needed?

[text field]

12. What other feedback do you have about middle/high STEM residencies?

[text field]

13. Overall, what are the biggest challenges you are currently facing in preparing middle/high school STEM teachers (irrespective of residencies)?

[text field]

The Texas legislature, State Board for Educator Certification, and State Board of Education are considering several requirements for residency programs defined in the proposed new residency certification (19 TAC Subchapter E §228.65. Residency). Federal and State monies and local strategic staffing models are frequently mentioned as sources of funding for resident stipends in order to sustain this pipeline of new teachers.

14. Which of these proposed requirements do you believe are important to improve the preparation of middle and high school STEM candidates?

[matrix with check boxes and a text entry for comments for each item]

- Full year clinical teaching defined as a total of 750 hours in the residency, including a minimum of 21 hours per week and first and last day of instruction with students
- Shared governance with K-12 school partners, including quarterly meetings
- A minimum of 3 meetings per semester between campus supervisor and EPP field supervisor
- Co-selection of a site supervisor with district partners
- Co-training of mentor teachers with district partners
- Minimum co-teaching between candidate and classroom teacher of 400 hours
- Minimum of six informal observations of candidate teaching
- Minimum of four formal observations of candidate teaching (45 minutes each with pre- and post-conference)
- Eliminating some educator certification exam requirements
- OTHER [text field]

15. Which of these features and incentives do you believe present the greatest challenges to the preparation of middle and high school STEM candidates?

[matrix with check boxes and a text entry for comments for each item]

- Full year clinical teaching defined as a total of 750 hours in the residency, including a minimum of 21 hours per week and first and last day of instruction with students
- Shared governance with K-12 school partners, including quarterly meetings
- A minimum of 3 meetings per semester between campus supervisor and EPP field supervisor
- Co-selection of a site supervisor with district partners
- Co-training of mentor teachers with district partners
- Minimum co-teaching between candidate and classroom teacher of 400 hours
- Minimum of six informal observations of candidate teaching
- Minimum of four formal observations of candidate teaching (45 minutes each with pre- and post-conference)
- Eliminating some educator certification exam requirements
- OTHER [text field]

[end page]

We thank you for your time spent taking this survey. Your responses have been recorded.

APPENDIX B: INTERVIEW QUESTIONS FOR K–12 STAKEHOLDERS

1. Thank you for agreeing to participate in this interview. You received the required consent form in advance. Do you have any questions before we proceed? Please verbally consent to participate.
2. Please describe your experience with implementing (or supporting the implementation of) middle and/or high school STEM residencies.
3. What do you believe are the benefits and challenges of middle and/or high school STEM residencies?
4. Based on your experience, what suggestions do you have for EPPs for leveraging residency opportunities for middle and/or high school STEM candidates?
5. What support do K-12 systems need to leverage residency opportunities for middle and/or high school STEM candidates?
6. Please describe any experience you have with strategic staffing models.