A prediction model for peer attachment in KOREAN female adolescents using back propagation neural network

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Abstract

Background/Objectives: This study used data mining technique to explore the potential factors affecting the peer attachment of South Korean female students.

Methods/Statistical analysis: This study analyzed 2009 9th grade female students, who attended Panel Study on Korean Children in 2016. Peer attachment was defined as a dependent variable. The explanatory variables included gender, academic achievement satisfaction, subjective household economy level, parent-child dialogue frequency, subjective health status, depression symptom, self-esteem, subjective life satisfaction, and mobile phone dependence. The predictors of peer attachment were analyzed by using back propagation neural network (BPN).

Findings: Analysis results showed that depression, self-esteem, dialogue level between parent and child regarding school life, subjective health condition were highly related to the peer attachment of female students.

Improvements/Applications: It is required to develop a customized educational program to form a successful social relationship between adolescent female students.

Keywords: Data mining; Back Propagation Neural Network, Peer Attachment; Risk Factors; Female Students.

1. Introduction

People experience rapid physical, psychological, and social development during the adolescence period. Hormonal changes in this period lead to secondary sexual characteristics and people frequently experience anxiety and impulse1. Particularly, when students begin to go to school, their temporal and spatial scales expand to school in addition to the home. They improve their academic achievement and they also form identity while spending time with peers. Furthermore, they develop personality and social competence during the period2. Therefore, the stable attachment with peers during the adolescent period is important for successful learning and growth.

Peer attachment is an emotional bond formed between horizontal relation and it indicates the trust and intimacy between peers or a positive relationship allowing a person to exchange feelings and thoughts2. Adolescents learn intimacy and sociality through interactions with peers and form interpersonal relationships3. It is necessary to pay attention to peer attachment to enhance the peer relation because they form a relationship with other peers based on the attachment with close peers. Previous study reported that children with the higher level of peer attachment were more likely to adapt to school life and felt competence and satisfaction in interpersonal relationships4. On the other hand, children with the lower level of peer attachment had a higher probability to experience emotional problems and school maladjustment5. Consequently, it was expected that we could reduce the emotional problems including depression by identifying factors influencing peer attachment and predicting a group with a high risk of peer attachment instability to manage them in advance.

Numerous previous studies reported that peer attachment is affected by various factors including personal variables such as self-esteem and family variables such as parent-child relationship and sibling relationship6-7. For example, when a parent showed a positive parenting behavior, an adolescent child felt comfortable with having a close relationship with others7. Particularly, many studies reported that female students showed a higher level of peer attachment and higher desire to form relationships with others than male students8, 9. Consequently, it is urgent to identify the high-risk female student group with peer attachment instability. However, the majority of the previous studies dealt only a portion of individual variables that could affect the peer attachment of adolescents or they tended to define and analyze peer attachment as an independent variable rather than a dependent variable2, 10. Moreover, although gender is known to affect the level of peer attachment, there are only a few studies evaluating the instability risk factor of female students’ peer attachment.

Artificial neural network is widely used as a method of developing a prediction model in recent years. Particularly, back propagation neural network (BPN) has many advantages including high prediction accuracy, fast learning speed, and excellent classification ability11. This study developed a peer attachment prediction model based on the BPN algorithm for 9th-grade female students in South Korea.

Chapter 2 will define the study subjects and measurement variables. Chapter 3 will explain the BPN algorithm and the procedure of model development. Chapter 4 will describe the results of the peer attachment prediction model based on the BPN algorithm. Chapter 5 presents conclusion and direction for future studies.
2. Materials

2.1. Subject

This study used the raw data of ‘Panel Study on Korean Children in 2016’, which was conducted by National Youth Policy Institute under the auspices of Ministry of Health and Welfare and Headquarters for Community Children’s Center [12]. This study targeted 209 female students in 9th grade among all respondents.

2.2. Measurement and definition of variables

Dependent variables were defined by the presence of peer attachment instability. Peer attachment was measured by using ‘The Inventory of Parent and Peer Attachment (IPPA)’ [13], which is composed of 9 items. A higher total IPPA score is interpreted as higher peer attachment establishment. This study defined the bottom 25% of the IPPA scores as a peer attachment instability high-risk group.

Explanatory variables included gender, academic achievement satisfaction (i.e., satisfied or dissatisfied), subjective household economy level (i.e., rich, moderate, or poor), the frequency of parent-child dialogue (i.e., less than 2 times per week, 3-4 times per week, or more than 5 times per week), subjective health status (i.e., poor, normal, or healthy), depression symptoms, self-esteem, subjective life satisfaction, and mobile phone dependency.

3. Methods

3.1. Exploring potential factors of peer attachment instability high-risk group

The general characteristics of the subjects according to the presence of peer attachment are presented in Table 1. Among 209 subjects, 48 subjects (23.0%) were classified as the peer attachment instability high-risk group. Cross-validation analysis showed that the adolescents in the peer attachment instability high-risk group and girls without a peer attachment instability risk were statistically different (p<0.05) in subjective health status, life satisfaction, depression symptom, and self-esteem. The probability of peer attachment instability risk was higher with girls who subjectively recognized unhealthy (60.0%), showed depression symptoms (47.5%), and had low self-esteem (42.2%).

4. Results

4.1. Exploring potential factors of peer attachment instability high-risk group

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4.2. Back propagation neural network

The BPN analysis results of learning samples (63.6%), testing samples (27.3%), and validation samples (9.1%) are shown in Figure 1. Five hidden layers generating the least data error were withdrawn. The area under ROC was 0.728, indicating that the fit and explanatory power of the model satisfied the fair (0.7-0.8) condition (Figure 2).

A BNP model was constructed by selecting the frequency of parent-child dialogue, subjective health status, academic achievement satisfaction, subjective household economy level, depression symptom, self-esteem, subjective life satisfaction, and mobile phone dependency as input variables (Figure 3).

The importance of independent variables in the BPN model was analyzed (Figure 4). Depression symptom (0.373), self-esteem (0.207), parent-child dialogue level (0.128), and subjective health status (0.15) were withdrawn as the major variables for predicting peer attachment instability, which had higher prediction weight.

The normalized importance, which uniformed the units of input variable importance and the influence level of input variables, was shown in Table 2. The most important predictor of peer attachment instability was depression, followed by self-esteem, parent-child dialogue level, and subjective health status in the order of magnitude.

In the analysis of artificial neural network analysis, the major predictor variables were presented by comparing the normalized importance, which uniformed the unit of the relative importance of inputs and that of the input variables.
Factors affecting the peer attachment of South Korean female middle school students were explored by using the BPN algorithm. The results showed that depression, self-esteem, parent-child dialogue level, and subjective health status were main factors affecting the formation of peer attachment formation. Previous studies evaluating the factors related to peer attachment showed that peer attachment was closely related to personal factors, family factors, and school factors \[2, 15\]. In these studies, personal factors were self-esteem, stress, life satisfaction, depression, and self-efficacy, school factor was academic achievement, and family factors were socioeconomic status and family conflict \[2, 16\]. Particularly, the acknowledgment and approval of a parent affected the peer attachment formation of female students\[17\]. Moreover, a previous study reported that the close and positive relationship with parents positively affected the peer attachment formation \[9\]. These results supported the results of this study, which predicted the parent-child dialogue level as a major variable determining the peer attachment.

This study found that personal health factors such as depression were major factors affecting peer attachment. Particularly, depres-
sion symptoms were the top priority factor of peer attachment. It
was known that unstable peer attachment relationship and depre-
sion had a close relationship 10, 18. It was believed that depres-
sion symptom was the major predictor of peer attachment because
interpersonal behavior associated with depression covaried with
depression symptoms or SOMETHING affected interpersonal
relationship through the interaction with stress [19], [20]. There-
fore, it will be necessary to give an attention and counseling op-
portunity to depressed adolescents preferentially for successful
peer attachment during the adolescence period.

6. Conclusion

In summary, female students with low self-esteem, low dialogue
level with a parent, a depression symptom, and subjectively per-
ceived unhealthy have a high risk of peer attachment instability.
Therefore, we have to actively seek a way to identify the attach-
ment level of the high-risk group and help them adapt to life with
peers. It is required to develop a customized peer attachment en-
hancement program considering the family factors as well as personal
characteristics based on the results of this study.

References

[1] Arnett J J, Adolescence and emerging adulthood, Pearson, Boston,
MA, 2014.
[2] Lee H, Jung E, A study on prediction models for adolescent attach-
ment types of parents, teachers and peers using data mining, The
[3] Rueger SY, Malecki CK, Demaray M K, Relationship between mul-
tiple sources of perceived social support and psychological and ac-
cademic adjustment in early adolescence: Comparisons across gen-
attachment: Individual differences and their relationship to psycho-
logical well-being in adolescence, Journal of youth and adoles-
social anxiety, aggression and peer relations affected by adult at-
tachment types for the 5th and 6th graders in elementary school,
40.
child–parent attachment and peer relations: A meta-analysis of re-
psychopathology of children and adolescents: A meta-analysis,
[8] Ma CQ, Huebner ES, Attachment relationships and adolescents’ life
satisfaction: Some relationships matter more to girls than boys,
Psychology in the Schools, 2008; 45, pp. 177–90.
gender and age differences and associations with parent attachment,
[10] Kim JC, Gyeyong JS, Choe WH, Effects of parents, teachers and
friends’ attachment on aggression in early adolescence, The Korean
propagation neural network model and its cross application and val-
idation for landslide susceptibility analyses. Computers, Environ-
[12] Korea Youth Policy Institute, Panel survey of local children’s cen-
ters, Korea Youth Policy Institute, Seoul, 2015.
multi-culture children and social anxiety, Pukyong University, Med.
Integrated Method of Decision Tree and Multi-Layer Perceptron
Artificial Neural Network Algorithm, International Journal of Ad-
subjective well-being in middle school students, The Journal of