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Understanding the Impact of Peer-to-Peer Tutoring: Individual and Course-Level Associations with Academic Success

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Abstract

Peer-to-peer tutoring is widely used in higher education to support academic success, yet evidence of its effectiveness varies depending on how success is measured. This study examined the relationship between peer-to-peer tutoring attendance and academic success at both the individual student level and course levels in residential health science courses at a large private four-year institution. Using a causal-comparative design, data from 3,670 students enrolled in biology and chemistry courses during the fall 2021 semester were analyzed using chi-square tests and linear regressions. Results from tests of significance indicated that tutoring attendance and frequency were associated with individual course grades and semester GPA in limited ways, with effect sizes generally small. However, stronger associations emerged from tests of significance at the course-section level, where higher proportions of students attending tutoring were associated with differences in course success rates, particularly in lower-level biology courses. These section-level patterns likely reflect underlying course difficulty and common academic challenges rather than a direct relationship of tutoring on student performance. This suggests peer-to-peer tutoring may play a more meaningful role in course-level academic support than in assessing individual academic performance. The study highlights the importance of evaluating associations between tutoring and other variables across multiple levels of analysis and challenges against relying solely on individual student outcomes when assessing academic support services.

Keywords: Peer-to-peer tutoring, academic success, tutoring program evaluation, foundational science courses

Recommended Citation

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The topic of academic success is foundational in higher education. Colleges and universities look for ways to improve retention and graduation rates. In those efforts, improving students' academic success is an important focal point. In an effort to define academic success, York et al. (2015) stipulated six areas in its composition: "academic achievement, satisfaction, acquisition of skills and competencies, persistence, attainment of learning objectives, and career success" (p. 9). Since academic success encompasses cognitive outcomes and persistence-related factors, institutions often implement interventions, like peer-to-peer tutoring, to support students. While the current literature supports peer tutoring in a broader sense, few studies explore the relationship between tutoring participation in specific courses and individual student academic success and retention at four-year private institutions. Gaps in understanding how tutoring relates to academic success exist across different levels of analysis.

The purpose of this study was to examine the relationship between peer-to-peer tutoring attendance and individual and course-level academic success. To better capture the complexity of the topic, a multi-level analytic approach was adopted. The following research questions guided the study:

- RQ1: Is there a relationship between peer-to-peer tutoring attendance and individual academic success, including course grades and semester GPA?
- RQ2: Is the frequency of peer-to-peer tutoring attendance associated with individual academic success outcomes?
- RQ3: Do relationships between peer-to-peer tutoring attendance and academic success differ by course level and discipline (lower-level vs. upper-level biology and chemistry)?
- RQ4: Is peer-to-peer tutoring participation at the course-section level associated with course success rates?

Literature Review

Researchers discuss the best ways to predict success. It is frequently recognized as best practice to have an early detection system of at-risk students to best promote academic success efforts (Alyahyan & Düştegör, 2020). Alyahyan and Düştegör (2020) argued that contributing factors to a student's success include academic success before enrollment, student demographics, digital learning, psychological characteristics, and previous and current environmental experience. While using past and existing data to predict future outcomes helps institutions support students, interventions that can be tailored to students on an individual level through personalized academic support and help-seeking opportunities are key.

Kappe and Van Der Flier (2012) on the other hand stated that conscientiousness is the best way to predict success since it accounts for more variance in GPA than intelligence. Furthermore, they stated that intelligence only showed very little connection with academic success. They also advocated for collecting and analyzing personality data for students to tailor academic success efforts to each student. Since conscientiousness is tied closely to persistence and academic success, academic support services that provide a space for students to seek help and plan and practice may help increase student success (Balzer Carr & London, 2019; Walvoord & Pleitz, 2016). When examined together, these frameworks help institutions view their peer-to-peer tutoring programs as influencing both academic performance and persistence.

Tutoring Intervention

To promote academic success, institutions offer tutoring services. Tutoring is conducted by teachers, professors, paraprofessionals, or students who are chosen or hired and trained to serve students. The use of peer tutors often makes tutoring more accessible for students (Cohen & Kulik, 1981). Tutoring is frequently more structured than informal study sessions between peers in that same course learning together. Peer tutors offer a higher level of quality assurance since they are hired after confirming their own academic success in the necessary course content (Saunders, 1992). Across studies, outcomes tied to tutoring programs do not rely on just participation, but the frequency and intensity of the tutoring sessions.

Effectiveness of peer tutoring is often assessed using academic integration frameworks and sociocultural learning theories. In light of Vygotsky's zone of proximal development, peer tutors serve as more knowledgeable students who help deliver course content in a more accessible way for their peers. Peer-to-peer tutoring also helps with academic and social integration, which according to Tinto, is an important part of persistence. Therefore, tutoring programs can help meet academic and social needs (Cohen & Kulik, 1981; Hurtado & Ponjuán, 2005; Saunders, 1992).

Measuring the success of tutoring is important, and researchers have conducted a variety of studies over the last 30 years to do so. Studies have assessed the impact tutoring has on test grades, final course grades, grade point averages (GPA), students' perception of success, success rates, and students' sense of belonging. Some studies even analyzed how the number of tutoring interactions may influence a variety of academic success factors. The result of years of research indicates that tutoring services are important and play a role in academic success efforts but has produced mixed levels of statistical significance across a variety of outcomes and contexts (Rickard & Mills, 2018).

Bryant et al. (2022) found that seeking help from a peer tutor was a significant predictor of a larger sense of institutional identity and belonging, which are confirmed predictors of academic success. Moore-Russo et al. (2025) also claimed that since students attend tutoring for a variety of reasons, spanning from specific topic exploration to filling large content gaps, establishing success tied to grades is not wise and should be seen as an indicator of general help-seeking behavior. Differences across the findings are often indicative of variations between student populations, course difficulty, student need, resilience, frequency of tutoring attendance, and more (Seraj & Leggett, 2023).

As institutions seek to understand their student population, it is important to take into consideration the type of students that interact with tutoring services. Balzer Carr and London (2019) accomplished this in a study analyzing a cohort of students who started in 2010 where one-tenth of the students attended tutoring. They noted that underserved students were more likely to attend compared to their counterparts. Tutoring attendance in this study was positively related to retention, but the researchers noted that this connection was probably because the students who wanted to be successful likely wanted to return for the next term (Balzer Carr & London, 2019). These findings suggest that tutoring services and peer-to peer-support services play a role in increasing equitable access of services to students who may historically be academically at-risk or underserved by other campus supports.

Tutoring Outcomes

Other studies have examined the impact of tutoring attendance. When studying the effects of nudges on tutoring attendance, Pugatch and Wilson (2018) determined that nudges resulted in students being more likely to attend multiple tutoring sessions and surmised that while they could not find a connection to grades, attending tutoring may positively impact study habits. Similarly, De Cort and De Witte (2025) also examined the effects of tutoring through their research and determined that students perceived tutoring contributed to improvement in their academic performance. However, that perception had its limits as students did not see a benefit of attending tutoring more often than an hour in a two-week span (De Cort & De Witte, 2025).

Still another study by Arco-Tirado et al. (2019) continued to further the research of peer tutoring by studying the relationship between peer tutoring and academic performance, including students' GPA and success rate, defined as the number of credits passed divided by the number of credits completed. Arco-Tirado et al. (2019) utilized an experimental group and a control group as part of their study, and the results showed that attendance and participation in peer tutoring had a positive effect on the academic performance of the experimental group .

Studies have reported mixed results between the relationship tutoring has on students' GPA, course grades, and test grades. Among them, multiple published studies noted a contribution to students' GPA, including reporting a positive difference in tutees' GPAs, as opposed to their counterparts who did not attend tutoring (Martin et al., 2018; Seo & Kim, 2019). Nwaesei and Liao (2023) noted the tutees who had a lower course grade than those that did not attend tutoring were likely already at risk for not being successful in the course for a variety of reasons. Another study paired students (one tutee and one non-tutee) who had matching high school GPAs and standardized test scores and determined that tutees had the higher GPA during their first year due to their participation in tutoring (Walvoord & Pleitz, 2016). Other studies have cited higher GPAs by comparing the students' actual GPA against an estimation of their expected GPA based on their SAT scores (Reinheimer & McKenzie, 2011).

In addition to GPA, research indicated that tutoring improves students' test grades, including for at-risk students (Elbulok-Charcape et al., 2019). Pennington et al. (2021) saw a grade letter improvement for tutees, even after controlling for academic skill and motivation. Another study showed that students needed to attend tutoring at least twice to show improvement in final exam grades (Kim et al., 2021).

Still other studies have shown higher course grades for tutees in comparison to peers that did not attend tutoring (Balzer Carr & London, 2019). Pennington et al. (2021) noted that the more sessions, specifically three or more, tutees attended, the higher final grade they received. Another study had similar results showing that for every three tutoring visits, the student's course grade increased by one percent even after controlling for academic skill (Rickard & Mills, 2018). Rickard and Mills (2018) go on to show that tutoring attendance had even more of an influence on lower achieving students' final grade. Other schools found that associations were not seen until students attended tutoring five or more times (Racchini, 2020). Yet another study concluded that attending tutoring more often resulted in higher grades only after controlling for demographics and academic preparation (Balzer Carr & London, 2019).

Other positive connections that have been drawn are regarding course success rates. Made et al. (2019) noted that attending at least one hour of tutoring was positively connected to less than half a failure rate for students. Other studies showed that the DFW rate for tutees was lower than non-tutees, and conversely that tutees had higher overall success rates than non-tutees (Racchini, 2020; Vick et al., 2015).

Other studies, however, have shown no academic performance differences for tutees vs. non-tutees. One study showed that while tutoring resulted in an improvement in overall GPA, tutoring did not improve students' final grade in the tutored course (Seo & Kim, 2019). But while Reinheimer and McKenzie (2011) determined that tutees and non-tutees completed the semester with the same GPA, they argued that tutoring improved the GPA of tutees since those students had lower SAT scores and were expected to be at risk. Another study implied that while students who come to tutoring are motivated to do well, they struggle with test-taking (Walvoord & Pleitz, 2016).

Research has also shown that it is possible for tutees to earn poorer grades in classes for which they received tutoring, but Balzer Carr and London (2019) explained that students likely attend to tutoring for courses they are struggling in. Because of this, the relationship between grades and tutoring is not contradictory. Tutoring is possibly helping the students with course content, but students may still earn lower grades. Another study showed similar results as tutees had lower first exam grades than non-tutees (Kim et al., 2021). Across the variety of these studies, the relationship between tutoring and academic performance seems to be connected to tutoring intensity and reoccurring tutoring interactions.

Another added benefit of tutoring is the increased sense of community and belonging it brings. Research has shown the value of support networks, academic success services, and diverse interactions to help students feel a sense of belonging and combat issues of discrimination and bias (Hurtado & Ponjuan, 2005; Hussain & Jones, 2021; Martin et al., 2018). Hurtado and Ponjuan (2005) noted that supports, like tutoring, can increase necessary skills and confidence. Since belonging and academic confidence are associated with student success and persistence, participation in tutoring programs seems to be a meaningful academic support service that ultimately supports retention.

Other studies have focused on whether tutoring has an relationship with retention. One focused specifically on retention of students without a declared major and also found a positive relationship between tutoring, academic performance, and retention (Reinheimer & McKenzie, 2011). While tutoring alone may not move the needle on retention, literature suggests that the benefits of peer-to-peer tutoring programs contribute to academic progress and integration, which are often tied to continued enrollment.

While most research evaluates tutoring effectiveness using individual academic outcomes, such as grades or GPA, academic support services often operate within environments where content rigor, assessment structure, and student preparedness are collectively experienced. Examining tutoring participation at the course-section level allows for a wider understanding of how academic support usage aligns with course demands and student need. In this way, tutoring participation may function as a diagnostic tool of broader academic challenges experienced within a course. With full course context, tutoring data may be one of many diagnostic indicators of course difficulty student specific academic preparation, and it may be used to trigger certain student success interventions.

Methods

Participants

The participants of this study were students who were enrolled in 18 residential health science courses in the fall of 2021 at a large private 4-year institution in Virginia. The health science courses in the sample were selected due to their historically high academic rigor and students' consistent use of tutoring services at this institution. The sample included 3,670 students who were enrolled in 72 sections taught by 25 professors. The institution's tutoring services offered peer tutoring for all 20 courses, so data were collected on whether the students attended tutoring, how often they attended tutoring, and the percentage of each section that attended tutoring.

Tutoring Services Details

Tutoring services at the sample institution offered centralized peer-to-peer tutoring to residential students for over 100 courses through the academic support department. Highly skilled students that have successfully completed the course with an earned grade of an A or B and receive a recommendation from faculty are hired as student employees. New employees have synchronous and asynchronous training during their first week of employment. Training includes tutoring session best practices and observations of live in-person sessions. At the beginning of each semester, returning student employees complete synchronous training that communicates important reminders.

Peer tutors serve students through one-on-one 45-minute appointments that are scheduled ahead of time by the tutee via an online scheduling tool. When scheduling appointments, students were required to indicate the course they wanted tutoring for and had to leave a comment outlining problems, concepts, or questions they wanted to discuss. The peer tutors would review this information before the scheduled appointment. Appointment flow was determined by the tutor based on the need of the tutee after initial introductions and goal setting for the 45-minutes. Tutors use the Socratic method to understand the student need and gaps in any understanding. From there, tutors used creative methods to ensure the appointment is interactive and accomplished the goal of the appointment.

At the end of each appointment, tutors encouraged the tutee to complete the appointment survey which is available in the tutoring room via QR code. Tutors were evaluated that semester through appointment observations and appointment satisfaction survey data. Observations assessed the tutor and appointment structure using a rubric based on 19 unique measures of success. These measures were integrated with the college's 6 core values of engagement, communication, service, innovation, accountability, and integrity.

Most appointments take place on the first floor of a main academic building. A few peer tutors have their appointments embedded in their respective departments, some of which are on different floors of the same academic building (aeronautics and engineering) while others are in separate buildings (business and health sciences).

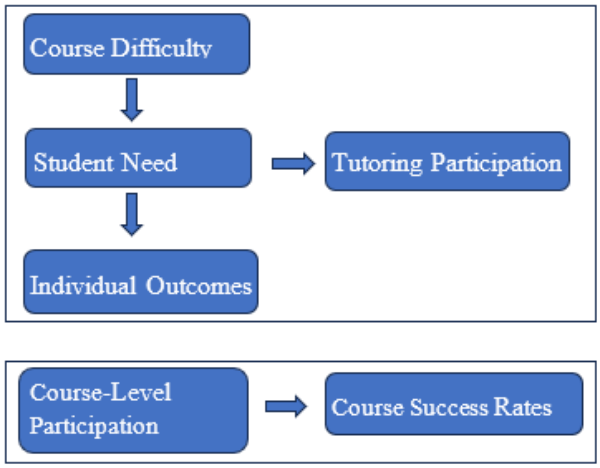
Students use their school identification card to tap or swipe into different support services on campus, including tutoring services. Once in the one-on-one tutoring room, the tutor would swipe the student into the system using their personal computer. During that conversation, the

student confirmed the course they requested when making the appointment online. The system keeps a record of their visit, and the record is sent to the institution's data warehouse. This peer-to-peer tutoring model aligns with best practice that emphasizes employee training, structured sessions, and institutional oversight (Saunders, 1992).

Figure 1 is a visual representation of several factors contributing to tutoring participation and course success rates at the site institution. Course difficulty and/or content rigor, student need and/or academic skill, and individual outcomes, like assignment grades, influence whether a student participates in one-on-one tutoring. Course-level participation in tutoring is associated with course success rates. This study was conducted within this framework while acknowledging a variety of other factors influence participation and success rates.

Figure 1

Conceptual Model for Individual Outcomes and Course Success Rates



Data Analysis

The data for this causal-comparative study included demographic information, course enrollment data, final course grade, tutoring attendance data, institutional GPA for the fall of 2021, and attempted credit hours for the fall of 2021. Chi-square tests and linear regressions were conducted to evaluate the relationship between tutoring attendance and academic success (GPA), retention and success rates. This analysis mirrors earlier studies on tutoring programs that examine both categorical success and continuous enrollment (Balzer Carr & London, 2019; Rickard & Mills, 2018).

Because tutoring participation for the sample was voluntary, all analyses reflect associations rather than causal effects. Tutoring attendance may be influenced by student motivation, academic difficulty, help-seeking behavior, and more, so the results should be interpreted within this non-experimental context.

Results

Sample Descriptive Statistics

The study included 3,670 students who were enrolled in 20 residential courses while attending a large private four-year institution in Virginia in the fall of 2021. The top three reported ethnicities were White (74%), Hispanic (6.5%), and unreported (6.2%) with 36.4% of the sample classified as freshmen, 25.1% as sophomores, 17.3% as juniors, and 21.2% as seniors.

Grade point averages (GPA) are calculated at the end of every semester at the institution. A cumulative GPA is the average GPA of all semesters the student is enrolled in at the institution. The GPA for fall 2021 was the primary metric used in this study for academic success. The average cumulative GPA of the sample before the fall of 2021 was a 2.2. The average semester GPA for the sample for the fall of 2021 was a 3.1. Full-time student status at the institution is students taking 12 or more credit hours with the sample taking an average of 15 credit hours.

This study assessed the relationship between tutoring attendance and academic success in 20 different health science courses. The 20 courses had 72 sections taught by 25 faculty members. These 20 courses were classified as lower-level biology, lower-level chemistry, upper-level biology, or upper-level chemistry. Table 1 shows the number of students enrolled in each of the courses, course level groups, the course success rate, and the percentage of unique students that attended tutoring. BIOL 214 and BIOL 216 are laboratory courses that accompany BIOL 213 and BIOL 215 respectively. Since tutoring appointments cover course content often delivered in lecture courses instead of the laboratory courses, students in these sections did not independently attend appointments. The laboratory sections were retained in the data analysis to reflect the full residential biology and chemistry course structure, though most tutoring interactions were associated with the lecture courses. Success rates are determined by the percentage of students who completed the course and earned a grade of an A, B, or C. Course grade was another variable used in this study as a measurement for academic success.

Table 1

Course Enrollment, Success Rate, and Percent of Students Who Attended Tutoring

Course	Total student enrollment	Course Group	Course success rate	Percent of students who attended tutoring
BIOL213	725	Lower-level Biology	67%	15%
BIOL214	726	Lower-level Biology	77%	0%
BIOL215	484	Lower-level Biology	89%	7%
BIOL216	494	Lower-level Biology	93%	0%
BIOL224	691	Lower-level Biology	65%	15%
BIOL225	340	Lower-level Biology	70%	8%
CHEM107	369	Lower-level Chemistry	83%	35%
CHEM121	607	Lower-level Chemistry	58%	29%
CHEM122	273	Lower-level Chemistry	71%	21%
CHEM132	24	Lower-level Chemistry	81%	12%
BCHM450	113	Upper-level Biology	82%	3%
BIOL203	275	Upper-level Biology	94%	7%
BIOL301	201	Upper-level Biology	75%	9%
BIOL303	196	Upper-level Biology	94%	1%
BIOL313	161	Upper-level Biology	86%	1%
BIOL385	123	Upper-level Biology	71%	2%
BIOL415	146	Upper-level Biology	85%	5%
CHEM105	15	Upper-level Chemistry	93%	13%
CHEM301	209	Upper-level Chemistry	59%	28%
CHEM302	148	Upper-level Chemistry	71%	19%

In total, 15% of the sample attended tutoring at least once for their health science class. Table 2 reveals the number of students who attended a certain number of tutoring appointments for their course. These appointment categories were used as a variable when exploring the relationship between tutoring attendance and academic success.

Table 2

Tutoring Visits

Number of visits	Number of students	Percent of the sample
0 visits	3,125	85.1%
1 visit	243	6.6%
2 visits	88	2.4%
3-4 visits	97	2.6%
5-7 visits	56	1.5%
8+ visits	61	1.7%
Total	3,670	100%

Tutoring Attendance and Individual Academic Success

Attended and Final Grades

To address RQ1, which explored the relationship between tutoring attendance and individual academic success, several statistical tests were conducted. First, a chi-square test of independence was conducted between whether a student attended tutoring for a course and their final grade in the course. One expected cell (7.1%) contained less than 5; however, all other expected cells had frequencies greater than 5. There was a statistically significant but small association between attending tutoring and a student's final grade, $\chi^2(6) = 32.501$, $p < .001$. The association was small (Cohen, 1988), Cramer's V = 0.09. A linear regression evaluating the relationship between tutoring attendance and semester GPA was statistically insignificant (p = 0.649).

Number of Appointments and Final Grades

To address RQ2 which focused on frequency of tutoring attendance and individual academic outcomes, a linear regression evaluating the relationship between final grades in the course and number of tutoring appointments for that specific course was run. The test was statistically insignificant (p = 0.612). Another linear regression evaluating the relationship between semester GPA and number of tutoring appointments was conducted. The test was also statistically insignificant (p = 0.088).

Across individual student data analyses, statistically significant relationships between tutoring and academic success were limited with most effects small in magnitude.

Number of Appointments and GPA by Course Level Group

To address RQ2 and RQ3, analyses were conducted controlling for course level to explore whether tutoring frequency and semester GPA differ. When grouped by lower-level biology classes, there was a statistical significance that reflected a very small relationship between semester GPA and number of tutoring appointments, $F(1, 1937) = 7.350$, p = 0.007, only accounting for less than 1% of the variance ($R^2 = .004$). The prediction equation was: GPA = 3.040 + 0.045(x) where x represents each additional tutoring appointment. The linear regressions for the upper-level biology classes (p = 0.898), lower-level chemistry (p = 0.302), and upper-level chemistry (p = 0.551) were statistically insignificant.

Number of Appointments in Categories and GPA

Additionally, to examine RQ2, the number of tutoring appointments were grouped into categories (0 visits, 1 visit, 2 visits, 3-4 visits, 5-7 visits, 8+ visits) to further assess the relationship between academic success and tutoring attendance. To explore the relationship between the number of tutoring appointments when categorized and the semester GPAs of the students in the courses, a linear regression was conducted and was statistically insignificant (p = 0.090).

Tutoring Attendance and Course Grades by Course Level Group

To address RQ1 and RQ3, chi-square tests of independence were conducted to explore the relationship between tutoring attendance and course grades across course level groups. The test for the lower-level biology was statistically significant but reflected a very small association, $\chi^2(6) = 13.619$, p = .034. The association was very small (Cohen, 1988), Cramer's V = 0.084. The test for the lower-level chemistry was also statically significant but small association, $\chi^2(6) = 18.462$, p = .005. The association was small (Cohen, 1988), Cramer's V = 0.151. The chi-square tests for upper-level biology (p = 0.684) and upper-level chemistry (p = 0.903) were statistically insignificant.

Number of Tutoring Appointments when Grouped and Course Grade

To look at the students' course grades and number of tutoring appointments when grouped into categories in connection with RQ2, a chi-square test of independence was conducted. Eleven expected cells (26.2%) contained less than 5; however, all other expected cells had frequencies greater than 5. There was a statistical significance that reflected a very small association between attending tutoring and a student's final grade, $\chi^2(30) = 54.707$, p = .004. The association was very small (Cohen, 1988), Cramer's V = 0.055.

Number of Tutoring Appointments when Grouped and Course Grades when Grouped

To examine RQ2 and RQ3 at the same time, linear regressions were conducted. The linear regressions were statistically insignificant for the lower-level biology courses (p = 0.365), upper-level biology courses (p = 0.581), lower-level chemistry courses (p = 0.853), and upper-level chemistry courses (p = 0.319).

Number of Tutoring Appointments when Grouped and GPA by Course Level Group

However, to address RQ2 and RQ3, linear regressions were conducted evaluating the relationship between the number of tutoring appointments when categorized and the semester GPA of students in the courses when grouped by course level. The regression evaluating the lower-level biology courses was statistically significant but accounted for very little variance $F(1, 1937 = 8.729$, p = 0.003, accounting for less than 1% of the variance ($R^2 = 0.004$). The prediction equation was: GPA = 3.036 + 0.076(x) where x represents each additional tutoring category. The linear regressions for the upper-level biology courses (p = 0.844), lower-level chemistry courses (p = 0.208), and the upper-level chemistry courses (p = 0.960) were statistically insignificant.

Tutoring Attendance and GPA when Grouped by Course

To explore RQ1 and RQ3 further, linear regressions assessing the relationship between tutoring attendance and semester GPA for lower-level biology (p = 0.060), upper-level biology (p = 0.389), lower-level chemistry (p = 0.680) and upper-level chemistry (p = 0.934) were statistically insignificant, noting that the analysis of chemistry courses resulted in p-values close to one indicating little to no statistical relationship.

When course levels were considered, statistically significant relationships emerged primarily in lower-level biology courses, while other course groups showed no significant associations.

Course Success Rates and Tutoring Attendance

This section addresses RQ4, which evaluated the relationship between the number of students in a section who attended tutoring and the success rate for the section. A linear regression was conducted, which was statistically significant and accounted for a moderate amount of variance, $F(1, 70) = 22.264$, $p < 0.001$, accounting for approximately 24% of the variance ($R^2 = .241$). The prediction equation was success rate = 0.823 + -0.608(x), where x represents each additional tutoring appointment. To evaluate the relationship between the number of students in a section who attended tutoring and attended for at least a second time and the success rate for the section, a linear regression was conducted, but was statistically insignificant, ($p = 0.308$).

Furthermore, linear regressions were conducted to examine the relationship between the section success rate and the percent of students who attended tutoring when the courses were grouped by level. The linear regressions evaluating the upper-level biology sections ($p = 0.282$), lower-level chemistry sections ($p = 0.462$), and upper-level chemistry sections ($p = 0.489$) were statistically insignificant. However, the linear regression for the lower-level biology sections was statistically significant and accounted for a substantial portion of variance, $F(1, 38) = 15.597$, $p < 0.001$, accounting for approximately 29% of the variance ($R^2 = 0.291$). The prediction equation was success rate = 0.807 + -0.956(x).

To explore the relationship between the percentage of students who attended tutoring 2 or more times and the course success rate when the sections were grouped by level, linear regressions were conducted. Linear regressions conducted for lower-level biology sections ($p = 0.371$), lower-level chemistry sections ($p = 0.995$), and upper-level chemistry sections ($p = 0.306$) were statistically insignificant. However, the linear regression for the upper-level biology sections was statistically significant and accounted for a large portion of variance, $F(1, 8) = 6.856$, $p = 0.031$, accounting for approximately 46% of the variance ($R^2 = 0.461$). The prediction equation was success rate = 1.083 + -.129(x).

Section-level analyses revealed stronger associations between tutoring participation and course success rates than were observed at the individual student level. Notably, higher levels of tutoring participation within a section were associated with lower course success rates. This inverse relationship likely reflects the academic context of the course rather than the effect of tutoring itself. Courses with greater academic difficulty may prompt higher utilization of tutoring while simultaneously exhibiting lower overall success rates. This dichotomy positions tutoring participation as a marker of shared academic challenge rather than a causal determinant of course outcomes.

Discussion and Limitations

As higher education leaders seek to promote academic success and persistence, tutoring remains a commonly implemented support strategy. This study examined the relationship

between peer-to-peer tutoring attendance and academic outcomes in residential health science courses at a large private four-year institution in Virginia.

Overall, the findings reveal that relationships between tutoring participation and academic success outcomes varied by level of analysis and course context. While tutoring attendance and frequency were associated with individual academic outcomes in limited ways, stronger associations occurred when participation was examined at the course-section level, particularly in biology courses. These results suggest that the impact, not effectiveness, of tutoring and how institutions use tutoring data are not the same across students or courses and may be better understood within the larger academic context in which tutoring is used.

When academic success was explored at the individual student level, tutoring attendance and frequency were associated with final course grades and semester GPA in limited and small ways. These findings suggest that while peer-to-peer tutoring may contribute to individual academic performance, its relationship to grades and GPA is modest and not uniform across students. This pattern may reflect how students utilize tutoring services. One possible explanation is that tutoring is frequently utilized in response to academic difficulty or confusion rather than as a proactive or preventative action, meaning students who seek tutoring may already be experiencing a variety of challenges that complicate efforts to isolate the effect of tutoring on individual outcomes (Balzer Carr & London, 2019; Bryant et al., 2022). In this context, tutoring may function as a supplemental academic support rather than a direct means for large gains in individual academic performance.

In contrast to the limited associations seen at the individual student level, stronger relationships emerged when tutoring participation was examined at the course-section level. Specifically, sections with higher proportions of students attending tutoring were associated with lower course success rates, particularly in biology courses. Rather than indicating that tutoring hinders academic success, this pattern likely reflects the concentration of academic difficulty within certain courses as Balzer Carr and London (2019) discovered in their study. Lower-level biology courses may function as foundational courses where academic difficulty and adjustment demands are more pronounced. In this context, increased tutoring participation may reflect broader academic challenges as courses with difficult foundational content may prompt students to seek academic support. As a result, section-level tutoring participation may serve as an indicator of course-level academic demand rather than a direct influence of differences in course success rates.

The findings of this study reflect patterns noted in prior research on peer tutoring, which consistently reported mixed associations between tutoring and individual academic outcomes when measured using grades or GPA. Instead of indicating that tutoring is ineffective, these mixed results highlight the importance of considering how tutoring is utilized and how academic success is defined and measured on the individual and course level (Moore-Russo et al., 2025). Research on tutoring has shown outcomes are often influenced by course difficulty, student preparedness, and the frequency and context of tutoring interactions, factors that were also evident in the present study (Nwaesei & Liao, 2023). By examining tutoring participation at both the individual and course-section levels, this study extends the literature by demonstrating that tutoring patterns may be more readily observed when academic success is assessed within a broader academic context. These results highlight the value of evaluating tutoring not only through individual performance metrics, but also through course-level indicators that capture shared academic challenges.

From an institutional perspective, this study may suggest that evaluating tutoring effectiveness solely through individual student outcomes may provide an incomplete picture of program impact. In alignment with Seraj and Leggett (2023), tutoring is more than reinforcing course content, but helps develop confidence and motivation in students. In addition, as Pugatch and Wilson (2018) concluded, while there may not always be a connection between tutoring attendance and grades, they did find reason to surmise that attending tutoring did result in changes to students' study habits. Course-level tutoring participation patterns appear to offer helpful insight into where academic challenges are concentrated, particularly in foundational science courses. Instead of serving only as a method for improving individual grades, tutoring data, in addition to course success rates, may function as a diagnostic tool that informs faculty evaluation, curricular review, or targeted academic interventions. Incorporating course-level indicators alongside individual outcomes may allow institutions to more accurately assess the role of tutoring within the academic context. On the other hand, using course level indicators at the same time as individual outcomes may overshadow individual improvement within passing grades after utilizing tutoring.

Several limitations should be considered when interpreting the findings of this study. First, the data were drawn from a single private four-year institution and focused on residential health science courses, which may limit the generalizability of the results to other institutional types or academic disciplines. Second, tutoring participation was voluntary and students scheduled and attended all appointments, making it difficult to isolate the effects of tutoring from factors such as student motivation or help-seeking behavior. As a result, higher levels of tutoring participation should not be interpreted as causing differences in academic outcomes, but rather as reflecting underlying academic need within specific courses or student groups. Additionally, this study relied on quantitative measures of academic success, including course grades, GPA, and course success rates, which may not fully capture other academic, developmental, and social benefits associated with tutoring participation. Finally, the analysis examined tutoring attendance and frequency but did not account for variation in the timing, quality, or focus of tutoring interactions, which may influence outcomes. These factors are common metrics of success for tutoring, thus not controlling for them can limit the confirmation of the quality of the tutoring measured in the study. These limitations highlight opportunities for future research to further examine how tutoring functions across contexts and student populations. In light of the listed limitations, future research should explore the relationship between tutoring attendance and academic success with additional contextual factors, like tutoring effectiveness, timing, and academic rigor.

Conclusion

This study contributes to the growing body of research on peer-to-peer tutoring by highlighting continued need for further multi-level analysis of the effect of tutoring on course performance and individual student success as a diagnostic tool. While tutoring attendance and frequency were associated with individual academic outcomes in limited ways, stronger relationships emerged when tutoring participation was examined at the course-section level, particularly in foundational biology courses. These findings suggest that tutoring interactions and data may play a more meaningful role in increasing knowledge of course-level academic difficulty and student engagement rather than in producing uniform gains in individual grades or GPA. Tutoring should not be seen only as an intervention, but as a diagnostic tool for academic need. By examining tutoring outcomes across multiple levels of analysis, this study underscores

the importance of contextualized approaches to evaluating academic support services, while admitting other factors, including quality of tutoring and content focus, should be considered. Instead of relying solely on individual performance metrics, institutions may gain a more accurate understanding of tutoring's role by considering how tutoring participation aligns with course-level academic demands and shared student challenges.

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