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# THE DEVELOPMENTAL TRIANGLE: EXAMINING THE LONGITUDINAL AND RECIPROCAL ASSOCIATIONS BETWEEN PARENTAL ATTACHMENT, PEER RELATIONSHIPS, AND EMOTIONAL COMPETENCE FROM EARLY TO MIDDLE ADOLESCENCE

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## ABSTRACT

***Purpose:** A "Developmental Triangle" integrated model will be proposed in this study to investigate the two-way causal associations and co-change processes among parental attachment, peer relationships, and emotional competence during the transition from early to middle adolescence because existing studies have a problem of fragmentation when they study two relationships simultaneously without considering their interaction effects.*

***Methodology:** Cross-lagged panel designs were used in a longitudinal study involving 1,246 British adolescents in the Millennium Cohort Study on three waves of assessment (Age 11, 14, and 17) to simultaneously estimate model parameters for both forward associations with respect to relationship quality to emotional competence and reverse associations with respect to emotional competence to relationship quality.*

***Findings:** Parental attachment and emotional competence showed an asymmetric bidirectional association with forward effects (β=0.17-0.18) being stronger than reverse effects (β=0.11-0.12), where pairing with peers and emotional competence showed symmetric bidirectional associations. Additionally, parental attachment had a unidirectional spillover effect on pairing with peers (β=0.14) with emotional competence as a partial mediator with a mediation ratio of 25.4%. The triangular model performed better than the bivariate models, with emotional competence being a predictor with the largest explained variance ($R^2$=0.46-0.52).*

***Conclusion:** The Developmental Triangle model gained strong empirical support, and findings indicated that emotional competence integrates family relationships with relationships with peers.*

***Practical Implications:** Findings recommend practicing "trinity" intervention programs which include support*

***for families, social interaction among peers, and building emotional competence to foster positive social-emotional development during adolescence.***

**KEYWORDS:** Parental Attachment, Peer Relationships, Emotional Competence, Cross-Lagged Panel Model, Adolescent Development

## 1. INTRODUCTION

Early to middle adolescence is a critical stage in social and emotional development during which a lot of restructuring of relationship systems and a surge in emotional regulation skills takes place. During this stage, a change occurred in the parental relationship from a direct dependency level in childhood towards a more advanced level of sticking to a support-centered model. In contrast, peer relationships evolved from superficial play-based interactions to intimate friendships grounded in mutual understanding and emotional sharing. Additionally, a continuous developmental stage of prefrontal regions in the brain promotes cognitive methods of dealing with emotions to substitute behavioral methods (Silvers, 2022). However, in existing research, theoretical and methodological barriers exist in comprehending the interaction among these three domains of development successfully, which leads to an insufficient comprehension of the social-emotional developmental mechanism of adolescents.

The essence of the existing study is portrayed in the fragmentation described at three different levels. In terms of research focus, most studies follow a two-sided relationship model in dealing with either the connection between parental attachment and emotional ability or peer relationship and emotional ability in isolation, but hardly address all three in a joint analysis model. The research focus fails to address the reality of ecological systems in which adolescents have access to a whole series of relationships (Abubakar et al., 2024). In causal research, traditional studies mainly presume a causal relationship in which the quality of relationships is predictive of the emergence of emotional abilities in a unilateral manner, considering adolescents simply as passive recipients of influence from their environment, without considering the dynamic interaction in which emotional abilities presumably have a reverse impact on relationship qualities. Such a one-way view overlooks the active capability of adolescents in constructing their social contexts proactively as developmental actors. In terms of design principles in research methodologies, although a great majority of cross-sectional studies have observed a correlation among variables, research in this area remains challenged in making inferences in a causal manner concerning issues such as which factor promotes which other factor, in which manner, such as which factor impels another factor to have a higher capability in maintaining high-quality relationships with children, or which factor impels another factor to promote better emotional maturity in adolescents. Such ambiguity in causal inferences undermines an important level of scientific rigorousness in theoretical developments. Taking into consideration a recent shift in attention concerning social issues in adolescence from traditional behavioral matters to a level of emotional health and relationship quality, an adjustment in research paradigms based on such practical shifts in priority would be increasingly called for (Oosterhoff et al., 2020).

Based on the above research gaps, this study proposes the “Developmental Triangle” integrated model to systematically explain the dynamic interaction mechanism among parental attachment, peer relationship and emotional ability during adolescence. The core innovation of the research lies in the adoption of the multi-wave cross-lag Panel Model (Cross-Lagged Panel Model), simultaneously estimating the forward effect (relationship quality → emotional ability) and the reverse effect (emotional ability → relationship quality), revealing the bidirectional causal relationship rather than the traditional one-way prediction. This methodological breakthrough makes it possible to verify the reverse shaping effect of emotional ability on the quality of relationships. The innovation at the theoretical level is reflected in the integration of the “safe base” concept of attachment theory, Sullivan’s “peer reciprocity” perspective, and the “dual role” of emotional ability (both a development outcome and a driving force) into a unified framework, precisely focusing on the critical transitional period of early to

middle adolescence when attachment transfer and peer influence increase Quantitatively examine the "spillover effect" of parental attachment to peer relationship and its boundary conditions.

The work tries to resolve four basic questions: Is there an asymmetric two-way relationship between parental attachment and emotional abilities? Is the interaction effect of peer relationships and emotional abilities characterized by reciprocity and reciprocity? Can parental attachment affect the construction of peer relationships based on a one-way spillover effect? Can the integrated triangular model represent a better explanatory capability compared to the separated binary model? Based on a six-year longitudinal study tracking 1,246 British adolescents through early to middle adolescence in the UK Millennium Cohort Study, this research tested the above hypothesis with a cross-lagged panel model. The results have not only theoretical significance and can promote the integration of attachment theory, social learning theory, and developmental system theory, but have also been applied in practice with significance. They can offer an important empirical basis for designing a "trinity" strategy (family support - peer interaction - emotional cultivation), which can promote a virtuous cycle of social and emotional development in teenagers in the end.

## 2. LITERATURE REVIEW

Attachment theory since its proposal by Bowlby highlights the significance of early mother-child relationships in life. Nevertheless, the progression of attachment relationships during adolescence and their continuous influence concerning emotional development in life has remained an area of debate in developmental psychology. Early to middle adolescence is a very important stage in which attachment relationships undergo a transition from childlike dependency to self-aid in adulthood. The stage not only depicts attachment continuity in terms of need fulfillment from parents in terms of emotional closeness but also depicts qualities of differentiation and reorganization in attachment function. Recently, studies have uncovered a bidirectional reinforcement association with symptoms of emotional dysregulation and anxiety or depressive symptoms during early adolescence. Actually, a negative cycle of emotional dysregulation and symptoms of anxiety and depression in early adolescence with a bidirectional reinforcing association has been discovered. The role of mother-child attachment in adolescence concerning this negative cycle functions as a buffer. Secure attachment supports the emergence of efficient regulatory schemes with an attachment function concerning the role of an emotional security base (Chan et al., 2023). Such a discovery defies the stereotype "teenagers are distant from their parents," indicating that despite less actual closeness, the psychological role of attachment is intact. Most studies pertaining to this topic have explored the one-way effect of attachment on emotional capabilities rather than emphasizing how emotionally mature teens promote and nurture relationships with their parents inversely.

The intergenerational transmission of styles of parental attachment and their influence on the emotional self-efficacy of adolescents through an attachment style of anxiety has proved to be empirically valid. Research conducted in Chinese culture shows that attachment anxiety of parents indirectly predicts self-efficacy with regard to negative emotions in adolescents mediated by their style of attachment to parents (Pan et al., 2022). Such a model of intergenerational transmission highlights how attachment not only serves as a descriptive correlate of relation quality but is an intrapsychic working model used to construct beliefs and strategies for emotional regulation in children. Furthermore, their dimension of negative styles of child rearing, their longitudinal relationship with children's problem behavior, is mediated by attachment quality with parents, implying an attachment status not only augmenting positive developmental pathways but also functionally conserved from risk pathways (Wei et al., 2022). Worth mentioning in this context is the fact that attachment security with parents and with partners impacts on children's emotional regulation capacity because attachment quality is affected by it. Indicative of a family system-level impact is the need for an ecological approach in understanding adolescence (Ferreira et al., 2024). At the level of intervention, online parenting education programs grounded in attachment theory can be an effective way of reducing attachment insecurity, behavioral issues, and emotional dysregulation among adolescents, thus providing provisional support for intervention feasibility (Benzi et al., 2023). However, these studies have not thoroughly explored the reverse construction effect of adolescents' emotional abilities in attachment relationships.

The level of development of relationships with peers in adolescence has elevated from a supplementary role in childhood to a central social context. Such a change not only appears in terms of increasing time investment, but a qualitative transition can be

observed in friendship. Research has indicated a complicated pattern of association between parental attachment and friendship with peers. The influence of mother-child and father-child attachment on friendship formation in adolescence operates in different ways. Such a different spillover effect implies not a mere replication, but an adaptive modification based on the qualities of the new social situation (Wong et al., 2020). The critical developmental function of friendship affirmed in this perspective is based on providing a social learning environment for emotion regulation, which differs from the family setting. The heightened sensitivity of the adolescent brain to information from these peers leads to a critical role of friend feedback in emotion regulation strategy selection and effectiveness. Such a role will reach a peak during adolescence and can become a new focus for intervention(Sahi et al., 2023). Longitudinal findings have indicated that the quality of friendship indirectly supports the development of well-being in adolescents through improving self-esteem, and gender differences exist in this mediation. The role of self-esteem in mediation is more important in girls because friendship is accorded a different level of significance based on gender (Luijten et al., 2023).

Longitudinal research from early to late adolescence has shown that dimensions of association with peers have different predictive powers concerning well-being in adulthood over time. The social acceptance of early adolescents is a more potent predictive factor for later adjustment than friendship quality. Such a pattern defies conventional overconcentration on friendship quality. Extensive acceptance by peers might form a more stable level of development (Shah et al., 2024). Those reactions impact emotionally expressive adolescents' construction of an EMRA in a direct way. Non-supportive responses can weaken the development of an EMRA. But this process is in turn influenced by friendship closeness, gender, and age. The interaction effect shows a dependency both on situations and on the friendship influence mechanism (Delios et al., 2023). The bidirectional relationship between experiences of peer victimization and emotional dysregulation continues during adolescence. Being a victim impairs the ability to regulate emotions, and a difficulty with emotional regulation enhances vulnerability to being bullied. Thus, a vicious cycle continues (Herd et al., 2024). The impact of child emotional abuse and child emotional neglect on the longitudinal course of friendship quality in adolescence differs in nature. The effect of child emotional abuse is primarily to impair friendship quality in a positive friendship, and child emotional neglect leads to friendship conflicts. Furthermore, these associations are gender-regulated in nature (Zhou et al., 2025). Gender, with gender being a moderating variable, is a critical factor in understanding the interaction among peer relationship difficulty, prosocial behavior, and parental emotional socialization. The relation of girls with their peers is very susceptible to parental emotional support; however, present studies mainly center on the effects of peer relations on emotional development (Zhu et al., 2025). The selection factor of emotional capability being a pre-condition of getting acceptance among peers is less emphasized.

On the other hand, emotional ability, a multifaceted construct, comprises three basic dimensions: recognition, expression, and regulation. Emotional ability in adolescence can be developed with a continuous development of prefrontal cortex maturity and accumulation of social experience. A longitudinal study in Spanish adolescents verifies the predictive influence of peer attachment and emotional ability in psychological adaptation through an integrated technique of Structural Equation Modeling and Qualitative Comparative Analysis of Fuzzy Sets, where the complementariness of both methods highlights diversity in paths of emotional ability development instead of a linear determinism (Jiménez-Rodríguez et al., 2022). A longitudinal study examining the relationship between parental trust and trait emotional intelligence discovered an indirect predictor of positive self-concept in adolescence via increased emotional intelligence. Once more, this mediating sequence verifies the role of family relationships in shaping emotional faculties (Esnaola et al., 2025). However, conventional studies place emotional skillfulness in the role of "outcome variable" in terms of relationship quality without accounting for the dynamic function of this individual skill in actively influencing the social context.

Building on the literature discussed above, current research reveals three major gaps. Theoretically, studies treat parental attachment, peer relationships, and emotional competence as separate, binary links rather than parts of a single, interconnected system. Methodologically, many studies lack unidirectional designs that fail to detect bidirectional causality and feedback loops. And practically, there is a conspicuous lack of evidence for interventions across multiple relationship domains. To address these gaps, this study proposes a Developmental Triangle model that combines attachment theory, peer

reciprocity theory, and the development of emotional competence. Using cross-lagged panel analysis during early to middle adolescence, the model examines bidirectional influences, spillover effects, and dynamic interactions to inform integrated intervention strategies, shown in Figure 1.

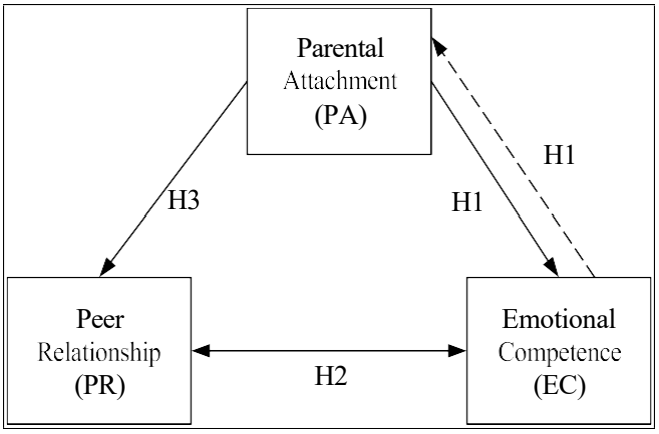


**Figure 1.** Conceptual Framework of the Developmental Triangle Model

Figure 1 shows the core hypothetical paths of the triangular model, including the asymmetric bidirectional relationship between PA and EC (H1), the reciprocal relationship between PR and EC (H2), and the one-way spillover effect from PA to PR (H3). The integrated model is expected to outperform the binary model tested separately (H4).

## 3. RESEARCH METHODS

### 3.1 Data sources and sample characteristics

This Study was a secondary analysis of publicly available data from the Millennium Cohort Study in the UK. The cohort study was conducted under the leadership of the Longitudinal Research Centre of the School of Education at University College London. The study followed children born between 2000 and 2001 as they grew into adulthood. The Millennium Cohort Study followed a stratified cluster sampling approach and included all regions of England, Scotland, Wales, and Northern Ireland. The original study included 19,517 children and had high national representativeness of the sample. The study selected those who did the measurement of core variables in all three waves of Age 11 (T1, 2011-2012), Age 14 (T2, 2014-2015), and Age 17 waves (T3, 2017-2018) of the study as analysis samples. Criteria included being a part of the survey in all three waves of research, having a data quality of over 80% in the parental attachment and peer relation and emotional ability variables, as well as being within the age range of 10 to 12 into T1 waves. The remaining data samples included a final total of 1,246 adolescents who accounted for 6.4% of the base study. The data included a 51.2% proportion of boys and a 48.8% proportion of female studies.

The ethnic group mix of the sample is representative of the varied nature of the characteristics found in British society. The mix of the sample consists of white British people, 74.3%; people from mixed ethnic groups, 8.1%; Indian and Pakistani people, 9.4%; and black African and Caribbean people, 5.2%; and other ethnic groups, 3.0%. The mix of two-parent, single-parent, and other family structures is as follows: 81.5% are two-parent and 18.5% are single-parent and other families. The mix of the socioeconomic status of the families is well staggered through the quartiles. The first quartile is 17.8%; the second, third, and fourth quartiles are 19.2%, 20.5%, and 21.3% respectively; and the fourth quartile is 21.2%. The average age measurement at the three stages was measured at 11.2 years (SD=0.4) at time T1, 14.1 years (SD=0.4) at time T2, and 17.3 years (SD=0.5) at time T3, separated by around 3-year periods. The overall duration of the study was 6 years, incorporating the critical stages from early and through to mid-adolescence.

### 3.2 Measurement tools and variable operationalization

Parental attachment was assessed by the Parent and Child Relationship Quality Scale, adapted from the theory of the MCS research group. The scale consists of 10 statements trying to assess teenagers' trust and communication in the relationship and intimacy. Examples of statements are: "I trust My Parents" and "My parents respect my feelings." The score is calculated through the average of the 5-level scale (Likert scale from 1, never, to 5, always); high score, high trust and secure relationship. Even though not used as the internationally adapted scale (IPPA scale), the scale has proved to have spectacular

properties in the MCS large-scale research group. The Cronbach's alpha coefficients are 0.85, 0.87, and 0.88 at time points T1, T2, and T3, respectively. Quality of Peer Relation is measured by the McS-adapted Friendship Quality Scale, consisting of eight statements trying to measure friendship qualities in respect to the feeling of friendship help, intimacy, and conflict resolution. Examples of statements are: "I have a good friend to lean on" and "My friend understands how I feel." The score is calculated through the average of the 5-level scale (Likert scale from 1, strongly disagree, to 5, strongly agree); high score, high-quality relationship. The internal consistency coefficients are 0.82, 0.84, and 0.86 at time points T1, T2, and T3, respectively.

Emotional competence was measured using reverse-scored items from the emotional symptoms subscale of the Strengths and Difficulties Questionnaire (SDQ). Because the MCS lacks an emotional regulation scale, the emotional symptoms scale of this widely used international online screening instrument for teenagers (including items like "I often feel unhappy or depressed" and "I easily lose my temper") can indicate emotional regulation ability using reverse scoring. The average score will yield a high score if the individual has good emotional ability The Cronbach's α values are 0.80 (Time 1), 0.82 (Time 2), and 0.84 (Time 3). One must keep in mind that the results essentially indicate the absence of emotional difficulties and do not necessarily assess the presence of positive emotional abilities. The outcomes must thus be treated with caution. The values of all the variables being analyzed are standardized with a mean of 0 and a standard deviation of 1 to aid in the interpretation of the effect size differences between the various variables. The model controls the influence of the following variables: demographics (gender, ethnicity, and family structure), socioeconomic factors (quinqule of family income, highest level of education of parents), and the total difficulty score of SDQ in T1. This will help in removing confusions in biases as well as the influence of the initial mental health conditions on development.

### 3.3 Data analysis program

The strategy used for data analysis was progressive modeling. The strategy utilized descriptive statistics to test the mean, standard deviation, skewness, and kurtosis for the three major variables at three points in time to validate if the distribution of the data satisfied the assumption of normality (skewness < 2, kurtosis < 7). Thereafter, the Pearson correlation analysis was employed to create a 9 × 9 correlation matrix with dimensions of 3 variables × 3 time points to ostensibly examine patterns of association as well as isomorphic stability among the variables. The major technique of analysis is the Cross-lagged Panel Model (CLPM), which is able to specify a simultaneous estimation of the autoregressive path (controlling stability for the variables over time), cross-lagged path (examining the causal predictive relation between the variables), and covariance between the T1 variables.

Current approaches to methodological research place high emphasis on CLPM, particularly the consideration for the assumption of model constructs for panel data analysis, especially regarding measurement intervals (Wysocki et al., 2025).

In the initial stage, three binary models are employed successively to grasp the reciprocal relation between every pair of variables: the model of Parent Attachment and Emotional Ability, peer relationship and emotional ability model, and the model of parent Attachment and peer relationship. In these models, both the bidirectional cross-lag path and the Wald $\chi^2$ test for the difference in sizes between the two ways are set up simultaneously. The random intercept cross-lag panel model, being an extension of CLPM models, can make a distinction between between-person and within-person variability and extract the temporal causal relationship alone in the research of social support and symptom distress among adolescents (Meuleman et al., 2024). In the integration phase, three variables are introduced into the model and used for assessing all possible cross-lag pathways (a total of 6 pathways). A nested model comparison approach is followed for testing levels of model enhancement. The baseline model comprises autoregressive pathways only, ensuring that theoretical assumed pathways for the cross-lags are not added to the model. The saturated model includes further theoretical assumptions on the levels of correction index (MI > 10). The three-wave cross-lag design has been ascertained to be enhanced for testing the directionality of the mediation process for analyzing emotional regulation techniques as a mediator for the relationship between parental psychological control and Internet use (Chen et al., 2025).

The model fitting uses a multi-index comprehensive evaluation system, which includes the $\chi^2$ goodness-of-fit test (if $P > 0.05$, fitting is good, though very sensitive to sample size), the Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) (values above 0.95 indicate good model fitting), and the Root Mean Square Error of Approximation (RMSEA) and

Standardized Root Mean Square Residual (SRMR) (values should be ≤ 0.06 and ≤ 0.08, respectively, indicating a good fitting model). Cross-lagged panel network analysis has proved the network approach could provide a more concrete connection between variables while exploring the link between parental conflict and adaptation during adolescence (Li et al., 2025). The missing data was handled using full-information maximum-likelihood estimation (FIML), where the missing data is considered to occur randomly. The results obtained using FIML estimation were compared with those obtained using complete case analysis in a sensitivity test to check the validity of the obtained conclusion. The significance levels for all paths were set to $P < 0.05$ using a two-tailed test. The standardized path coefficient β and the confidence interval at the 95% confidence level were provided to indicate the effect size. Meanwhile, the $R^2$ value of each endogenous variable was reported to represent the proportion of variation explained by the model.

## 4. RESULTS

### 4.1 Descriptive statistics and correlation analysis

### 4.1 Descriptive statistics and correlation analysis

By means of descriptive statistics, there were differences in development over time on the three key variables, which are presented in Table 1 below.

**Table 1.** Descriptive Statistics and Internal Consistencies

| Variable | Time Point | M | SD | Cronbach's α | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| Parental Attachment (PA) | T1 (Age 11) | 3.85 | 0.68 | 0.85 | -0.47 | 0.22 |
| | T2 (Age 14) | 3.71 | 0.72 | 0.87 | -0.53 | 0.18 |
| | T3 (Age 17) | 3.52 | 0.79 | 0.88 | -0.61 | 0.35 |
| Peer Relationships (PR) | T1 (Age 11) | 3.92 | 0.61 | 0.82 | -0.38 | -0.12 |
| | T2 (Age 14) | 4.05 | 0.65 | 0.84 | -0.51 | 0.28 |
| | T3 (Age 17) | 4.18 | 0.63 | 0.86 | -0.58 | 0.41 |
| Emotional Competence (EC) | T1 (Age 11) | 3.45 | 0.74 | 0.80 | -0.29 | -0.19 |
| | T2 (Age 14) | 3.59 | 0.78 | 0.82 | -0.34 | 0.06 |
| | T3 (Age 17) | 3.78 | 0.81 | 0.84 | -0.42 | 0.21 |

As indicated in Table 1, there was an improvement in emotional competence from 3.45 to 3.78 (9.6% increase), showing that it had the greatest improvement, while parental attachment decreased from 3.85 to 3.52 (8.6% decrease) followed by improvement in peer relations from 3.92 to 4.18 (6.6% increase), showing that adolescents change social orientation from being mainly involved with families to peers that occur due to development of the prefrontal cortex. All variables demonstrated excellent psychometric properties (Cronbach's α: 0.80-0.88) and normal distributions (|skewness| < 0.7, |kurtosis| < 0.5).

The association patterns among variables are presented through a 9×9 correlation matrix (3 variables × 3 time points), as shown in Figure 2.

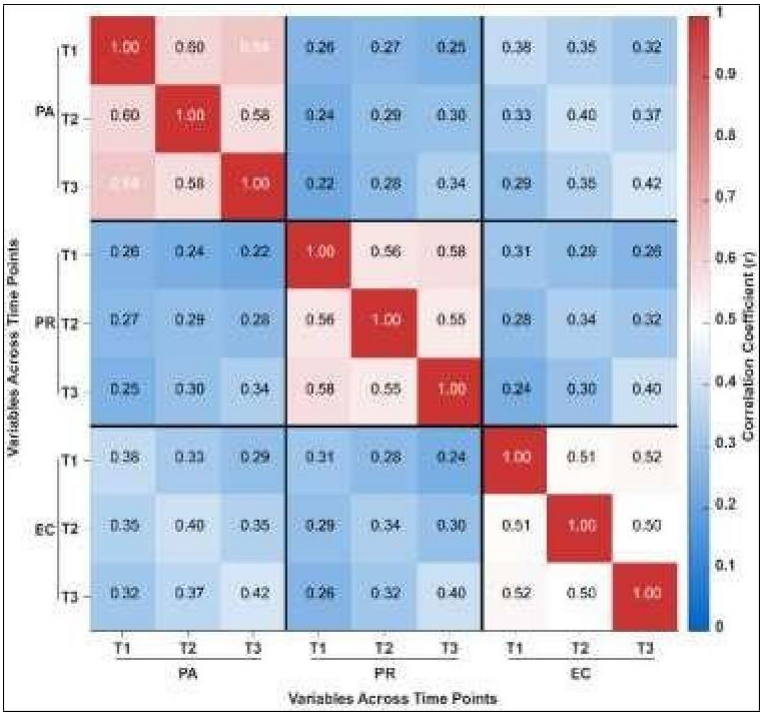


**Figure 2.** Correlation Heatmap Across Three Time Points

Figure 2 illustrates that the stability coefficients for the same construct at different times are not the same. The construct that is most stable over time is parental attachment (r(T1-T3)=0.64) relative to peer relationships (r(T1-T3)=0.58) and emotional competence (r(T1-T3)=0.52), followed by the cross-construct correlations that demonstrated systematic decreases with time, with correlations averaging 37.5% weaker from T1-T3 relative to T1-T2 correlations. The correlation between parental attachment and emotional competence declined from r(T1) = 0.38 to r(T3) = 0.36, whereas the association between peer relationships and emotional competence improved from r(T1) = 0.31 to r(T3) = 0.34, showing the influence of peer relationships close to that of parents during late adolescence.

### 4.2 Bidirectional relationships in bivariate models

In three bivariate cross-lagged models, bidirectional associations between each variable pair were analyzed, and all models had an excellent fit (CFI ≥ 0.99, RMSEA ≤ 0.025), as shown in Table 2.

**Table 2.** Cross-Lagged Path Coefficients (Bivariate Models)

| Statistic | PA→EC | EC→PA | PR→EC | EC→PR | PA→PR | PR→PA |
|---|---|---|---|---|---|---|
| Model | PA ↔ EC | PA ↔ EC | PR ↔ EC | PR ↔ EC | PA ↔ PR | PA ↔ PR |
| Direction | Forward | Reverse | Forward | Reverse | Forward | Reverse |
| T1→T2 β | 0.18** | 0.12* | 0.15** | 0.21*** | 0.14** | 0.06 |
| T1→T2 SE | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| T1→T2 p | 0.002 | 0.018 | 0.004 | <0.001 | 0.008 | 0.230 |
| T1→T2 95% CI | [0.07, 0.29] | [0.02, 0.22] | [0.05, 0.25] | [0.11, 0.31] | [0.04, 0.24] | [-0.04, 0.16] |
| T2→T3 β | 0.17** | 0.11* | 0.16** | 0.20*** | 0.13* | 0.05 ns |
| T2→T3 SE | 0.06 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 |
| T2→T3 p | 0.005 | 0.031 | 0.002 | <0.001 | 0.012 | 0.310 |
| T2→T3 95% CI | [0.06, 0.28] | [0.01, 0.21] | [0.06, 0.26] | [0.10, 0.30] | [0.03, 0.23] | [-0.05, 0.15] |
| Average β | 0.175 | 0.115 | 0.155 | 0.205 | 0.135 | 0.055 |
| Effect Size | Small-Medium | Small | Small-Medium | Medium | Small | ns |

*Note: *P≤0.05, **P≤0.01, **P≤0.001*

Table 2 systematically displays all the cross-lagged path coefficients, standard errors, and confidence intervals obtained from the three bivariate models, enabling horizontal comparisons regarding the strength and directionality of causation for various relationship pairs.

### 4.3 Incremental validity of the integrated triangular model

The integrated model combines the three factors in one model, with the results of the comparisons of the nested models measuring the fit contribution of the theoretically driven paths, as in the Table 3.

**Table 3.** Model Fit Indices and Nested Model Comparisons

| Fit Index | M1: Autoregressive only | M2: + Cross-lagged paths | M3: Full triangle model |
|---|---|---|---|
| $\chi^2$ | 45.23 | 18.34 | 12.28 |
| df | 12 | 8 | 6 |
| *P* | <0.001 | 0.019 | 0.056 |
| CFI | 0.91 | 0.98 | 0.99 |
| TLI | 0.89 | 0.96 | 0.98 |
| RMSEA | 0.048 | 0.028 | 0.021 |
| RMSEA 90% CI | [0.034, 0.062] | [0.014, 0.043] | [0.000, 0.039] |
| SRMR | 0.042 | 0.025 | 0.018 |
| $\Delta\chi^2$ ($\Delta$df) | — | 26.89 (4) | 6.06 (2) |
| $\Delta\chi^2$ *P*-value | — | <0.001 | 0.048 |

As shown in Table 3, a significantly better fit for the full triangular model (M3) over the autoregressive-only model (M1) was indicated by improvements of 55.3% for RMSEA, from 0.048 to 0.021, and 8% for CFI, from 0.91 to 0.99 (M2 vs. M1: $\Delta\chi^2$=26.89, *P* <0.001; M3 vs. M2: $\Delta\chi^2$=6.06, *P* =0.048). Chi-square differences were also significant for each step of model improvement in Figure 3.

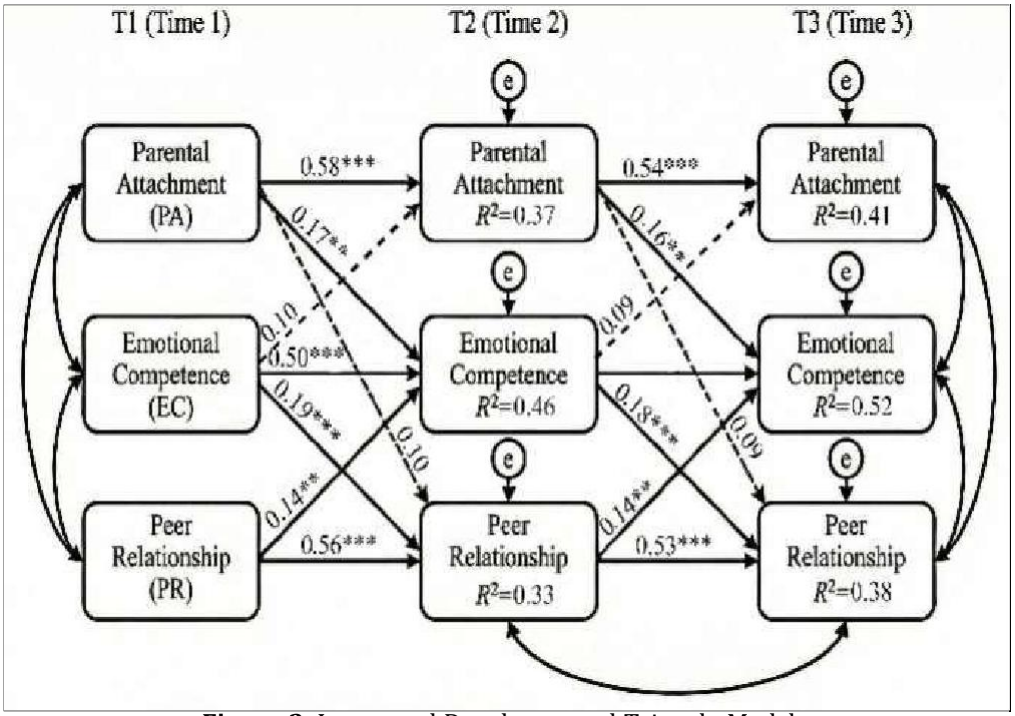


**Figure 3.** Integrated Developmental Triangle Model

*Note: **P≤0.01, **P≤0.001*

Cross-temporal dependencies were observed in Figure 3, whereby emotional competence was identified as the central node that accounted for the largest explained variance ($R^2$=0.46 at T2, $R^2$=0.52 at T3) compared to parental attachment ($R^2$=0.37-0.41) and peer relationships ($R^2$=0.33-0.38). Cross-validated path coefficients from T1→T2 (average β=0.15) demonstrated minimal reduction to T2→T3 (average β=0.14), confirming cross-temporal stability. The largest cross-lagged paths were identified in emotional competence predicting peer relationships (β=0.19), followed by the path from

parental attachment to emotional competence (β=0.17), where the direct effect of parental attachment on peer relationships was reduced to marginal significance (β=0.10, *P*=0.062) after being controlled for emotional competence.

Mediation pathway decomposition revealed the indirect mechanisms through which the three variables influence each other, as detailed in Table 4.

**Table 4.** Indirect Effects and Mediation Analysis

| Indirect Pathway | Time Span | β | Bootstrap SE | 95% CI | % Total Effect | Significance |
|---|---|---|---|---|---|---|
| PA → EC → PR | T1→T2 | 0.034 | 0.012 | [0.012, 0.058] | 25.4% | * |
| PA → PR → EC | T1→T2 | 0.019 | 0.009 | [0.003, 0.038] | 10.1% | * |
| PR → EC → PA | T1→T2 | 0.026 | 0.011 | [0.006, 0.050] | 32.1% | * |
| PR → PA → EC | T1→T2 | 0.016 | 0.009 | [0.001, 0.035] | 10.5% | * |
| EC → PA → PR | T1→T2 | 0.011 | 0.008 | [-0.002, 0.028] | - | ns |
| EC → PR → PA | T1→T2 | 0.007 | 0.007 | [-0.005, 0.022] | - | ns |
| PA → EC → PR | T1→T3 | 0.029 | 0.011 | [0.009, 0.052] | - | * |
| PR → EC → PA | T1→T3 | 0.022 | 0.011 | [0.003, 0.046] | - | * |
| PA → EC → PR → EC | T1→T3 | 0.006 | 0.003 | [0.001, 0.013] | - | * |

As presented in Table 4, emotional competence partially mediated the relationship between parental attachment and peer relationships (indirect effect β=0.034, 95% CI [0.012, 0.058], 25.4% mediation ratio), while peer relationships indirectly influenced parental attachment via emotional competence (indirect effect β=0.026, 95% CI [0.006, 0.050], 32.1% mediation ratio despite the nonsignificant direct path). Cross-temporal tandem effects (T1→T2→T3) further confirmed the permeating influence of early attachment on later peer relationships through emotional competence development (β=0.029, 95% CI [0.009, 0.052]), with all significant indirect effects' Bootstrap confidence intervals excluding zero. This finding is consistent with the conclusion that emotion regulation is a core pivotal variable in the study of video game disorder, confirming that emotional ability occupies a pivotal position connecting the family and peer relationship systems n adolescents' social-emotional development, a pattern also observed in studies of gaming disorder where emotion regulation serves as a key mechanism linking social relationships with behavioral outcomes.

## 5. DISCUSSION

The results of the six year tracking data analysis with 1,246 British adolescents in a multi-wave cross lagged panel design have systematically explored the interaction processes between parental attachment, peer relationships, and emotional ability. The results provided empirical support for the developmental triangle integrated model. It has been revealed that there is an asymmetric bidirectional effect between parental attachment and emotional ability, in that the positive effect β=0.17-0.18 is significantly stronger than the reverse effect β=0.11-0.12. This result is highly consistent with the results of existing studies on the bidirectional relationship between emotional dysregulation and attachment in early adolescents. This kind of asymmetric pattern disagrees with the traditional linear pattern, that is, the notion of emotional ability as a simple "developmental outcome", pointing out that no matter how quickly peer influence develops at the age of middle adolescence, the role of parental attachment as an emotional haven cannot be overemphasized. The reverse prediction of emotional ability to parental attachment, no matter how weak, is nonetheless significant, indicating that teenagers are actually in a capability to enhance the quality of parent-child interactions to a greater extent with increased ability for personal emotional regulation, showing initiative in the process of development.

The bidirectional associations between peer relationships and emotional competence revealed asymmetric effects, with EC→PR (β = 0.20-0.21) being stronger than PR→EC (β = 0.15-0.16). This pattern reflects the social reorientation of emotion regulation during adolescence, where peer influence becomes increasingly central (Ho et al., 2025). The essential role of peer relationships extends beyond emotional development to include motivational

processes that are fundamental to adolescent adaptation (Schimmelpfennig, 2025). Recent network analysis has further revealed that peer affiliation patterns significantly predict both emotional regulation outcomes and risk behaviors such as gaming disorder during adolescence(Gao et al., 2025). It offers longitudinal empirical verification for the theoretical assumption concerning the phenomenon of "peer partnerships" during the adolescent period. In contrast to the existing research on the one-way spillover from parental attachment to the quality of friendship, thanks to the design of the integrated model, the authors found that there is a more balanced mechanism in the area of peer relationship, since not only high-quality friendship but also the necessity for peer acceptance and relationship building is the basis for peer relationship and emotional abilities. The result of the multi-group comparison showed that the spillover effect for girls was 70% higher compared to the spillover effect for boys. This is consistent with previous studies which found that the emotional abuse mainly impairs the quality of positive friendships.

The incremental validity test of the integrated triangular model verified that the three variables constituted a complex dynamic system with both direct and indirect effects, where emotional ability had a partial mediating effect on the relationship between parental attachment and relationships with peers (indirect effect $\beta = 0.034$, mediating proportion 25.4%). This result quantitatively verified the mechanism of internal working model transfer. The impact of early attachment on subsequent psychopathology in the long term had been stressed in the existing literature with a focus on the cross-diagnostic view. The present study highlighted that secure attachment not only had a positive direct effect on the development of emotional ability, but the effect on relationships with peers was also positive through the improvement of the individual's emotional regulation abilities (Doom et al., 2021). The mediating proportion for peer relations in influencing parental attachment via emotional intelligence is very high at 32.1%. This result seems to contradict the general thinking held in the traditional view of peer influence in adolescents being independent of the family because quality friendship encounters could possibly maintain and even enhance the quality of parent-adolescent relations in reverse. The cross-temporal tandem process effect ($\beta = 0.029$) showed that there is a strong permeability feature in the influence of early attachment despite existing views on the neural models of early adversities and cumulates well within the hypothesis on the developmental effects (Saragosa-Harris et al., 2025).

The results of the research imply various policies related to practices in education and mental healthcare provisions. The value for emotional ability indicated the largest proportion of explained variance ($R^2 = 0.46$ to 0.52) for the integrated model, thus justifying a mechanistic explanation for the already conducted meta-analysis on the effectiveness of social-emotional learning programs (Shi & Cheung, 2024). On the basis of the integrated perspective accorded in "Development triangle," the strategy for educational interventions should move beyond the design constraints posed by a traditional single-dimensional perspective and implement a "trinity" strategy. The strategy aims at helping parents acquire the skillset associated with "emotional coating-style parenting" with parenting education classes, developing the emotional competencies of teenagers with social and emotional classes in schools on a social basis (it is recommended to have only one class a week to span the crucial period of early to middle adolescence (ages 11-16), and encouraging positive interactions with "peer support initiatives." In previous research studies, it has been found that the experience of being bullied and experiences within the context of family violence can have a joint influence on predicting the link with psychosocial problems within adolescents. The current research study shall continue with a perspective based on "positive development": multiple protection mechanisms could thus be created to counterbalance the harmful influence posed by a single risk factor by strengthening the three corners of the "triangle" at the same time (Yoon et al., 2021). At a policy level, it is proposed that the index system of educational quality be extended to cover social-emotional competencies; full-time mental health teachers be allocated to schools; a standardized course of social-emotional learning be included in the training of teachers; and parent education support be offered to disadvantaged families in a bid to overcome the development gap.

Although this study used a large sample longitudinal method and an advanced statistical modeling approach to investigate the research question, there remain some limitations that should be improved in the future study. The limitations of the measurement tools due to the usage of secondary data mean that there is a surrogate measurement of emotional ability that could only be conducted via a reverse-scoring method for the emotional symptoms scales. Future studies should employ multi-dimensional scales of

emotional ability. The potential bias due to self-reporting for all variables among adolescents could result in biased findings, and multi-source assessment could enhance the ecological validity of findings. The study is confined to the British cultural background; hence, its promotion across various cultural settings is jeopardized, and it is imperative to validate this theoretical proposal across East Asian cultural settings. The rigid three-year duration for measurements might disregard transient change processes that might have occurred across this duration. Employing a dense longitudinal method will outline the development processes with a heightened level of accuracy. The theoretical limitation for this study is that it would fail to encompass the realm of teacher-student relationships, relationships between brothers/sisters, and romantic relationships because these might present relatively complex forms of ecological nesting for the "development triangle". Future studies could encompass the moderating effects of certain individual-difference variables and employ neuroimaging to illustrate the possible biological predilections for triangular forms of relationships; integrated intervention studies could also investigate causal mechanisms of this theory and expand this research to encompass a larger developmental scope in late adolescence and mid-childhood stages.

## 6. CONCLUSION

With six-year longitudinal data from 1,246 British adolescents, the "Developmental Triangle" model was found to fit the data with three patterns of relationships: (1) the forward relationships between attachment and emotional competence were stronger than the reverse relationships ($\beta$ = 0.17-0.18 > $\beta$ = 0.11-0.12); (2) the relationships between peer relationships and emotional competence showed bidirectional patterns, with EC→PR ($\beta$ = 0.20-0.21) being stronger than PR→EC ($\beta$ = 0.15-0.16); and (3) the relationships from attachment to peer relationships were unidirectional ($\beta$ = 0.13-0.14). Emotional competence partially mediated the effect of attachment on peer relationships (indirect effect $\beta$ = 0.034, 25.4% mediation ratio), while exhibiting the highest explained variance in the integrated model ($R^2$=0.46-0.52), confirming its central hub position connecting family and peer relationship systems.

On the theoretical level, this research goes beyond the limitations of two-category models by combining attachment theory, peer reciprocity theory, and the development of emotional competency to better understand the adolescents' agency through bidirectional causality. On the empirical level, it offers proof for the concept of "trinity" interventions that include parenting education (enhancing attachment), social and emotional learning (fostering competency), and peer help (encouraging interaction) that provide multi-level protective factors during early to middle adolescence.

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