# Student preparation, perceptions, and persistence in a newly accredited undergraduate forensic science program.

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**Abstract:** Attainment of Forensic Science Education Programs Accreditation Commission (FEPAC) accreditation represents a major achievement for university forensic science programs. This designation is a recognition of a program's rigor and can help prospective students in selecting quality training. In 2021, the authors examined one undergraduate forensic science program located in the southeastern United States as it neared completion of the FEPAC accreditation process. Current program students were surveyed for their incoming academic preparations, as well as their perceptions of the program on a range of variables including comfort level in interactions with professors, perceptions of the program's effectiveness in preparing them for employment post-graduation, and factors contributing to student success in the program. The results indicated that the program met many but not all of the students' expectations, and demonstrated that some students may conflate the goals of their program with a separate but complementary Forensic Anthropology program. Overall, the majority of surveyed students felt the program adequately prepared them for their post-graduation careers. These results can inform other FEPAC-accredited undergraduate programs or those seeking accreditation as to student preferences and expectations of their forensic science preparation.

**Keywords**: student perceptions, student preparation, undergraduate forensic science program

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## Introduction

The Forensic Science Education Programs Accreditation Commission (FEPAC) is the accrediting body for university programs of forensic science education. The organization has been a key partner to the forensic science profession through its standardization and assurance of rigor within forensic science programs throughout the United States and internationally. Although all academic programs undergo the same evaluation in pursuit of FEPAC accreditation and most list their requirements online, little is known about the individual qualitative differences among programs. Furthermore, there are many questions about what students desire from their forensic science training. This paper adds to the broader discussion of undergraduate forensic science education by examining student perspectives of a specific academic program. Students enrolled in an undergraduate forensic science degree program at Middle Tennessee State University (MTSU) were surveyed in March 2021. This survey was deployed while the program was simultaneously seeking FEPAC accreditation, a status which was since attained in 2022. The primary goals of the survey were to examine incoming student academic preparations and influences, as well as measure current student perceptions of the coursework, faculty, and campus supports.

MTSU's bachelor's degree program in Forensic Science is an interdisciplinary program developed by the Biology, Chemistry, and Criminal Justice Administration departments. At the time of this study, there were 180 students in the program, the majority female (78%). Of the 180 students, 21% were African American or Black, 11% Hispanic, and 67% white. The degree requires a minimum of 120 credit hours, 73 of which are direct requirements for the major and another 17 credit hours are specified supporting courses. To meet FEPAC accreditation standards, the degree has a tightly comprised curriculum with few electives and little room for deviation from the academic map. MTSU's program was developed with an eye for prospective local and state employers of its graduates, and therefore emphasizes coursework which would prepare a graduate for work in a crime laboratory. One such prospective employer for example, the Tennessee Bureau of Investigation, requires a minimum of 24 semester hours of chemistry classes for forensic science job applicants (1).

Separate from MTSU's Forensic Science degree is a program in Forensic Anthropology in which bachelor's degree-seeking students may receive a minor. The

Forensic Anthropology academic program is supplemented by several hands-on experiential learning opportunities for students, such as the Forensic Anthropology Search and Recovery (FASR) team which assists the state Medical Examiner's Office to identify unknown skeletal remains (2). Many forensic science students choose to take part in these extracurricular opportunities, which are complementary experiences but outside of the laboratory focus of their degree program.

Before examining the perceptions of students enrolled in the MTSU Forensic Science program, the authors first wanted to determine and understand factors which contribute to student academic success in science-focused undergraduate programs. One such factor was found to be incoming college student preparation. Wang (3) found a significant association between high school math achievement and the decision to major in a science, technology, engineering, or math (STEM) degree. Dwyer, Gonzalez-Espada, de la Harpe, and Meier (4) found that high school preparation was strongly associated with student persistence in STEM degrees received at the United States Air Force Academy. Their study also found that success in Calculus and General Physics classes most strongly predicted graduation from a STEM degree at the institution.

Beyond the academic factors related to student success in a STEM major, student perceptions of their competence as well as a sense of belonging in the major were found to be very important to student retention. Hilts, Part, and Bernacki (5) surveyed 208 students enrolled in an undergraduate anatomy and physiology class and found that students who felt competent in their major were more likely to persist in the degree until graduation. They also found that when students made connections to peers who were also STEM majors, they developed a sense of relatedness which was correlated with student success as a STEM major. As a result of this finding, the researchers recommended that peer mentoring programs be utilized by STEM majors to increase contact with classmates and therefore build a sense of community and relatedness. A study of female undergraduate engineering majors found that same-gender peer mentors, in particular, produced the best results in terms of fostering student sense of belonging and self-efficacy, which led to greater retention in the major (6).

Although peer mentoring can yield strong results in terms of student retention, faculty-student connections are also important in this regard (7). Christe (8) found that students who felt a positive connection with their professors, such that they felt comfortable speaking in class or engaging in conversations outside of class, were more likely to persist in their degrees. She recommended that universities encourage opportunities for greater student engagement, for example through faculty-led research projects as well as peer mentoring by upperclassmen. Cundell and Pierce (9) similarly emphasized the importance of a nurturing environment to succeed in hard science majors. They cited the positive effects of certain classroom management strategies, for example creating an environment whereby all students felt emboldened to speak in class. They also found that biology students needed real-life examples in order to best learn the material, whereas chemistry students needed structured questions and analytical homework assignments.

A final consideration is the impact of media and entertainment in influencing students to choose forensic science as their college major, a phenomenon sometimes termed the "CSI effect". Weaver, Salamonson, Koch and Porter (10) examined the perceptions of students enrolled in an undergraduate forensic science program and found that a majority of participants (91.1%) had watched popular TV shows such as *NCIS* and *CSI*. Although the participants overwhelmingly had negative views regarding the accuracy of the science depicted in the TV shows, many regarded the shows' characters as role models at least as it related to their depiction as intelligent and skilled scientists. The researchers concluded that the shows were useful as a means to "enhance recruitment and provide ideas about the spectrum of technologies and specialties available in the career." Other research has noted that since the inception of these forensic-related TV shows, student demand for forensic science degrees has increased and universities have responded by expanding the number of available forensic science programs (11)(12)(13).

**Methods**

This study utilized an embedded mixed methods design approach (14) in which quantitative and qualitative data were collected using the same instrument. Although the survey instrument emphasized quantitative data collection, two open-ended questions gathered student perceptions of the major as well as the program's overall effectiveness.

The purpose of this study was to better understand the preparation and academic experiences of students currently enrolled in MTSU's Forensic Science program. Specifically, the authors sought to examine the following questions:

(1) RQ 1: How are incoming students prepared, in both their academics as well as their perceptions, for the rigor of the Forensic Science program?
(2) RQ 2: What are current student perceptions of the Forensic Science program?
(3) RQ 3: What are current student perceptions of Forensic Science faculty and campus supports at MTSU?

### *Participants*

This study utilized a convenience sample of participants (N=46) who responded to an emailed solicitation to all forensic science program majors to participate in a survey. At the time of the survey deployment, the program enrolled 180 students; this survey therefore had a 25.5% response rate.

The participants were primarily of ages 18-22 (80.43%, n=37), and were overwhelmingly female (84.78%, n=39). There were, however, respondents between the ages of 23-30 (15.22%, n= 7) and ages 31-50 (4.35%, n=2). The majority of participants (97.83%, n=45) were enrolled full-time at MTSU and were rather evenly distributed between the academic classifications of freshman (21.74%, n=10), sophomores (28.26%, n=13), juniors (26.09%, n=12), and seniors (23.91%, n=11). In addition to their studies, many of the students enrolled in the program were also employed, with 13.04% (n=6) of students working between 11 and 19 hours per week, and 28.26% (n=13) of students working 20 hours or more per week.

### *Survey Instrument*

A survey consisting of 38 individual questions was developed for this study and was administered through Qualtrics, an online survey tool. Students were emailed a solicitation through a departmental mailing, asking them to voluntarily complete the survey by clicking a link. The survey obtained informed consent before presenting the survey questions. A copy of the survey instrument, the institutional review board (IRB) approval letter, and the data set may be viewed at https://osf.io/e8mkb/?view_only=19f01518b2b246d283ba9f43987cb1db.

### *Data Collection and Analysis*

Participant data were downloaded from Qualtrics, then cleaned by removing extraneous data fields and suppressing responses of participants who did not agree to the IRB consent language. This resulted in 42 entirely completed responses and 4 mostly complete responses, for a total of 46 individual responses. All personally identifying information, such as participants' IP addresses, were removed prior to data analysis to protect participant confidentiality. Data analysis entailed performing descriptive statistics and calculating percentages based on individual responses to the survey questions.

## Results

### RQ 1: How are incoming students prepared, in both their academics as well as their perceptions, for the rigor of the Forensic Science program?

Several questions in the survey helped the authors understand the high school academic preparation of incoming students in MTSU's Forensic Science program. Nearly half (51.11%, n=23) of the participants stated that they took more than the required number of science classes in high school. About a third (37.78%, n=17) of participants expressed that they participated in science or math based extracurricular activities while in high school, and 71.11% (n=32) said that they had a strong interest in forensic science at that time. Nearly all (93%, n=43) of participants entered MTSU as a Forensic Science major.

Because of individual departmental prerequisites, remediation is sometimes necessary prior to entering certain required classes in the forensic science curriculum. More than half (57.78%, n=26) of respondents were required to take Pre-Calculus prior to beginning the program's required Calculus I course because they did not have calculus in high school or a Math ACT score of 26 or above. Twenty percent (n=9) of participants stated that a remedial chemistry course was required prior to taking General Chemistry I because of the Chemistry Department prerequisite of College Algebra or a Math ACT score of 19 or better. Few students (13.33%, n=6) reported that they needed to take both remediation courses, while 35.56% (n=16) did not need to take either and instead directly entered the program's core classes.

Another area of interest was the importance of role models and other influences in choosing to go into forensic science. The survey asked students whether their parents had a STEM background. A slight majority (58.70%, n=27) of participants had parents who graduated from a 4-year college or university and of those, 63% (n=17) of parents graduated with a STEM degree. For parents with a STEM degree, the highest degree obtained for the majority was a bachelor's degree (n=13); however one parent obtained a master's degree and three parents attained doctorate degrees. A later question in the survey asked in more open-ended terms: "In high school, did you have science role models (example parents, teachers, even TV/media figures)?". A large number of participants (64.44%, n=29) claimed to have science role models in their lives. An open-ended question asked "Please explain briefly: what attracted you to this major?", and participant responses to this question point to many motivations such as "subject matter interest", "early exposure", "being able to help", "career stability", and "CSI/crime analysis interest".

**RQ 2: What are current student perceptions of the Forensic Science program?**

MTSU's Forensic Science program is an applied and hands-on degree with an emphasis on laboratory work. The core courses of the program include topics in chemistry, biology, physics, criminal justice, and some survey courses regarding career opportunities. When surveyed, 56.52% (n=26) of respondents said that they would prefer a greater amount of field work, as compared to lab work, in the program. To better understand what students were referring to by the term "field work", as well as to further identify student preferences for coursework, the survey presented respondents with a list of 21 hypothetical forensic-based upper-division electives for the program and asked them to select all courses for which they had an interest. The top three electives which found the most interest were: Death Investigation (n=27), Bloodstain Pattern Analysis (n=24), and Forensic Fingerprinting (n=24). Other elective choices with twenty or more student responses were: Forensic Trace Evidence Analysis, Forensic Psychology, Forensic Anthropology, Forensic Serology, Ballistics, and Forensic Hair and Fiber Analysis. **TABLE 1** contains the complete list along with the number of interested students per course.

**TABLE 1** *Student interest inventory of suggested future upper-division electives.*

| *Possible Forensic-Based Upper-Division Electives* | *Number of Interested Students (n=)* |
|---|---|
| Death Investigation | 27 |
| Bloodstain Pattern Analysis | 24 |
| Forensic Fingerprinting | 24 |
| Forensic Trace Evidence Analysis | 23 |
| Ballistics | 21 |
| Forensic Anthropology | 21 |
| Forensic Hair and Fiber Analysis | 21 |
| Forensic Psychology | 20 |
| Forensic Serology | 20 |
| Forensic Skeletal Trauma | 18 |
| Forensic Pathology | 16 |
| Forensic Aspects of Fire and Explosion Investigation | 12 |
| Forensic Questioned Documents | 9 |
| Forensic Dentistry | 8 |
| Forensic Archaeology | 7 |
| Computer or Cyber Forensics | 6 |
| Forensic Entomology | 5 |
| Other | 4 |
| Forensic Accounting/Auditing | 3 |
| Forensic Nursing | 3 |
| Forensic Taphonomy | 2 |
| Forensic Graphology | 1 |

In addition to the list of 21 possible electives, this question also gave students a free response choice of "Other" which yielded four responses. Students expressed that they would be interested in elective classes focused on the following content: "medical examiner", "forensic chemistry- or specifics of learning about drugs and drugs testing", "crime scene investigation", and "a class on forensic careers". Some of these open response questions demonstrate student lack of familiarity with the current required coursework, as "forensic chemistry", "crime scene investigation", and "a class on forensic careers" are all covered in current course offerings.

In addition to examining the issue of the coursework, the survey attempted to measure student perceptions of the Forensic Science program as a whole. For 79.07% (n=34) of the participants, Middle Tennessee State University was their first choice of school to attend for their bachelor's degree. Nearly all (92.86%, n=39) of participants felt that the Forensic Science major at MTSU was challenging, and moreover, 83.33% (n=35) of the participants stated they felt the Forensic Science major at MTSU was effectively preparing them for their post-graduation career. A scaled survey question scored from 0 to 10 asked participants to express how confident they were that they would finish their degree in 6 years or less. A score closer to 0 represented "I am not very confident" and a score closer to 10 represented "I am very confident". The mean score of participants was approximately 9.07, indicating high levels of student confidence in their ability to graduate in 6 years or less. A majority of participants (74.42%, n=32) planned to continue their education through graduate school at some point in the future. One area of concern however was in terms of career preparedness: almost every student was aware that an off-campus internship is required for the degree, yet only 28.89% (n=13) knew how to secure one. This was a puzzling response because faculty spend considerable time in the Forensic Freshman Seminar class discussing how to obtain an internship. It is possible that preparing students in the freshman year is the wrong time, and perhaps it would be better to give students this information when they are upperclassmen or multiple times throughout their program.

The survey gave a free response question asking if the Forensic Science program at MTSU had met their expectations and asked if they could explain. Of the 34 responses, 22 (64.7%) responded in the affirmative, with

some students providing enthusiastic comments such as: "Yes, despite the pandemic, the Forensic Science program is obviously curated with the help of local professionals. I do believe the associate professors have exposed me to connections that I would not have made without their 'foot in the door'." Four students wrote ambivalent comments indicating their novice status in the program such as "I am only in my second semester so I have not gotten into the coursework yet." Six students had mixed reviews because they desired a specific forensics focus that they felt the program lacked; for example one student wrote "I am excited that MTSU even offers a forensics degree, but I feel like there could be a lot more forensic specific classes." Another student comment provided greater context to this sentiment, writing:

> "I feel that we technically only have a handful of Forensic science classes. Whereas when I take classes like chemistry subjects or biology subjects there may have been one or no other person in my class with a forensic science major. Whereas if there were chemistry and biology classes focused solely on Forensic Science you can make a better connection with the information in those classes."

Only 4 of the 34 respondents to this question (11.76%) indicated that the program had not met their expectations.

**RQ 3: What are current student perceptions of Forensic Science faculty and campus supports at MTSU?**

The literature review indicated the importance of faculty-led research projects as a factor which favorably impacted student retention in STEM fields. Of those surveyed, 15.56% (n=7) had participated in research under a professor's supervision. Besides research projects, the survey examined other ways in which students might interact with faculty outside of class. When given options of how participants contacted professors and how often they interacted with Forensic Science faculty outside scheduled class times, the majority of the 45 students responding said that they communicated via email (93.33%, n=42), followed by virtual office hours (55.55%, n=25), and in-person office hours (37.77%, n=17). Regarding faculty interactions within the Forensic Science program, most of the 45 student respondents claimed to only interact with faculty once a month (20%, n=9), once a semester (33.33%, n=15), or never (31.11%, n=14); small numbers of students interacted weekly (6.67%, n=3) or biweekly (8.89%, n=4).

A Likert scale was used to determine the satisfaction of participants with the level of support offered by the Forensic Science faculty members. The scale ranged from 0 to 10 with lower values representing "very dissatisfied", the middle representing "neutral", and the higher values representing "very satisfied". The mean response was approximately 6.20 with a median of 6, indicating moderate satisfaction. Regarding perceptions of faculty support, the participants were asked a series of yes/no questions. Although the majority of participants felt that the Forensic Science faculty had not gotten to know them on an individual basis (75.56%, n=34), the majority of students felt empowered to ask questions in class (71.11%, n=32), felt Forensic Science professors actively engaged them in classroom activities (71.11%, n=32), and felt comfortable to speak individually with their Forensic Science professors (84.44%, n=38). These results suggest that most students experienced individual engagement in the classroom, however attention outside of the classroom may have been limited due to the COVID-19 pandemic.

In addition to faculty supports to students, the authors hoped to isolate additional factors which could be considered campus supports. Participants were asked if they had attended a non-faculty led study group, and of the respondents (N=45), one-third (33.33%, n=15) stated they had while the majority (66.66%, n=30) had not. Out of the 15 participants who answered in the affirmative, two attended weekly study groups, five attended them every other week, four attended monthly, and four attended them once a semester.

One question from the survey that was very interesting for its almost unanimous affirmative response was a question regarding mentoring. Participants were asked if they would find mentoring from senior forensic science students to be beneficial, and 95.56% responded in the affirmative. Student mentoring programs have been implemented in the past, but with very few actual participants. It is possible that a renewed effort at peer mentoring may attract participants if the correct format is achieved. For example, it is possible that today's students may appreciate virtual or online opportunities for peer mentoring rather than the in-person opportunities previously offered. Additional study is required to understand student interest.

Regarding extracurriculars at MTSU, 93.02% (n=40) of the participants did not take part in the Crime Busters Living Learning Community through on-campus housing. This is likely correlated to the majority of participants (69.77%, n=30) reporting that they lived off campus. On a scale from 0 to 10, participants were asked to score how likely they were to participate in campus extracurricular activities with the lower values representing "very unlikely", the central values representing "some interest", and the higher values representing "very likely". The mean value chosen by participants was approximately 6.85 with a median of 7. Students therefore have interest in campus extracurricular activities despite being a largely nonresidential student population.

**Discussion and Conclusion**

This study was undertaken to understand the pre-collegiate preparations of students currently enrolled in MTSU's Forensic Science program, as well as their perceptions of the program. Far more respondents indicated the need for math remediation courses (57.78%) versus science remediation courses (20%) prior to beginning the program's required sequences. It is possible that recruitment of high school students should reiterate the importance of both areas for students who desire to pursue a bachelor's degree in Forensic Science, as they may be under the impression that advanced math preparation in high school is less important. The RQ1 findings also suggest that a majority of students entering the Forensic Science program were influenced by science role models such as parents, teachers, and even TV shows; this finding partially supports the "CSI effect" noted by other researchers (10)(11)(12)(13). This is one of many factors behind incoming student motivation for the major, in which a very high percentage of students (93%) entered MTSU as Forensic Science majors. It may be helpful for Forensic Science faculty to understand these influences as possible sources of student motivation in choosing Forensic Science and/or persisting through the degree.

One important discovery of the study is that these highly motivated students may be entering the program with misconceptions of what it is to be a Forensic Science major at MTSU. In particular, the results of RQ2 regarding student expectations demonstrated that there are several student assumptions which Forensic Science faculty should consider. Several of the survey's inquiries, for example, demonstrated that students held misconceptions regarding the curriculum, expecting specialized introductory Biology and Chemistry classes that focus on forensic science. This expectation reveals a lack of understanding in how the foundational coursework prepares students for the rigor of upper division classes in Forensic Science. Additionally, it appears that some students may conflate their interest in forensic anthropology (as perhaps cultivated through MTSU extracurricular experiences such as FASR team) with the Forensic Science degree coursework. Although forensic anthropology content, such as Death Investigation and Forensic Anthropology, can complement one's understanding of the forensic sciences, the Forensic Science program is a separate and laboratory science focused degree. These results suggest that more needs to be done to clearly articulate to students the parameters of the Forensic Science program, and its objective of training future scientists to work in crime labs rather than death investigations. This points to a need for the Forensic Science faculty to manage student expectations regarding the laboratory focus of the degree program. Also, these student misconceptions can prompt questions to Forensic Science faculty of an existential nature: why should students major in Forensic Science instead of Biology, Chemistry, or Anthropology? Is there an added value in specializing in Forensic Science? If so, faculty must clearly articulate this value to incoming students, who may be heavily influenced by their high school science role models and may therefore lack real-world understanding.

Despite these misconceptions, it is important to retain sight of student motivation factors. Students clearly are interested in some of the hands-on opportunities afforded by the Forensic Anthropology curriculum such as the FASR team. This finding may be supported by the literature review, in which Cundall and Pierce (8) reported that biology majors benefit from real life examples more so than chemistry majors. For those Forensic Science majors with a predisposition towards the biological sciences, the coursework as well as extracurricular opportunities afforded by the Forensic Anthropology Program may provide needed engagement and motivation to persist through the laboratory sciences classes of the Forensic Science major. In response to these factors, the Forensic Science Program has added new coursework beginning with the 2022-2023 academic year in Forensic Anthropology, Forensic Taphonomy, Forensic Photography, and Advanced Forensic Chemistry. New courses in Latent Fingerprints and Firearm and Toolmark Analysis are currently in development.

Finally, the survey's findings reiterate the importance of student connections to their peers and faculty, an idea supported by the literature review (5)(6)(7)(8)(9). The study has identified several areas of student interest which were underutilized at the time of the survey's deployment such as peer mentoring, study groups, extracurricular opportunities, and individual faculty attention such as through office hours and research opportunities. Some of these are longstanding issues: even before the COVID-19 pandemic, the Forensic Science program struggled to find the right balance of extracurricular activities by which to engage students. Like the previously reported interest in peer mentoring, attempts were made over the years to foster extracurricular Forensic Science opportunities but with little student participation. More study is needed to determine the precise format and topics needed for optimal student interest and participation. Other issues, however, may be more directly related to the COVID-19 pandemic. Although the results of RQ3 found that student-reported interactions with faculty were mixed, it is important to consider these results within the context of the survey's deployment in March 2021. At that time, students were attending class under COVID-19 enforced policies of limited in-person contact and upper classmen had been experiencing various degrees of no or partial in-person contact since March 2020. Although in-person classes were offered at MTSU during the time of the survey, the campus culture was one of social distancing,

limited in-person class sizes, and fewer social gatherings. Therefore, students may have hesitated to interact with their faculty in-person. It would be helpful to deploy the survey again as the campus environment has largely resumed normal classroom interactions including regular-sized classroom enrollments as well as extracurricular offerings.

In all, we were pleased to find that our students appeared to be largely satisfied with the academic preparation they were receiving. A vast majority of surveyed students expressed that they chose MTSU as their first choice, that the Forensic Science program was preparing them well for the job market, and that they felt engaged by their faculty. Although the survey, with its 25.5% response rate, does not represent a majority of our enrolled students, we feel that the results of this survey support the implementation of additional course offerings and other improvements to our program. We hope our findings will assist other FEPAC-accredited programs who are examining similar concerns.

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