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The Relationship between Peer Environment and Academic Achievement among Pre-Service Social Studies Teachers

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ABSTRACT

Academic achievement in higher education is associated not only with individual and instructional factors but also with students' social environment. However, evidence on peer environments among Social Studies Education students in Indonesia remains limited, particularly regarding how peer interactions are experienced in academic contexts. This study examines the relationship between peer environment and academic achievement among pre-service Social Studies teachers at the Social Studies Education Study Program, Faculty of Education and Teacher Training, State Islamic University of Maulana Malik Ibrahim Malang. A sequential explanatory mixed-methods design was used. The quantitative phase involved 220 students from a population of 488 students in the 2023, 2024, and 2025 cohorts and was analyzed using PLS-SEM. The qualitative phase involved semi-structured interviews with 15 students selected purposively from the quantitative phase. The quantitative results indicated a positive and statistically significant association between peer environment and academic achievement ($\beta = 0.145$; $t = 2.123$; $p = 0.034$), although the effect size was small ($f^2 = 0.014$) and the model explained 1.5% of the variance in academic achievement ($R^2 = 0.015$). The qualitative findings identified four themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive. Together, the findings suggest that peer environment is a contextual factor associated with academic achievement through students' academic behaviors and interactions, rather than a dominant determinant of GPA. The study extends the application of Peer Influence Theory to pre-service Social Studies teacher education by highlighting the academic orientation and quality of peer interactions.

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1. INTRODUCTION

Academic achievement is one of the important benchmarks for measuring the success of the higher education process because they represent the academic achievement

obtained by students after participating in learning activities [1], [2]. However, academic achievement is not solely constructed through individual capacity or classroom instruction. The learning process is closely intertwined with the social environment, which shapes students' opportunities to interact, exchange information, develop learning patterns, and receive support from peers. In this context, the peer environment represents an important informal learning context associated with students' academic behavior and outcomes. Various studies have reported associations between peer relationships, academic achievement, learning engagement, and academic development [3], [6].

Peer Influence Theory provides the conceptual basis for understanding how peer environments may be associated with students' academic behavior. Brown and Larson [7] explain that peer relationships provide a social space in which individuals observe, compare, imitate, and adapt to behavioral patterns within the group. In the academic domain, this perspective is operationalized through academic interaction, information exchange, imitation of learning patterns, social support or reinforcement, group learning norms, and group identification. These dimensions describe the social processes through which students may encounter and adjust to academic behaviors in their peer environment. Thus, Peer Influence Theory provides a framework for examining the relationship between the peer environment and academic achievement without assuming that peer exposure alone causes changes in achievement.

Various research findings reinforce this argument. Carrell et al. [8] found an influence of peers on student achievement in the context of higher education, and Griffith and Rask [9] revealed that the influence of peers on academic outcomes can vary depending on institutional context and student characteristics. Furthermore, Cheng [10] also found a similar effect on students' academic performance, and Golsteyn et al. [11] showed that peers' personality characteristics can contribute to students' academic achievement. These studies indicate that peer influence can emerge through group characteristics or through the interaction processes that occur within them.

Nevertheless, although the peer environment is closely intertwined with Academic achievement, the strength of its influence can vary depending on student characteristics and educational context. Hanushek et al. [12] underline the difficulty of distinguishing peer effects from the similarity of student characteristics, while Ficano [13] and Griffith and Rask [9] reveal variation and heterogeneity in the influence of peers on academic achievement. Recent findings remain consistent in highlighting its relevance, whether through the relationship between peers and academic achievement [5], the interaction between peers and academic achievement in digital environments [14], peer climate and students' academic functioning [15], or the relationship between interpersonal relationships and academic outcomes based on meta-analysis [6]. Peer relationships have also been linked to academic achievement through peer attachment and interaction quality [16], while broader reviews of higher-education peer effects emphasize the importance of peer composition and context [17]. Within the framework of constructive alignment, the learning environment also contributes to reconstructing Academic achievement through the connection between students, learning activities, and the educational environment [18]. Peers are also part of the

informal learning environment through discussion, group work, exchange of learning resources, and encouragement of academic orientation [19].

This phenomenon is relevant to Social Studies Education students at Universitas Islam Negeri Maulana Malik Ibrahim Malang, as prospective educators, because their learning activities involve group discussions, presentations, group work, analysis of social phenomena, communication, and collaboration. Collaboration-based learning through the *Merdeka Belajar Kampus* (Independent Campus) program has also expanded opportunities for student interaction [20], [21]. Nevertheless, empirical evidence concerning the relationship between peer environment and academic achievement among Social Studies Education students in Indonesia remains limited. Existing studies also tend to emphasize peer similarity, academic achievement, or peer effects as outcomes, while fewer studies conceptualize peers as a multidimensional social environment involving interaction, imitation, reinforcement, norms, and group identification. In addition, quantitative findings do not by themselves explain how students experience these peer processes in everyday academic life.

Departing from this gap, this study examines the relationship between the peer environment (X) and academic achievement (Y) of Social Studies Education students. The peer environment is constructed based on Brown and Larson's Peer Influence Theory [7], while GPA represents academic achievement with reference to the Constructive Alignment perspective [18]. This study uses a sequential explanatory mixed-methods approach: PLS-SEM is used to estimate the X→Y association, and qualitative data are used to explain students' experiences underlying that association. The study aims to determine whether the peer environment is positively associated with academic achievement and to explain the academic experiences through which students perceive peer-related processes. The contribution of this study lies in connecting a theoretically specified peer-environment construct with students' lived academic experiences in Social Studies teacher education.

H1: The peer environment is positively and significantly associated with the academic achievement of Social Studies Education students.

2. METHOD

This study employs a mixed-methods approach with a sequential explanatory design, in which the quantitative phase is followed by a qualitative phase to clarify the quantitative findings [22]. The study was conducted among Social Studies Education students at Universitas Islam Negeri Maulana Malik Ibrahim Malang. The population consisted of 488 students from the 2023, 2024, and 2025 cohorts. A quantitative sample of 220 students was obtained using the sampling procedure reported in the original study. Data were collected through a 4-point Likert questionnaire measuring the peer environment. Academic achievement was measured using students' self-reported GPA, which was obtained through the questionnaire. The peer-environment indicators were developed from Brown and Larson's Peer Influence Theory [7], covering academic interaction, imitation of learning patterns, social reinforcement/support, group norms, and group identification.

Quantitative data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) through SmartPLS. The analysis included evaluation of the

measurement model through indicator loadings, Cronbach's alpha, composite reliability, and average variance extracted (AVE), followed by assessment of discriminant validity using HTMT. The structural model was evaluated using R^2 and f^2, while hypothesis testing used bootstrapping with 5,000 subsamples [23], [24]. The analysis focused on the association between the peer environment (X) and academic achievement (Y).

Before completing the questionnaire, participants were informed about the purpose and procedures of the study. Participation was voluntary, and participants were free to decide whether to participate after receiving the relevant information. The confidentiality of participants' identities and responses was maintained throughout the study.

The results of interviews with 15 purposively selected students indicate that a positive peer environment is associated with greater academic engagement. Across the interviews, students described studying together, discussion, information and resource sharing, academic support, peer role modeling, and positive academic comparison. These experiences were organized into four themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive. The data were analyzed thematically and integrated with the quantitative findings to provide a deeper explanation of the X→Y association [25], [26].

3. RESULTS AND DISCUSSION

3.1. Quantitative Analysis Results

3.1.1 Structural Model Evaluation

Before interpreting the structural model, the measurement model was assessed to establish indicator reliability, internal consistency, convergent validity, and discriminant validity. The retained peer-environment indicators showed loadings of 0.729, 0.698, 0.777, and 0.729; Cronbach's alpha was 0.713, composite reliability was 0.823, and AVE was 0.538. The HTMT value between peer environment and academic achievement was 0.136, indicating adequate discriminant validity. These results demonstrate acceptable measurement quality. For the structural model, $R^2 = 0.015$ indicates that peer environment explains 1.5% of the variance in academic achievement, while $f^2 = 0.014$ indicates a small effect size. Overall, the structural model indicates that peer environment has a statistically significant but relatively small association with academic achievement.

Table 1. Measurement Model Results

Indicator	Loading	Cronbach's Alpha	Composite Reliability	AVE
X.P1 – Peer Environment	0.729	0.713	0.823	0.538
X.P7 – Peer Environment	0.698			
X.P9 – Peer Environment	0.777			
X.P11 – Peer Environment	0.729			

Table 2. Discriminant Validity

Construct Pair	HTMT	Decision
Peer Environment → Academic Achievement	0.136	Meets criterion (<0.90)

Table 3. PLS-SEM Cumulative Results

Indicator	Value	Interpretation
R^2	0,015	The explained variation is 1,5%
f^2 X → Y	0,014	small effect

3.1.2 Hypothesis Testing

Hypothesis testing was conducted using bootstrapping with 5,000 subsamples. The results show a positive path coefficient of $\beta = 0.145$, with a t-statistic of 2.123 and a p-value of 0.034. The association is statistically significant ($t > 1.96$; $p < 0.05$), so H1 is supported. This result indicates a positive and significant association between peer environment and the academic achievement of Social Studies Education students; it should not be interpreted as evidence of a causal effect. H1: Peer environment is positively associated with academic achievement among Social Studies Education students

Table 4. Structural Model and Hypothesis Testing

Path	β	t-statistic	p-value	R^2	f^2
Peer Environment → Academic Achievement	0.145	2.123	0.034	0.015	0.014

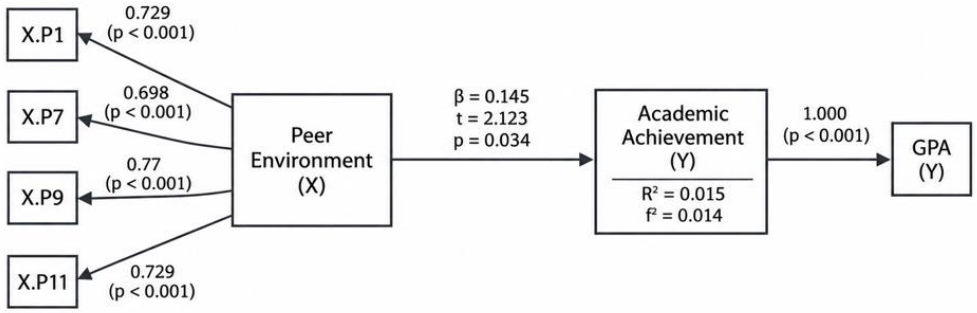


Figure 1. PLS-SEM Structural Model of the Relationship between Peer Environment and Academic Achievement

This finding reveals an interesting pattern: the X→Y relationship is statistically significant, yet its effect size is small. In other words, the peer environment does contribute to academic achievement, but it is not the sole dominant factor. This finding is consistent with research showing that peer effects on academic achievement can emerge significantly yet vary according to student characteristics and educational context [8], [9], [5]. This condition provides an important basis for the qualitative phase to explore the forms of interaction and academic experience that explain why the influence of peers remains significant despite its relatively small contribution.

3.2. Qualitative Analysis Results

The results of interviews with 15 purposively selected students indicate that a positive peer environment is associated with greater academic engagement. Across the interviews, students described studying together, discussion, information and resource sharing, academic support, peer role modeling, and positive academic comparison. These experiences were organized into four themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive.

Table 5. Summary of Informant Interview Results

Informant	Interview results
Informant 1	The environment of diligent friends encourages informants to follow their study habits and be more consistent in studying.
Informant 2	The habit of reminding each other about assignments makes informants more disciplined in completing academic obligations.
Informant 3	Discussions with friends helped informants understand material that was previously difficult to understand independently.
Informant 4	Friends' academic targets became a trigger for informants to set higher learning targets.
Informant 5	Studying together makes informants more organized in allocating time for studying.
Informant 6	Exchanging information and learning resources with friends helps informants obtain additional references.
Informant 7	Positive academic competition makes informants feel challenged not to be left behind by their friends.
Informant 8	Friends' support when facing difficulties makes informants more confident in completing tasks.
Informant 9	Friends' more regular study patterns encouraged informants to improve their own study habits.
Informant 10	Group discussions provide different perspectives and help deepen understanding of the material.
Informant 11	Peer encouragement helped informants reduce the habit of procrastinating and be more consistent in completing tasks.
Informant 12	Being in a group with a strong academic orientation fosters a desire to improve academic achievement.
Informant 13	Sharing learning experiences with friends provides new strategies for understanding lecture material.
Informant 14	Friends' academic achievements are an example that encourages informants to increase their learning efforts.
Informant 15	A positive learning culture in groups makes informants more active in participating in academic activities and learning independently.

The analysis of the overall interviews produced four main themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive. Modeling was evident when students adjusted their study habits to match friends considered to have better academic patterns. Socio-academic support emerged through activities of mutual help, discussion, and sharing of learning resources. Meanwhile, group norms were formed through shared habits in completing assignments and studying, while positive competitive drive emerged when a friend's achievement became a standard that motivated students to increase their effort.

The qualitative phase was conducted to provide contextual explanations for the positive association identified in the quantitative analysis. Fifteen students were purposively selected from the quantitative participants based on their relatively high levels of peer-environment involvement and intensive peer interaction. The thematic analysis identified four themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive.

Academic Behavior Modeling

The first theme, academic behavior modeling, reflects how students observe and use their peers' learning behaviors as references for developing their own academic routines. Informants particularly described the role of diligent and consistent peers in encouraging better study habits. Informant 1 stated:

> *"Lingkungan teman yang rajin mendorong saya untuk mengikuti kebiasaan belajar mereka dan menjadi lebih konsisten dalam belajar."* (Informant 1)

Similarly, Informant 9 explained:

> *"Pola belajar teman yang lebih teratur mendorong saya untuk memperbaiki kebiasaan belajar saya sendiri."* (Informant 9)

These accounts indicate that peers can function as behavioral references within students' academic environments. Through regular interaction, students may observe, evaluate, and adjust their own learning routines based on the behaviors of their peers.

Socio-Academic Support

The second theme, socio-academic support, concerns the academic assistance, encouragement, discussion, and exchange of learning resources among peers. Informant 8 highlighted the role of peer support when facing academic difficulties:

"Dukungan teman ketika menghadapi kesulitan membuat saya lebih percaya diri dalam menyelesaikan tugas." (Informant 8)

Peer interaction also facilitated academic understanding through discussion. Informant 3 stated:

"Diskusi dengan teman membantu saya memahami materi yang sebelumnya sulit dipahami secara mandiri." (Informant 3)

Similarly, Informant 10 noted:

"Diskusi kelompok memberikan perspektif yang berbeda dan membantu memperdalam pemahaman saya terhadap materi." (Informant 10)

The exchange of academic resources was also reported by Informant 6:

"Bertukar informasi dan sumber belajar dengan teman membantu saya memperoleh referensi tambahan." (Informant 6)

Meanwhile, Informant 13 stated:

"Berbagi pengalaman belajar dengan teman memberikan saya strategi baru dalam memahami materi perkuliahan." (Informant 13)

Overall, these accounts suggest that peer relationships provide students with accessible academic and social resources that may support their engagement with academic tasks and learning difficulties.

Group Learning Norms

The third theme, group learning norms, describes the shared routines and expectations that emerge through repeated academic interaction among peers. Informants reported that reminders, collaborative study, and peer encouragement helped them maintain academic discipline and consistency. Informant 2 stated:

"Kebiasaan saling mengingatkan tentang tugas membuat saya lebih disiplin dalam menyelesaikan kewajiban akademik." (Informant 2)

Similarly, Informant 5 explained:

"Belajar bersama membuat saya lebih teratur dalam mengalokasikan waktu untuk belajar." (Informant 5)

Informant 11 also described the role of peer encouragement in reducing procrastination:

> *"Dorongan dari teman membantu saya mengurangi kebiasaan menunda-nunda dan menjadi lebih konsisten dalam menyelesaikan tugas."* (Informant 11)

Beyond these specific practices, Informant 15 described the broader learning culture within the group:

> *"Budaya belajar yang positif dalam kelompok membuat saya lebih aktif dalam mengikuti kegiatan akademik dan belajar secara mandiri."* (Informant 15)

These findings indicate that peer groups can develop informal expectations concerning academic responsibility, participation, and consistency, which may become embedded in students' everyday learning routines.

Positive Competitive Drive

The fourth theme, positive competitive drive, reflects how peers' academic achievements and targets become references for students' own academic aspirations. Informants generally described this competition as constructive and motivating rather than hostile. Informant 7 stated:

> *"Persaingan akademik yang positif membuat saya merasa tertantang untuk tidak tertinggal dari teman-teman."* (Informant 7)

Similarly, Informant 4 explained:

> *"Target akademik teman menjadi pemicu bagi saya untuk menetapkan target belajar yang lebih tinggi."* (Informant 4)

Informant 12 further stated:

> *"Berada dalam kelompok yang memiliki orientasi akademik yang kuat menumbuhkan keinginan saya untuk meningkatkan hasil belajar."* (Informant 12)

Informant 14 also described peers' achievements as a source of academic encouragement:

> *"Prestasi akademik teman menjadi contoh yang mendorong saya untuk meningkatkan usaha belajar."* (Informant 14)

These accounts suggest that comparison with academically oriented peers may serve as a reference for students' academic aspirations and learning efforts. The finding therefore illustrates how students experience positive academic competition within their peer environment without implying that such competition directly causes higher academic achievement.

Overall, the 15 informants described positive changes in their learning experiences after engaging in a peer environment they perceived as supportive. These changes were not manifested uniformly: some informants emphasized greater learning discipline, while others highlighted improved understanding of course material, increased study intensity, better time management, or stronger motivation to achieve better academic results. Although the experiences varied across informants, the findings revealed a common pattern of mutual influence in which peer interactions were perceived to shape learning behaviors, attitudes, and effort. Thus, the qualitative findings provide contextual evidence for how a supportive peer environment may be associated with academic achievement through changes in students' learning processes and behaviors. The integration of these qualitative findings with the PLS-SEM results is discussed in the findings-integration subsection below.

3.3 Integration of Quantitative and Qualitative Findings

The quantitative results show a positive and significant association between peer environment and academic achievement, with $\beta = 0.145$, $t = 2.123$, and $p = 0.034$. The $R^2 = 0.015$ and $f^2 = 0.014$ values indicate that the contribution is small. The qualitative findings help explain this statistical association through four themes: academic behavior modeling, socio-academic support, group learning norms, and positive competitive drive. Together, the findings suggest that peer-related academic experiences may accompany changes in study behavior, while the quantitative model does not establish that these experiences cause changes in GPA.

The qualitative findings help explain how students experience the association. Informants 7, 12, and 14 described positive academic comparison and strong academic orientation among peers as triggers for greater learning effort. Informants 1 and 9 described imitation of study habits; Informants 2 and 11 described mutual reinforcement of discipline; Informants 3 and 10 emphasized discussion; and Informants 8 and 15 emphasized academic support and positive learning culture. Information and learning-resource exchange reported by Informants 6 and 13 is treated as part of socio-academic support rather than as a separate fifth theme.

Other informants demonstrated more specific mechanisms. Informants 1 and 9 showed a process of imitating study habits; Informants 2 and 11 showed reinforcement through discipline and task completion; Informants 3 and 10 emphasized discussion as a means of deepening understanding; while Informants 6 and 13 showed the role of information and study-strategy exchange. Meanwhile, Informants 4 and 5 illustrated influence through targets and group study habits, while Informants 8 and 15 emphasized support and positive learning culture. All of these experiences show that peer influence operates through diverse mechanisms that ultimately lead to changes in students' academic behavior.

Thus, the integration of the two data sets shows that the statistical significance of the X→Y relationship gains empirical explanation through students' experiences. At the same time, the small effect size indicates that this mechanism operates as one of the supporting factors rather than as the sole determinant of academic achievement. This pattern is consistent with Brown and Larson's Peer Influence Theory [7], which positions peers as a social context in which individuals observe, compare, imitate, and adjust their behavior. This finding is also consistent with research by Carrell et al. [8], Griffith and Rask [9], and Yu et al. [5], which shows that peer effects can contribute to academic achievement, but their strength is influenced by group characteristics and educational context.

3.4 DISCUSSION

The PLS-SEM results demonstrate a positive and statistically significant relationship between the peer environment and academic achievement among pre-service Social Studies teachers ($\beta = 0.145$, $t = 2.123$, $p = 0.034$). This finding is consistent with previous evidence showing that peer relationships and peer composition are associated with academic performance in higher education [5], [8], [9], [28], [29]. However, the present result differs in magnitude from studies that report more substantial peer effects under specific conditions, particularly in settings involving controlled peer composition or roommate assignment [30]–[33], [46]. The relatively small effect size in the present study ($f^2 = 0.014$) therefore suggests that peer environment should not be interpreted as a dominant determinant of academic achievement. Rather, its contribution appears to be embedded within a broader academic ecology in which individual characteristics, learning practices, institutional conditions, and other social relationships also shape achievement [1], [3], [41]–[46]. This distinction is important because statistical significance indicates that the relationship is unlikely to be negligible in the observed sample, whereas the small effect size indicates that its practical contribution is limited.

The difference in effect magnitude can be understood partly from the way peer influence is conceptualized in this study. Rather than treating peers simply as a source of homogeneous academic ability, the present research conceptualizes the peer environment as a social context involving academic interaction, behavioral modeling, social support, group norms, and group identification. This broader conceptualization is consistent with Brown and Larson's [7] view of peer relationships as a context in which individuals observe, evaluate, and adjust their behavior in relation to others. Evidence from higher education similarly indicates that peer effects are heterogeneous and may depend on peer

characteristics, duration of exposure, gender, and institutional context [9]–[13]. Cao et al. [29], for example, demonstrate that roommate peer effects vary across students rather than operating uniformly. Thus, the relatively modest coefficient found here may reflect the heterogeneous nature of peer influence: not every interaction carries the same academic meaning, and supportive peers may influence some dimensions of learning behavior more strongly than academic achievement itself.

The qualitative findings provide an explanation for this statistical pattern. Informants described peer influence primarily through observable changes in learning behavior rather than through an immediate or uniform improvement in academic performance. Academic behavior modeling emerged when students observed peers' study habits and subsequently adjusted their own learning practices, while socio-academic support operated through information exchange, assistance, and encouragement. Group learning norms further established expectations concerning discipline and study participation, whereas positive competition encouraged students to increase their effort when confronted with peers who demonstrated stronger academic orientations. These mechanisms are compatible with evidence that peer effects may operate through students' allocation of time and study effort [30], [31], as well as through academic interaction and self-efficacy [14]. The important point, therefore, is that peer influence may affect achievement indirectly through proximal learning behaviors. This interpretation also helps explain why a statistically significant peer–achievement relationship can coexist with a small effect size: the peer environment may initiate or reinforce learning behaviors without being sufficient to determine the final academic outcome.

The distinction between peer influence and peer selection further supports this interpretation. The qualitative accounts show that students can adjust their behavior after observing or interacting with academically oriented peers, providing evidence consistent with an influence mechanism. Nevertheless, the quantitative association cannot establish that peer environment precedes academic achievement. Students may also select friends who already possess similar academic orientations, resulting in homophily between peer relationships and achievement [4], [27], [34], [35]. Brouwer and Engels [34] and related research on higher-education learning communities [35] indicate that academic achievement itself can contribute to the formation and development of peer networks. Consequently, the positive coefficient in this study may represent the combined presence of influence and selection processes. This is a critical qualification because interpreting the coefficient as evidence that peers directly cause higher GPA would exceed what the cross-sectional design can establish.

The findings also refine the interpretation of academic support within peer relationships. Previous studies have shown that peer support is associated with motivation, engagement, and academic functioning [3], [15], [19], while more recent evidence identifies pathways through behavioral engagement and emotion regulation [38]. The present qualitative findings similarly indicate that supportive peers can encourage discipline, facilitate academic information exchange, and sustain students' learning effort. However, the findings do not suggest that support operates independently of group dynamics. Support becomes academically meaningful when it is accompanied by shared expectations,

reciprocal interaction, and behavioral examples that students perceive as credible. In this sense, the present study extends the interpretation of peer support from a simple interpersonal resource toward a social process in which support, modeling, social comparison, and group norms reinforce one another. Such a process is particularly relevant in higher education, where students have greater autonomy in organizing their learning than in more teacher-directed educational settings.

The role of learning effort provides another explanation for why peer environment may be related to academic achievement without producing a large direct contribution. Mehta et al. [30] and Pu et al. [31] demonstrate that peer effects can operate through study effort and time use, while Stinebrickner and Stinebrickner [39], [40] show that students' allocation of time to studying is closely connected with college outcomes. The present qualitative evidence points to a similar mechanism: students reported becoming more disciplined, increasing study intensity, managing their time more carefully, or becoming more motivated after interacting with academically oriented peers. Nevertheless, these behavioral changes do not automatically translate into large differences in GPA because academic achievement also depends on prior ability, learning habits, motivation, engagement, teaching quality, family conditions, and institutional factors [1], [41]–[46]. The small R^2 value (0.015) therefore should not be regarded simply as a weakness of the model; it also indicates that peer environment represents only one component of a much more complex process of academic achievement.

From the perspective of Peer Influence Theory, these findings suggest that peer influence in higher education is better understood as a process of social adjustment than as a simple transfer of academic characteristics from one student to another. The qualitative themes illustrate several interconnected processes: students observe academically relevant behaviors, compare themselves with peers, receive social reinforcement, participate in shared learning norms, and adjust their effort accordingly. This interpretation is consistent with the broader literature on peer relationships and academic development [5], [7], [15], [34]. At the same time, the possibility of peer selection indicates that influence and selection should be treated as analytically distinct but empirically interconnected processes. The contribution of this study therefore lies not in claiming that peer influence is the strongest explanation of academic achievement, but in showing how a multidimensional peer environment is statistically associated with achievement and how students themselves experience the behavioral processes underlying that association.

The mixed-methods integration strengthens this interpretation. The quantitative findings establish the existence and direction of the association, whereas the qualitative findings explain how students perceive peer influence operating through academic behavior modeling, socio-academic support, group learning norms, and positive competition. This complementarity is consistent with the logic of sequential explanatory mixed-methods research, in which qualitative evidence is used to contextualize and explain quantitative patterns [22]. Importantly, the qualitative findings should not be interpreted as independently validating the causal effect of peer environment. Instead, they provide contextual mechanisms that make the observed statistical relationship theoretically plausible. The

convergence between the two phases is therefore strongest at the level of mechanism and experience, rather than causal inference.

The practical implication is consequently more specific than simply recommending that students maintain positive peer relationships. Social Studies Education programs can facilitate structured peer-learning opportunities, collaborative study groups, academic mentoring, and norms that encourage reciprocal academic support. However, interventions should recognize that peer effects are heterogeneous and relatively small in the present model. The objective should therefore be to create conditions in which constructive peer processes can complement, rather than replace, other determinants of academic achievement. This position is supported by evidence that peer climate and academic support can contribute to motivation and academic functioning [15], [19], while broader educational outcomes remain dependent on multiple individual and contextual factors [1], [41]–[46].

Overall, the central contribution of this study is the identification of a statistically significant but substantively modest relationship between peer environment and academic achievement in the specific context of pre-service Social Studies teachers. The result agrees with the broader literature establishing that peers matter, but it also qualifies that conclusion by demonstrating that the magnitude of the relationship is limited and potentially shaped by peer heterogeneity, behavioral pathways, and peer selection. The qualitative findings further show that peer influence is experienced not as a single mechanism but as an interconnected process of modeling, support, norm formation, and positive competition. Thus, the study contributes to Peer Influence Theory by illustrating how peer influence operates as a socially embedded and context-dependent process in higher education, while maintaining an appropriate distinction between statistical association, plausible mechanism, and causal explanation.

4. CONCLUSION

This study shows that the peer environment is positively and significantly associated with the academic achievement of Social Studies Education students. The PLS-SEM results yielded $\beta = 0.145$, $t = 2.123$, and $p = 0.034$, while $R^2 = 0.015$ and $f^2 = 0.014$ indicate a small contribution. The qualitative findings further describe four themes academic behavior modeling, socio-academic support, group learning norms, and positive academic competition through which students experience peer-related academic processes. The findings therefore answer the research objective by indicating a statistically significant but limited association rather than a causal effect.

The qualitative findings clarify that students experience peer-related academic processes through academic behavior modeling, socio-academic support, group learning norms, and positive academic competition. Information exchange is incorporated within socio-academic support rather than treated as a separate theme. Theoretically, the study reinforces Peer Influence Theory by illustrating observation, imitation, support, social comparison, and group norms in higher education. Practically, Social Studies Education programs can strengthen peer learning, study groups, and academic collaboration, while recognizing that the observed effect is small. Limitations include the cross-sectional quantitative design, the limited explanatory power of the model, purposive qualitative

sampling, and the absence of a design that can fully separate peer influence from peer selection. Future research should examine additional variables such as self-regulated learning, academic self-efficacy, learning engagement, teaching quality, and individual characteristics.

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