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The Mediator Role of Perceived Stress in the Relationship between Academic Stress and Depressive Symptoms among E-learning Students with Visual Impairments

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Structured abstract: *Introduction:* This study examined a mediator role of perceived stress on the prediction of the effects of academic stress on depressive symptoms among e-learning students with visual impairments. *Methods:* A convenience sample for this study was collected for three weeks from November to December in 2012 among students with visual impairments attending a Korean cyberuniversity in Seoul. A total of 103 students with visual impairments completed the survey via e-mail or telephone, with an overall response rate of 72.54%. *Results:* The present study demonstrated that perceived stress fully mediated the effect of academic stress on depressive symptoms. Academic stress was significantly associated with perceived stress and depressive symptoms, and perceived stress was significantly associated with depressive symptoms. However, the association between academic stress and depressive symptoms was no longer significant when perceived stress was included as a mediator. *Discussion:* This finding supports the full mediation model by demonstrating that academic stress indirectly influences depressive symptoms through perceived stress, and by highlighting the important contribution of perceptions of stressors. *Implications for practitioners:* Cyberuniversities, professors, and disability services offices need to identify and assess what academic resources are available. To improve the accessibility of e-learning materials and settings, reasonable accommodations in e-learning settings and special online assistance services should be provided. A precollege orientation program and a training program for better adaptation and usage of the e-learning materials and technologies are needed. Senior students' successful experiences and know-how should be shared among students with visual impairments. Psychological counseling services for students who have a high level of depressive symptoms should be provided.

The 2014 Korean census reported that the total number of registered people with disabilities was 2,494,000, which is about 5% of the total Korean population. The number of those with visual impairments was 253,000 (Korean Ministry of Health and Welfare, 2015). Higher education provides an opportunity for a better quality of life among people with disabilities; thus, the need for higher education among people with disabilities is increasing. However, higher education for such individuals still has many limitations. For example, learners with disabilities, who need educational accommodations to meet their special or unique needs, often struggle in traditional educational settings with, for instance, printed texts, written papers, and inaccessible classrooms. The dropout rate of Korean students with disabilities in higher education increased to 6.2% in 2011, mostly because of academic difficulties (Park et al., 2011).

Distance education is available through various settings using a variety of educational methodologies and assistive technology. It can be categorized into three types (Hanna, 1998): the first uses conventional print-based courses distributed by mail; the second uses various technologies such as satellite or two-way video and audio systems to reach students at distant sites; the third (e-learning) is the emerging online web-based universities that were developed to use online technologies exclusively. Korean cyberuniversities fall into the third type.

Distance education has become an alternative for learners with disabilities. It provides disabled students with educational accommodations that include diverse formats of study materials; makes physical attendance in the classroom unnecessary; and allows flexibility of study time. Despite those advantages, a relatively small number of students with disabilities—2.2% (1, 748 individuals) of the total number of students in Korean cyberuniversities—were enrolled in distance education in 2013 (Korean Council of Cyber Universities, 2013). Also, among many types of disabilities, the number of students with visual impairments who enrolled in 17 Korean cyberuniversities in 2012 was 419 (Korean Council for University College Education, 2013). Distance education opens up new opportunities for students with disabilities, but students face many stressors related to academic life. However, there is a lack of research on adult learners with disabilities, especially those with visual impairments, in distance education.

In higher education, students in general perceive academic life as stressful (Hammer, Grigsby, & Woods, 1998), due to external pressures and self-imposed expectations (Misra & McKean, 2000); lack of time and issues relating to time or task management (Trueman & Hartley, 1996); adaptation to new learning environments (Van-Rooijen, 1986); assigned academic workload (Fonseca et al., 2013); examinations (Marshall, Allison, Nykamp, & Lanke, 2008); and constant self-regulation (Fram & Bonvillian, 2001). Students in distance education experience the same stress-inducing academic demands; in ad-

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dition, they suffer from technical difficulties, confusion over course objectives (Song, Singleton, Hill, & Koh, 2004), and a perceived lack of community (Drouin, 2008), because of the educational setting of e-learning. Students with visual impairments can face additional academic stressors in the process of distance education because of the technological gaps between the latest e-learning environment and outdated rehabilitation technology (Oh & Lee, 2013). Advanced e-learning settings cannot be fully accessed by the adaptive technologies because of limitations in recognizing flash animations; web images; and programs constructed with Java, a general-purpose computer programming language that is largely inaccessible to screen readers.

Stress can be defined as the state in which individuals' perception of the environmental demands or mental strain go beyond their regulatory capacity or their interpretation of the available resources (Cohen, Kessler, & Gordon, 1995; Lazarus & Folkman, 1984). According to Lazarus and Folkman's theory of cognitive appraisal, the processes of stress are transactional, and cognitive appraisal of the stressor is related to the individual's emotional response. Students with visual impairments who experience an imbalance between their technological resources and the demands of their e-learning environment would be expected to have higher levels of stress. Stress occurs when a life event or circumstance creates an event-specific perception of stress, and these specific stresses gather into a generalized perception of stress that could result in negative mental health consequences such as depressive symptoms (Ford, Olotu, Thach, Roberts, & Davis, 2014; Ghorbani, Krauss, Watson, & LeBreton, 2008; Lee, Jon, & Choi, 2013). According to the transactional model of stress (Lazarus & Folkman, 1984), which describes a subjective process involving cognitive appraisals and emotional responses in the appraisal-based model of stress, it was expected in our study that students with visual impairments might develop depressive symptoms not only because they have academic stress, but also because of how they perceive and appraise their academic situations such as e-learning settings.

There are many studies that have examined the cognitive appraisal processes between academic stress, perceived stress, and depressive symptoms. The previous studies found that there were significant relationships between academic workloads and perceived stress (Kausar, 2010) and between perceived stress and depressive symptoms (Bergin & Pakenham, 2015; Cohen, Kamarck, & Mermelstein, 1983; Lee et al., 2013); and that academic stress (Ang & Huan, 2006), academic failure (Fauber, Forehand, Long, Burke, & Faust, 1987), academic problems, and low academic achievement (Chen, Rubin, & Li, 1995; Hilsman & Garber, 1995) would predict depressive symptoms.

Stress research has also elaborated a mediation model between stressful situations and depressive symptoms. In a *mediation model,* an independent variable causes a "mediator," which then causes a dependent variable; thus, the mediator explains the process by which the intervention achieves its effects. There is a mediation effect of perceived stress on work-related stress and depression (Lee et al., 2013), and an indirect effect of mental adjustment on the association between

perceived stress and depressive symptoms (Li, Yang, Zhang, Yao, & Liu, 2015). However, there has been a lack of research on the mediator role of perceived stress between event-specific stress (such as academic stress) and depressive symptoms. Furthermore, stress-related research has not been conducted among students with disabilities, specifically those with visual impairments. The purpose of the current study was to examine a mediator role of perceived stress in the prediction of academic stress (an independent variable) on depressive symptoms (a dependent variable) among e-learning students with visual impairments. Specifically, we hypothesized that perceived stress would carry the impact of academic stress on depressive symptoms. Academic stress may impact depressive symptoms through affecting perceived stress.

Methods

Research procedure and ethics statement

The data was collected from students with visual impairments who attended a Korean cyberuniversity that was based in Seoul. The possible respondents were recruited from the university registry list and were given an informed consent letter with a self-administered questionnaire via e-mail or telephone. Respondents were informed that returning the survey represented their signing the informed consent letter and indicated their agreement to participate in the study. One hundred and three students with visual impairments participated in the study during three weeks from November to December 2012, providing an overall response rate of 72.54%. The study was exempted from the institutional review board approval based on a 2014 Korean law of life ethics and safety.

Participants

Participants in this study were adult learners whose mean age was 41.29. There were more male students (n = 70, 68%) than female students (n = 33, 32%). At the time of the study, the participants took an average of 17.72 credits, had enrolled for an average of 4.31 semesters, and utilized 1.37 assistive technology devices or programs. The participants had been visually impaired for an average of 27.96 years (SD = 14.08), and 73.8% (n = 76) of the participants were diagnosed as having no light perception. Over half were married (n = 53, 51.5%), followed by those who were single (n = 37, 35.9%). Those whose annual income was under 20,000,000 won (about $20,000 United States dollars) were 46 (44.6%), while those above 20,000,000 won were 57 (55.3%). A total of 49.5% (n = 51) reported their physical condition as healthy or very healthy, while only 9.7% (n = 10) identified as not healthy or not very healthy (see Table 1).

Measures

The demographic information

The demographic characteristics questionnaire consisted of 10 items that were designed to obtain the participants' demographic information: gender, age, marital status, annual income, physical condition, degree of disability, duration of the disability, number of semesters spent at the current cyberuniversity, number and type of assistive technology devices or programs being used, and credits taken in the current semester.

Table 1
Participants' characteristics.

Variable	Frequency (%) (N = 103)
Gender	
Male	70 (68%)
Female	33 (32%)
Age	M = 41.29 (SD = 8.06)
Marital status	
Single	37 (35.9%)
Married	53 (51.5%)
Widow or widower	2 (1.9%)
Separated or divorced	11 (10.7%)
Annual income	
Under 5,000,000 won	21 (20.4%)
5,000,000–10,000,000 won	10 (9.7%)
10,000,000–15,000,000 won	9 (8.7%)
15,000,000–20,000,000 won	6 (5.8%)
20,000,000–25,000,000 won	19 (18.4%)
25,000,000–30,000,000 won	9 (8.7%)
30,000,000–35,000,000 won	11 (10.7%)
35,000,000 won or more	18 (17.5%)
Physical condition	
Very healthy	16 (15.5%)
Healthy	35 (34%)
Average	42 (40.8%)
Not healthy	7 (6.8%)
Not very healthy	3 (2.9%)
Degree of vision loss	
No light perception	76 (73.8%)
Light perception, correction-eye sight under .04	5 (4.9%)
The ability to count fingers, correction-eye sight under .8	5 (4.9%)
Correction-eye sight under .1	1 (1%)
Correction-eye sight under .2	4 (3.9%)
A visual field restriction	12 (11.7%)
The duration of vision loss (in years)	M = 27.96 (SD = 14.08)
The number of semesters spent in the current cyberuniversity	M = 4.31 (SD = 2.11)
The number and type of assistive technology devices or programs being used (multiple-response question)	M = 1.37 (SD = .58)
Screen reader	60 (58.3%)
Screen magnifying programs	32 (31.1%)
Braille notetaker	24 (23.3%)
Scanning programs	6 (5.8%)
Other devices	18 (17.5%)
Credits taken in the current semester	M = 17.72 (SD = 3.67)
Academic stress	M = 29.45 (SD = 6.96)
Low	51 (49.5%)
High	52 (50.5%)
Perceived stress	M = 16.85 (SD = 4.34)
Low	74 (71.8%)
High	29 (28.2%)
Depressive symptoms	M = 11.00 (SD = 8.65)
Low	76 (73.8%)
High	24 (26.2%)

Academic stress

Academic stress was composed of exhaustion, cynicism, and academic inefficacy, and it was measured by the Maslach Burnout Inventory-Student Survey (MBI-SS; Schaufeli, Martinez, Pinto, Salanova, & Bakker, 2002). The scale consists of 15 questions (for example, "I feel emotionally drained by my studies" and "I can't solve the problems that arise in my studies") with a 4-point Likert scale ranging from 1 (never) to 4 (always). Higher scores indicate higher levels of academic stress. The Korean version of MBI-SS was validated in Shin's study (2012) assessing academic stress among college students, and its internal reliability was reported as high (Cronbach's $\alpha = 0.87$). For our study, the original scale was slightly adapted for use with the sample of e-learning students, such as rephrasing "lecture" to "online lecture." Its internal reliability coefficient was higher (Cronbach's $\alpha = 0.912$) than in Shin's study (2012).

Perceived stress

Perceived stress was defined as the degree to which situations in one's life are appraised as stressful (Cohen et al., 1983), and it was measured with Perceived Stress Scale-10 (PSS-10; Cohen & Williamson, 1988). The PSS-10 was designed to assess the degree to which life in general is perceived as uncontrollable, overloading, and unpredictable during the past month. It consists of 10 questions (for instance, "In the last month, how often have you been upset because of something that happened unexpectedly?" and "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?") on a 5-point Likert scale ranging from 0 (never) to 4 (very often). Higher composite scores indicated greater perceived stress. The validated Korean short version of the perceived stress scale (K-PSS) was used in Lee et al. (2013), and its internal reliability (Cronbach's $\alpha = 0.80$) was proved. Our study validated the higher internal reliability (Cronbach's $\alpha = 0.816$).

Depressive symptoms

Depressive symptoms were categorized into depressed mood, decrease or increase in appetite, insomnia, and others. Depressive symptoms were assessed by the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The scale is a 4-point Likert scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time), consisting of 20 questions (such as "My sleep was restless" and "I did not feel like eating"). The total score ranged from 0 to 60, and higher composite scores indicated a higher level of depressive symptoms. Scores that are 16 or higher would indicate depressive symptoms requiring clinical attention. The Korean version of CES-D was validated in Chon, Choi, and Yang's study (2001), and its internal reliability was reported very high (Cronbach's $\alpha = 0.91$). In this study, the Cronbach's alpha of the CES-D scale was 0.906.

Data analysis

A correlation analysis of the three variables (academic stress, perceived stress, and depressive symptoms) and descriptive analysis on these variables were conducted using the Statistical Package for the Social Sciences (SPSS 21; IBM Corporation, Somers, NY), in order to check the assumptions of the multiple regres-

sion. For perceived stress to be a mediator of academic stress and depressive symptoms, four criteria as proposed by Baron and Kenny (1986) should be met: academic stress should be significantly associated with perceived stress; perceived stress should be significantly associated with depressive symptoms; academic stress should be significantly associated with depressive symptoms; and controlling for perceived stress, the association between academic stress and depressive symptoms should be reduced (a partial mediation model) or be no longer significant (a full mediation model).

Results

Descriptive statistics analysis of the testing variables

Based on the mean score (M = 29.45) of the MBI-SS, participants were sorted into lower and higher academic stress groups (see Table 1). The lower academic stress group consisted of 51 participants (49.5%), and the higher academic stress group consisted of 52 (50.5%). The higher group should have generally had the higher level of academic-related exhaustion, cynicism, and inefficacy. In the criterion of the clinical cut-off point of 16 of the CES-D scores, 73.8% (n = 76) of 103 participants had no severe depressive symptoms. However, 26.2% (n = 27) were considered to have critical depressive symptoms requiring clinical attention. Those students with visual impairments who had a score of 16 or higher had to have had either at least 6 of the 20 symptoms in the CES-D with persistence for most of the past week, or a majority of the 20 symptoms for shorter periods of time (Vilagut, Forero, Barbaglia, & Alonso, 2016). In terms of perceived stress, the lower perceived stress group consisted of 74 participants (71.8%) whose PSS-10 score was under 20 (Li et al., 2015). However, 28.2% (n = 29) of the participants whose PSS-10 score was 20 or more were considered to have high stress and needed to learn stress reduction skills (Cohen et al., 1983).

Verification of regression assumptions

The results of correlation analysis show that academic stress was positively correlated with perceived stress (r = .355, p = .0001) and depressive symptoms (r = .337, p = .0001). Perceived stress was positively associated with depressive symptoms (r = .637, p = .0001). The Pearson correlations, mean scores, and SDs for each of the three research variables are presented in Table 2. The kurtosis values, ranging between .721 and .561, and the skewness values, ranging between −.586 and .987, were in the acceptable range of the normality assumption (Curran, West, & Finch, 1996). The absolute values of Pearson's correlations for the study variables ranged between .337 and .637, and all the variance inflation factors were below 2 (see Tables 2 and 3). Therefore, there is no possibility of a multicollinearity issue, because all correlation values were below .8 and all of the variance inflation factor values were below the critical point of 10.

Test of a mediation model

In order to determine whether the four criteria of Baron and Kenny (1986) would be met, we performed three linear regression analyses. The first regression analy-

Table 2
Bivariate correlations and statistics for the study variables ($N = 103$).

Variable	Min.-Max.	Kurtosis	Skewness	1	2	3
1. Academic stress	15–53	.561	.239			
2. Perceived stress	5–27	.721	−.586	.355**		
3. Depressive symptoms	0–38	.320	.987	.337**	.637**	

** $p < .01$, * $p < .05$.

sis included academic stress as an independent variable and perceived stress as if it were a dependent variable. The first criterion for a mediation model, that academic stress should be significantly associated with perceived stress, was met. Academic stress (Step 1: $\beta = .355$, $p = .0001$) was significantly associated with perceived stress. The second regression analysis included perceived stress as if it were an independent variable and depressive symptoms as a dependent variable. Perceived stress was significantly associated with depressive symptoms (Step 2: $\beta = .637$, $p = .0001$); therefore, the second criterion was met. In the last regression analysis, we put academic stress in the first block, perceived stress in the second block, and depressive symptoms as a dependent variable, in order to confirm the third and fourth criteria. In accordance with the third criterion, academic stress was significantly related with depressive symptoms in the first model of the third regression analysis (Step 3.1: $\beta = .337$, $p = .0001$). Finally, the fourth criterion states that for perceived stress to be a mediator, the association between academic stress and depressive symptoms should be reduced or be no longer significant when controlling for perceived stress. This final criterion was also met in that the association between academic stress and depressive symptoms was no longer significant in the second model of the third regression analysis (Step 3.2: $\beta = .128$, $p = .121$) when perceived stress was included as a mediator (see Table 3). In other words, academic stress no longer explained the variance in depressive symptoms when perceived stress was controlled. This finding indicates that the association between academic stress and depressive symptoms was fully mediated by perceived stress. The previously significant relationship between academic stress and depressive symptoms was no longer significant when perceived stress was included in the model, providing evidence that perceived stress was a full

Table 3
Perceived stress as a mediator between academic stress and depressive symptoms ($N = 103$).

Step	β	t	F (p-value)	R^2	*VIF*
1. Academic stress, depressive symptoms (IV) (mediator)	.355**	3.810	14.519 (.0001)	.126	1.00
2. Perceived stress, depressive symptoms (mediator) (DV)	.637**	8.296	68.823 (.0001)	.405	1.00
3.1. Academic stress, depressive symptoms (IV) (DV)	.337**	3.600	12.961 (.0001)	.114	1.00
3.2. Academic stress, depressive symptoms (IV) (DV)	.128	1.566	36.132 (.0001)	.419	1.14
Perceived stress, depressive symptoms (mediator) (DV)	.591**	7.258			

** $p < .01$; VIF = variance inflation factor.

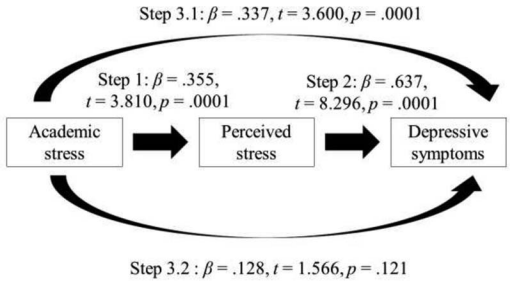

Figure 1. A complete mediation model of the relationship among academic stress, perceived stress, and depressive symptoms.

mediator among e-learning students with visual impairments (see Figure 1).

Discussion

The present study demonstrated that perceived stress mediated the effect of academic stress on depressive symptoms. The results support a full mediation model by demonstrating that academic stress indirectly influences depressive symptoms through perceived stress and highlights the important contribution of perceptions of stressors. These findings reconfirm the transactional model of stress (Lazarus & Folkman, 1984), showing that academic stress indirectly affects depressive symptoms. It implies that an individual's cognitive appraisal of a stressor, rather than the stressor itself, is more likely to predict depressive symptoms (Lee et al., 2013). It means that academic stress does not directly affect depressive symptoms. Instead, academic stress affects depressive symptoms through more general perceptions of stress-related personal experiences. E-learning students with visual impairments who experience high levels of academic stress may perceive the stressors more acutely, and ultimately they are more likely to have a high risk of depressive symptoms.

Implications for Practice

We found that perceived stress, as a mediator variable, transmitted the causal effect of academic stress to depressive symptoms. More than a quarter of our research participants indicated that they had high levels of perceived stress and depressive symptoms requiring clinical attention. The school's counseling services office, academic advisors, or disability services office can provide psychological counseling services for students with visual impairments who have a high level of perceived stress and depressive symptoms. Student counselors and academic advisors can give them guidelines on how to deal with academic stress as well as general stress (Connor, 2012). Counseling services can help improve depression knowledge and symptom recognition, reduce anxiety, and enhance behavioral activation levels, in order to increase their ability to manage depressive symptoms and feel more confident in their ability to adopt positive coping strategies (Gitlin, Szanton, Huang, & Roth, 2014).

As for other stress-reduction strategies, disability services offices should make use of the successful experiences and knowledge of senior students by organizing self-help groups that would allow younger students to share their experiences with and be matched to academic mentors. Precollege students with visual impairments should be invited to participate in orientation programs that offer information on how to navigate e-learning settings, utilize class materials, access online testing, and ask for additional support services including the disability services office. Through those strategies, students with visual impairments can feel empowered to

cope with their own stress and depressive symptoms.

Limitations

The sample of this study was highly selective, consisting only of students from a single cyberuniversity. To generalize these findings, additional studies with a larger sample size are necessary. The present study demonstrated that perceived stress mediated the relationship between academic stress and depressive symptoms among e-learning students with visual impairments. However, the findings should be carefully interpreted because the present study used a cross-sectional design. Longitudinal research is needed to examine causality and identify the importance of the general perception of stress among e-learning students with visual impairments. The previous study indicated that academic stress depends on accommodational resources (Oh & Lee, 2013), but our study did not include what types of accommodations were available at the cyberuniversity. A future study needs to explore the availability of reasonable accommodations for students with visual impairments. Despite the limitations of the present study, it is a foundational study in examining potential mediators of the association between academic stress and depressive symptoms among e-learning students with visual impairments. This present study serves as a beginning step for future studies designed to understand the relationships of stressors, general stress, and mental health among students with visual impairments in distance education.

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