

# Using Online Information Support to Decrease Stress, Anxiety, and Depression

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*Received April 7, 2021; revised June 3, 2021; accepted June 16, 2021;  
published August 31, 2021*

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## **Abstract**

Today, online education is becoming more important. The effectiveness of online education has been measured by student satisfaction and the possibility of substituting offline education. This study proposes a plan to increase the effectiveness of education in a new form by using online information. Education is the process of socializing and growing learners. Representative negative emotions experienced by learners are stress, anxiety, and depression (SAD). A reduction in SAD will promote student growth and improve educational outcomes. This paper considers online information by dividing it into online educational information support (OEDIS) and online emotional information support (OEMIS). We demonstrate that OEDIS reduces SAD, and OEMIS reduces stress and anxiety. By providing online information, negative emotions can be reduced, and educational outcomes can be improved. This study suggests a new role for online information support, such as emotional change in individuals and solving psychological problems. Online information support goes beyond knowledge transfer and can be used in various fields, such as online education that promotes human growth and positive change, and even healthcare.

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**Keywords:** Anxiety, Depression, Information Support, Online education, Stress

## 1. Introduction

COVID-19 has caused many changes in our daily life patterns. It has led most educational organizations to provide courses through online education systems [1]. Online education has various advantages, such as securing diversity and creativity. Moreover, it includes the use of vast amounts of information, such as big data, overcoming the limitations of place, and reducing discrimination of time. Online education is not a form of education that only replaces face-to-face education temporarily during the COVID-19 pandemic. In the 4th industrial era, more suitable information and technologies should be used [2]. The online education system has various merits, but it will have to be continuously developed and utilized.

Education aims at the process of human growth and socialization [3]. The socialization process is related to the curriculum and content of education. Growth is related to efforts to bring about more positive change. Most previous studies on online education have focused on the socialization process. These studies have emphasized socialization performance, such as lecture satisfaction and learning effects [4]. Unlike such studies focused on socialization performance, this paper focuses on individual growth. Providing information is regarded as a key element for improving individual growth. Information can facilitate the exchange of emotions, feelings, and thoughts [5]. Such exchange may promote positive change. Moreover, the positive change may lead to individual growth. Therefore, this research investigated whether individuals can grow through positive change by receiving online information.

Stress, anxiety, and depression (SAD) have been overwhelmingly prevalent across the world during the COVID-19 crisis [6]. These are widespread psychological problems [7]. For performance and health, they must be addressed and controlled. This research investigated whether it is possible to reduce SAD by providing online emotional and educational information. Information can promote positive change in public attitudes [8]. It also promotes positive health outcomes. Various studies have suggested that social and emotional support can reduce SAD [9]. Emotional support is able to increase a sense of stability, personal competence, perceived control, and recognition of self-worth [10]. Educational support can increase social integration and academic achievement [11]. It is expected that online emotional and educational information can lead to positive effects in online education. In addition, this research verifies the effectiveness of online educational information support (OEDIS) and online emotional information support (OEMIS). OEDIS refers to a program that provide students with educational information related to academic difficulties. OEMIS refers to a program that stimulates the sensitivity of students, and helps them overcome difficulties through empathy and comfort. These two types of online information will improve educational outcomes and individual growth through reduction of SAD.

This study investigated online educational performance with individual growth, which involves positive change. Positive change can be realized with a reduction in SAD. Overall, this research aimed to improve educational outcomes by providing two specific information supports, namely, OEDIS and OEMIS. If particular information could positively change people by reducing SAD, the new effectiveness of online education would be demonstrated. Our findings suggest that online education and information can be used to improve the availability of education and in e-health.

## 2. Theoretical background and Hypotheses

### 2.1 Stress

Stress is a part of human life. It is a concept that describes the response by an individual to stressors in the environment [12]. Stress refers to a state of emotional or mental tension or strain resulting from adverse or demanding circumstances. It is experienced through the physiological, psychological, and social stimuli of the individual [13]. Stress occurs when an individual believes that he or she cannot deal with his or her situation [12]. Experiencing stress can lead to various physical reactions. For example, the symptoms may include feelings of overall irritability, anxiety, nervousness, insecurity, social withdrawal, depression, loss of appetite, exhaustion, panic attacks, insomnia, migraine, and a sense of being overwhelmed [12, 14]. Stress leads to various negative consequences, such as psychosocial illnesses. A high level of stress causes emotional exhaustion, and such an experience increases an individual's intentions to leave their current institution [15]. Hence, if people experience a high level of stress, they will experience a lower quality of life, poor achievement, and difficulty in adapting to new environments. Moreover, their psychological health will be negatively affected.

### 2.2 Anxiety

Anxiety can be seen as psychophysiology difficulty. It is used to describe a series of emotions and behaviors. Anxiety can be experienced and manifested when people fear or are faced with a threatening situation [14]. Anxiety refers to vague and unpleasant feelings accompanied by being anxious with known or unknown origins [16]. It appears in various forms and symptoms, such as a sense of fear, excessive worrying, negative thinking, restlessness, and overly emotional responses [17]. Also, symptoms of anxiety include restlessness, dyspnea, heart palpitations, insomnia, fatigue, and disturbances of memory and concentration [16]. Anxiety includes passivity, which can lead to poor performance on assignments, low attendance, and poor performance in exams [17]. High levels of anxiety are related to lower levels of achievement. Therefore, it is a negative factor that may have a negative influence on both health and performance.

### 2.3 Depression

Depression is regarded as a common mental illness. Depression is a notably vague term. In lay usage, depression means occasional sadness and gloom [18]. It refers to feelings that can be enough to have negative influences on human mood and change social daily life [19]. Depression causes feelings of sadness and leads to life problems. These problems include trouble at school and work and in relationships. It can also increase disease burdens worldwide and poor health outcomes. It decreases interest in everything and problem-solving ability, causing individuals to have difficulty in adjustment, interpersonal relationships, social life, and cognition. It can also lead to various emotional and behavioral dysfunctions as well as physical symptoms [20]. It is negatively associated with life satisfaction and happiness. Therefore, depression can be seen as a negative factor that can impact human psychological health.

### 2.4 Online educational information support

Information refers to documentary messages, voice traffic, information and graphic files, and facsimile messages. Information support can provide people with information, such as suggestions, directives, and advice, on ways in which they can help themselves [21].

Educational support includes providing students with academic classes, tutoring, knowledge, internships, skills, and networking opportunities [22]. Educational information is defined as promoting the reform of educational methods, content, and ways of learning by making use of modern information technology (networks, the Internet, technology, computers, and multimedia) [23]. Thus, online educational information support (OEDIS) in this research is defined as a program that provides international students with the educational information they need to help them overcome academic difficulties. The contents of OEDIS include specific messages, such as academic information, learning skills, study methods, and educational advice. These contents can also influence SAD.

## 2.5 Online emotional information support

Emotion refers to a mental state observed by developmental and behavioral changes [24]. Emotional support is defined as taking care of people's emotional well-being, which includes various kinds of behavior that encourage trust and provide empathy, concern, and willingness to listen [21]. Emotional support involves respect, love, and acceptance [25]. Emotional support plays a key role in coping with stress, improving individual mental well-being, and increasing physical health and performance [26]. Informational support is defined as providing people with information to enable them to better deal with environmental and personal problems [21]. Combining these concepts and roles, online emotional information support (OEMIS) is defined as a program that stimulates the sensitivity of international students and helps them overcome difficulties through empathy and comfort. The contents of OEMIS include videos that present stories of people who have overcome difficulties, empathetic and comforting stories, stories of success, and humor. Because these contents can influence psychology, cognition, and mindset [27], they could contribute to the reduction of SAD.

## 2.6 The relationship between OEDIS, OEMIS, and SAD

Informational support refers to provide people with information to better deal with personal and environmental problems [21]. To solve problems, informational support can provide advice, information, and feedback about how well people work [28]. Informational support leads to higher self-esteem and increased recognition of social capital [29]. Moreover, information support reduces perceived threats and increases coping methods to protect mental health [30]. Thus, information support decreases perceived threats and it leads to more mental health support [31]. Therefore, informational support can protect mental health.

The elements of SAD are related to mental health. These elements can be reduced by providing information support. Students' mental health is influenced by academic and living factors. In particular, international students may experience SAD due to the emotional difficulties involved in studying and living in an unfamiliar environment [32]. Thus, students who receive support through academic and emotional information may recognize this help and may apply it in their studies and life; thus, this help would help to reduce SAD.

OEDIS provides educational information to help people overcome academic difficulties. This type of support includes educational advice, problem-solving skills, learning methods, and academic information. Such education information can improve health by increasing self-efficacy and problem-solving skills [33]. A low level of self-efficacy can lead to SAD and a narrow view of the best solutions to problems [34]. High self-efficacy decreases feelings of shame, loneliness, weakness of social skills, and low self-esteem, and in turn, it promotes mental health [35]. Therefore, when students receive OEDIS, their self-efficacy will be increased. A high level of self-efficacy increases their mental health and decreases weakness. Therefore, students who receive OEDIS may experience decreased SAD. Hence, the following

hypotheses were formulated.

*Hypothesis 1: EDOIS will reduce the degree of stress.*

*Hypothesis 2: EDOIS will reduce the degree of anxiety.*

*Hypothesis 3: EDOIS will reduce the degree of depression.*

OEMIS stimulates sensitivity and helps people overcome difficulties through empathy and comfort. Emotional support has been regarded as an important element for online health communities [36]. This type of support improves individual competence and emotional stability [37]. Emotional stability means a tendency to be self-assured, steady, and composed [38]. An emotionally stable individual remains calm in stressful situations and show strong emotional reactions in stressful circumstances [39]. Low emotional stability manifests as personal vulnerability to stress. On the contrary, high emotional stability functions as a protective element making individuals more resilient [40]. Resilience can be seen as a strategy in adverse circumstances that can affect people's psychological health [41]. People who are not resilient can become depressed, frustrated, and discouraged. On the contrary, people who are resilient possess a positive attitude to adversity and are less inclined to experience psychological uneasiness [42, 43]. Resilience plays a buffer role to mitigate the relationship between mental health and overall well-being [43]. Therefore, resilience improves an individual's mental health, which will help reduce factors such as SAD.

Previous research has demonstrated that emotional stability is negatively associated with SAD [44]. In particular, emotional stability can enable individuals to cope with negative emotions such as anxiety, stress, discontent, anger, and irritability [38]. Moreover, if students receive emotional support, they will be able to cope better with uncontrollable events and will receive encouragement that may lead to effective adaptation [45]. If social workers perceive a high level of emotional support from their supervisors and co-workers, their levels of SAD would be decreased [46]. Overall, when students receive emotional support, their emotional stability will be increased. High levels of emotional stability can help to reduce SAD. Therefore, if students receive OEMIS, SAD will be decreased. Hence, the following hypotheses were formulated.

*Hypothesis 4: EMOIS will reduce the degree of stress.*

*Hypothesis 5: EMOIS will reduce the degree of anxiety.*

*Hypothesis 6: EMOIS will reduce the degree of depression.*

### 3. Research design

#### 3.1 Participants

Data for this research were obtained from 226 participants who were international students attending universities in Korea. They voluntarily completed questionnaires. The participants were divided into a control group (received no support), an OEDIS group (received online emotional support), and an OEMIS group (received online educational support). The results of demographic analysis are summarized below.

**Control group:**

The control group consisted of 71 Chinese international students. Of these, 33 males (46.5%) and 38 females (53.5%) participated in the survey. In terms of age, 11 (15.5%) were aged 18–20 years, 54 (76.1%) were aged 21–24 years, 5 (7.0%) were aged 25–28 years, and 1 (1.4%) was over 29. Regarding their length of residence in Korea, 1 (1.4%) participant had been living in Korea for 1–3 months, 6 (8.5%) participants had been living in Korea for 4–6 months, 17 (23.9%) participants had been living in Korea for 1 year, 30 (42.3%) participants had been living in Korea for 2 years, 13 (18.3%) participants had been living in Korea for 3 years, and 4 (5.6%) participants had been living in Korea for over 3 years. In terms of lifestyle, 27 (38.0%) lived alone, 13 (18.3%) lived in dormitories, 28 (39.4%) lived with their Chinese friends, 1 (1.4%) lived with their Korean friends, and 2 (2.9%) lived with their family.

**OEDIS group:**

The OEDIS group consisted of 75 Chinese students. Of these, 30 males (40.0%) and 45 females (60.0%) participated in the survey. In terms of age, 7 (9.3%) were aged 18–20 years, 63 (84.0%) were aged 21–24 years, and 5 (6.7%) were aged 25–28 years. Regarding their length of residence in Korea, 2 (2.7%) participants had been living in Korea for 1–3 months, 8 (10.7%) participants had been living in Korea for 4–6 months, 11 (14.7%) participants had been living in Korea for 1 year, 26 (34.7%) participants had been living in Korea for 2 years, 20 (26.7%) participants had been living in Korea for 3 years, and 8 (10.5%) participants had been living in Korea for over 3 years. In terms of lifestyle, 21 (28.0%) lived alone, 24 (32.0%) lived in dormitories, 26 (34.7%) lived with their Chinese friends, and 4 (5.3%) lived with their family.

**OEMIS group:**

The OEMIS group consisted of 80 Chinese students. Of these, 29 males (36.3%) and 51 females (63.7%) participated in the survey. In terms of age, 35 (43.8%) were aged 18–20 years, 43 (53.8%) were aged 21–24 years, and 2 (2.4%) were aged 25–28 years. Regarding their length of residence in Korea, 15 (18.8%) participants had been living in Korea for 1–3 months, 9 (11.3%) participants had been living in Korea for 4–6 months, 21 (26.3%) participants had been living in Korea for 1 year, 27 (33.8%) participants had been living in Korea for 2 years, and 8 (9.8%) participants had been living in Korea for 3 years. In terms of lifestyle, 26 (32.5%) lived alone, 35 (43.8%) lived in dormitories, 18 (22.5%) lived with their Chinese friends, and 1 (1.2%) lived with their Korean friends.

### 3.2 Measurement

Stress is defined as feeling upset, finding it hard to calm down, and having difficulty relaxing. To measure student stress, it was assessed with 14 items that were developed, and sample items included “lost interest in everything” and “unable to be enthusiastic” [14].

Anxiety is defined as feeling anxious, fearful, and nervous, and being anxious about the one’s future. To measure student anxiety, it was assessed with 14 items that were developed, and sample items included “fear of being thrown” and “feeling of faintness” [14].

Depression is defined as feeling depressed, losing enthusiasm for life, and having no interest in anything. To measure student depression, it was assessed with 14 items that were developed, and sample items included “difficulty in relaxing” and “using nervous energy” [14]. All variables were measured by using Likert 7 scale.



### 3.3 Experimental design

The experiment was designed based on a previous study, which demonstrated mindset, attitude, and emotional change [27, 47]. The experiment was conducted as follows.

First, 226 students were assessed with the same questionnaire about SAD. Second, the participants were randomly divided into the three groups (OEDIS: 75, OEMIS: 80, and control group: 71). Third, the OEDIS and OEMIS groups received support online for three weeks. On the contrary, the control group did not receive any style of support or stimulus, and lived their daily lives without intervention.

The contents of OEDIS included specific messages, such as academic information, learning skills, study methods, and educational advice. For instance, information on the school schedule, and school support programs for international students, such as scholarships, effective learning methods, tips for taking exams well, and so forth. The OEDIS group received messages on their mobile devices around 1:00 p.m five days per week.

The contents of OEMIS included videos that presented the stories of people who had overcome difficulties, empathetic stories, comforting stories, stories of success, and humor. For example, Ma Yun's inspirational story (how to change yourself, overcome difficulties, and seek the path to success), the experiences of international students struggling in South Korea (successfully overcoming various difficulties in studying abroad), and humorous videos for relaxation (animation and pranks). The OEMIS group students watched an average of five minutes of videos on their mobile devices around 1:00 p.m on five weekdays.

Fourth, after three weeks, the participants answered the same questionnaire regarding SAD, and the results were analyzed.

## 4. Statistical results

For the empirical analysis of this study, we used confirmatory factor analysis (CFA), Cronbach's  $\alpha$  for reliability, descriptive statistics, correlation, and paired t-test.

### 4.1 Confirmatory factor analysis and reliability analysis

The confirmatory factor analysis was conducted to verify the validity of the factor structure. This research used a structural equation modeling analysis. The results of model goodness fit for confirmatory factor analysis were the following.

The absolute fit index showed  $X^2(p)=1858.928$ ,  $X^2/df=2.456$ , and  $RMSEA=.080$ . The incremental fit index showed  $TLI=.904$  and  $CFI=.904$ . The parsimonious adjusted index showed  $PNFI=.746$  and  $PGFI=.605$ . These results of the three types of indexes satisfied the acceptability requirements. Thus, the three types of indices in this research were acceptable.

In addition, we checked the value of average variance extraction (AVE) and composite reliability (C.R). The AVE results showed depression=.582, anxiety=.567, and stress=.701. The values of AVE were higher than .50. The C.R results of all variables showed depression=.893, anxiety=.899, and stress=.942. A C.R value is acceptable if it is higher than .70. Therefore, all measurements showed significant validity, and all indices were acceptable. **Table 1** shows the results of the goodness of fit model.

In addition, the value of Cronbach's alpha was calculated to estimate the reliability of each variable. The values of Cronbach's alpha are summarized as follows: depression=.955, anxiety=.957, and stress=.978. If the value of Cronbach's alpha is higher than .70, it is considered to have significant reliability. Therefore, all variables were judged to have significant reliability.

**Table 1.** The results of CFA and reliability analysis

Variable	AVE	C.R	Cronbach's alpha
Depression	.582	.893	.955
Anxiety	.567	.899	.957
Stress	.701	.942	.978
Absolute fit indices	$X^2(p)=1858.928(.000)$ , $X^2/df =2.456$ , RMSEA=.080		
Incremental fit indices	TLI=.904, CFI=.904		
Parsimony adjusted indices	PNFI=.746, PGFI=.605		

#### 4.2 Reliability, descriptive statistics, and correlation analysis

The results of mean were the following: depression=3.220, anxiety=3.023, and stress=3.187. The results of standard deviation showed depression=1.249, anxiety=1.208, and stress=1.411. Third, correlation analysis was conducted to identify the correlations between variables. Depression was positively associated with anxiety ( $r=.764$ ,  $p<.001$ ) and stress ( $r=.672$ ,  $p<.001$ ). Anxiety was also positively associated with stress ( $r=.811$ ,  $p<.001$ ). **Table 2** shows the results of reliability, descriptive statistics, and correlation analysis.

**Table 2.** The results of reliability, descriptive statistics, and correlation analysis

	Cronbach's Alpha	mean	std. deviation	depression	anxiety	stress
Depression	.955	3.220	1.249	-		
Anxiety	.957	3.023	1.208	.764***	-	
Stress	.978	3.187	1.411	.672***	.811***	-

\*\*\*  $p <.001$ , \*\*  $p <.01$ , \*  $p <.05$

#### 4.3 Paired t-test

To verify the hypotheses, we conducted the following experiments. The OEDIS group consisted of 75 Chinese students in universities in Korea. At time 1, we measured the levels of the Chinese students' stress, anxiety, and depression in the absence of any support. At time 2, from the day after the first measure, the Chinese students were supported with OEDIS messages for three weeks. After three weeks, we measured the levels of the Chinese students' SAD again. The levels of SAD at times 1 and 2 were compared to verify whether the change was significant. In this regard, a paired t-test was conducted to verify the significance of the change.

**Table 3** shows the results of the paired t-test comparison between the before (time 1) and after (time 2) tests on SAD for the OEDIS group. The mean of stress at time 1 was 2.830. At time 2, the mean was 2.387. Thus, the level of stress at time 2 was found to be lower than at time



1. Furthermore, the results showed a statistically significant ( $t=2.883$ ,  $p<.01$ ) difference between times 1 and 2. In addition, 95% Confidence Interval of the Difference(CID) was showed lower=.137 and upper=.752. Based on these results, hypothesis 1 was accepted. The mean of anxiety at time 1 was 2.747. At time 2, the mean was 2.314. Thus, the level of anxiety at time 2 was found to be lower than at time 1. Furthermore, the results showed a statistically significant ( $t=3.389$ ,  $p<.01$ ) difference between times 1 and 2. In addition, 95% CID was showed lower=.178 and upper=.687. Based on these results, hypothesis 2 was accepted. The mean of depression at time 1 was 3.033. At time 2, the mean was 2.548. Thus, the level of depression at time 2 was found to be lower than at time 1. Furthermore, the results showed a statistically significant ( $t=3.993$ ,  $p<.001$ ) difference between times 1 and 2. In addition, 95% CID was showed lower=.243 and upper=.728. Based on these results, hypothesis 3 was accepted.

**Table 3.** The results of paired t-test related to OEDIS group

	variables	time	mean	n	95% CID		t	df	sig. (2-tailed)
					lower	upper			
OEDIS group	Stress	Time 1	2.830	75	.137	.752	2.883	74	.005
		Time 2	2.387	75					
	Anxiety	Time 1	2.747	75	.178	.687	3.389	74	.001
		Time 2	2.314	75					
	Depression	Time 1	3.033	75	.243	.728	3.993	74	.000
		Time 2	2.548	75					

We conducted the same experiment for OEMIS as OEDIS support. The OEMIS group consisted of 80 Chinese students in university in Korea. At time 1, we measured the levels of the Chinese students' SAD in the absence of any support. At time 2, from the day after the first measure, they were supported with OEMIS for three weeks. After three weeks, we measured their levels of SAD again. The levels of SAD at times 1 and 2 were compared to verify whether the change was significant. In this regard, a paired t-test was conducted to verify the significance of the change.

**Table 4** shows the results of the paired t-test comparison between before (time 1) and after (time 2) tests on SAD for the OEMIS group. The mean of stress at time 1 was 3.753. At time 2, the mean was 3.028. Thus, the level of stress at time 2 was found to be lower than at time 1. Furthermore, the results showed a statistically significant ( $t=4.760$ ,  $p<.001$ ) difference between times 1 and 2. In addition, 95% CID was showed lower=.422 and upper=1.028. Based on these results, hypothesis 4 was accepted. The mean of anxiety at time 1 was 3.288. At time 2, the mean was 2.813. Thus, the level of anxiety at time 2 was found to be lower than at time 1. Furthermore, the results showed a statistically significant ( $t=3.889$ ,  $p<.001$ ) difference between times 1 and 2. In addition, 95% CID was showed lower=.232 and upper=.718. Based on these results, hypothesis 5 was accepted. The mean of depression at time 1 was 3.243. At time 2, the mean was 3.138. Thus, the level of depression at time 2 was found to be lower than at time 1. However, there was a statistically insignificant ( $t=.752$ ,  $p>.05$ ) difference between times 1 and 2. Moreover, 95% CID was showed lower=-.172 and upper=.381. Hence,

hypothesis 6 was rejected.

**Table 4.** The results of paired t-test related to OEMIS group

	variables	time	mean	n	95% CID		t	df	sig. (2-tailed)
					lower	upper			
OEMIS group	Stress	Time 1	3.753	80	.422	1.028	4.760	79	.000
		Time 2	3.028	80					
	Anxiety	Time 1	3.288	80	.232	.718	3.889	79	.000
		Time 2	2.813	80					
	Depression	Time 1	3.243	80	-.172	.381	.752	79	.454
		Time 2	3.138	80					

The control group consisted of 71 Chinese students in universities in Korea. At time 1, we measured the level of the Chinese students' SAD in the absence of any support. From the day after the first measure to time 2, they did not receive any support for three weeks. After the three weeks, we measured their levels of SAD again. Therefore, the levels of SAD of time 1 and time 2 were compared to verify whether there was any significant change. In this regard, a paired t-test was conducted to verify the significance of the change.

**Table 5** shows the results of the paired t-test comparison between before (time 1) and after (time 2) tests on SAD for the control group. The mean of stress was 2.925. At time 2, the mean was 2.995. Thus, the level of time 2 stress was found to be higher than that at time 1. Moreover, there was no statistically significant ( $t=-.384$ ,  $p>.05$ ) difference between times 1 and 2. Moreover, 95% CID was showed lower=-.436 and upper=.295. Therefore, the change of stress between time 1 and time 2 was insignificant. The mean of anxiety was 3.017 at time 1. At time 2, the mean was 2.903. Thus, the level of anxiety at time 2 was found to be lower than that of time 1. However, there was no statistically significant ( $t=.767$ ,  $p>.05$ ) difference between times 1 and 2. Moreover, 95% CID was showed lower=-.182 and upper=.409. Therefore, the change of anxiety between time 1 and time 2 was no statistically significant.

**Table 5.** The results of paired t-test related to control group

	variables	time	mean	n	95% CID		t	df	sig. (2-tailed)
					lower	upper			
Control group	Stress	Time 1	2.925	71	-.436	.295	-.384	70	.702
		Time 2	2.995	71					
	Anxiety	Time 1	3.017	71	-.182	.409	.767	70	.446
		Time 2	2.903	71					
	Depression	Time 1	3.406	71	-.136	.432	1.038	70	.303
		Time 2	3.259	71					

The mean of depression was 3.406 at time 1. At time 2, the mean was 3.259. Thus, the level of depression at time 2 was found to be lower than that at time 1. However, there was no statistically significant ( $t=1.038$ ,  $p>.05$ ) difference between times 1 and 2. Moreover, 95% CID was showed lower $=-.136$  and upper $=.432$ . Therefore, the change of anxiety between time 1 and time 2 was no statistically significant. These results indicate that change in the levels of SAD in the control group were insignificant.

## 5. Conclusion

### 5.1 Results and research implications

This study demonstrated that the support of educational and emotional online information are able to reduce SAD. The results and the implications are summarized as follows.

First of all, there was no significant change in the control group without any specific stimulus. This result indicates that, even after a certain period of time, SAD does not increase or decrease naturally. Thus, academic studies should be conducted to find ways to reduce SAD.

Second, OEDIS has been shown to reduce SAD at all significant levels. International students who are supported by educational information improve their self-efficacy for their studies, and have positive expectations for academic results. This positive attitude reduces SAD. Continuous provision of OEDIS will lead to positive outcomes in reducing SAD through this mechanism. Hence, schools should provide students with the educational information they need in online learning.

Third, it was proved that OEMIS had the effect of reducing stress and anxiety. However, OEMIS did not reduce the depression of international students. These results explain the difference between OEMIS and OEDIS. OEDIS carried objective information, while OEMIS included inspirational stories. Depression is a sad feeling for an individual. Thus, it was proved that successful stories or inspirational contents of others do not directly eliminate sad feelings. Rather, more interesting stories, deeply empathetic stories, or objective information, which could be predicted for the future, will reduce depression. Hence, future research needs to identify the causes of depression perceived by individuals, and explore new strategies to reduce them.

Also, the fact that SAD is reduced through specific online information has academic and practical implications.

Academically, certain stimuli provided online have the effect of reducing SAD. Therefore, the influence of the preceding variables to reduce negative factors such as SAD should be continuously studied. Besides education and emotional information, there are other types of information that students need. For instance, psychological states, attitudes, and mindsets are also influenced by online information. In addition, the results of factor analysis proved that stress, depression, and anxiety were independent variables. These variables were distinct from each other, so the reduction or management of each variable should be studied separately. Hence, other studies should be carried out with differences in each variable.

In practice, the reduction of SAD through online information suggests that online education has potential beyond the simple replacement of offline education. Online education can provide a variety of information to students transcending time and space. Schools should improve learning effectiveness by providing educational and emotional information in online learning. Colleges can evaluate student satisfaction and educational outcomes through direct factors, such as grades, language skills, and surveys. However, by managing other factors such as SAD through online information, the education performance will be further improved.

Therefore, universities should strive to manage these factors and seek educational performance measures appropriate for the online education environment.

In addition, SAD is also closely related to human health. OEMIS and OEDIS or other forms of information could reduce SAD. Thus, the results of this study imply that online information support can also be used in other areas, such as healthcare.

## 5.2 Limitations and Future Directions

The limitations of this study and future research directions are summarized below.

First, this study set only SAD as a negative factor affecting international students. Future studies should investigate the influence of online information on positive factors, such as academic commitment and engagement, or negative factors such as emotional exhaustion and cynicism. Second, there were limitations to the design of OEMIS and OEDIS. It is necessary to find a more effective plan for the content and length of videos, and the time zone in which information was provided in the experiment. Furthermore, a study in which OEMIS and OEDIS are provided at the same time should also be conducted. Third, individual students have different personalities, values, and cultural backgrounds. Depending on these differences, the effects of OEMIS and OEDIS might differ. Future research should consider ways to use strategies that are more appropriate for individuals, taking into account their characteristics.

Fourth, this study was only tested on international students. By providing online information, the SAD of other workers and students could also be reduced. Future research will have to establish and provide necessary information for general workers or students. These efforts will prove various effects, such as improving education and work performance.

Finally, the importance of using information is emphasized in the 4th industrial revolution [2]. It should improve achievements such as creativity by utilizing Internet information technologies [48]. This highlights that the field of e-business continues to develop, and students must increase their creativity to survive in the era of the 4th industrial revolution [49]. Future research should focus on the use of information and focus on improving performance at the individual and organizational level.

## References

- [1] W. Bao, "COVID-19 and Online Teaching in Higher Education: A Case Study of Peking University," *Human Behavior and Emerging Technologies*, Vol. 2, no. 2, pp. 113-115, Apr. 2020. [Article\(CrossRef Link\)](#)
- [2] M. Chung and J. Kim, "The Internet Information and Technology Research Directions Based on the Fourth Industrial Revolution," *KSII Transactions on Internet & Information Systems*, Vol. 10, No. 3, pp. 1311-1320, March. 2016. [Article\(CrossRef Link\)](#)
- [3] J. Dewey, *Democracy and Education by John Dewey*, Project Gutenberg, 1916.
- [4] M. Y. Doo, C. Bonk, and H. Heo, "A Meta-Analysis of Scaffolding Effects in Online Learning in Higher Education," *International Review of Research in Open and Distributed Learning*, Vol. 21, No. 3, pp. 60-80, Sep. 2020. [Article\(CrossRef Link\)](#)
- [5] T. Pantiuk, M. Pantiuk, I. Voloshanska, and Z. Burkovska, "Communicative Competence as a Subjective Determinant: Globalization and Personal Aspects," *Journal of Vasyl Stefanyk Precarpathian National University*, Vol. 4, No. 1, pp. 48-52, 2017. [Article\(CrossRef Link\)](#)
- [6] S. M. A. Shah, D. Mohammad, M. F. H. Qureshi, M. Z. Abbas, and S. Aleem, "Prevalence, Psychological Responses and Associated Correlates of Depression, Anxiety and Stress in A Global Population, during the Coronavirus Disease (CoViD-19) Pandemic," *Community Mental Health Journal*, Vol. 57, pp. 101-110, 2021. [Article\(CrossRef Link\)](#)

- [7] W. Husain, "Depression, Anxiety, and Stress among Urban and Rural Police Officers," *Journal of Police and Criminal Psychology*, Vol. 35, No. 4, pp. 443-447, Nov. 2020. [Article\(CrossRef Link\)](#)
- [8] X. Li, Y. Kuang, and L. Zhang, "Misperceptions of Chinese Investments in Canada and Their Correction: Evidence from a Survey Experiment," *Canadian Journal of Political Science*, Vol. 52, No. 2, pp. 285-302, Jun. 2019. [Article\(CrossRef Link\)](#)
- [9] S. Irshad, "Study of General Mental Health in Relation to Self-Disclosure, Extraversion-Introversion and Social Support," Aligarh Muslim University, 2011.
- [10] T. W. Strine, D. P. Chapman, L. Balluz, and A. H. Mokdad, "Health-related Quality of Life and Health Behaviors by Social and Emotional Support," *Social Psychiatry and Psychiatric Epidemiology*, Vol. 43, No. 2, pp. 151-159, 2008. [Article\(CrossRef Link\)](#)
- [11] U. K. Saikia, D. Sarma, and Y. Yadav, "Delayed Presentation of Turner Syndrome: Challenge to Optimal Management," *Journal of Human Reproductive Sciences*, Vol. 10, No. 4, pp. 297-301, Oct-Dec. 2017. [Article\(CrossRef Link\)](#)
- [12] R. S. Lal and A. P. Singh, "Employee's Work Stress: Review and Presenting a Comprehensive Model," *Journal of Psychosocial Research*, Vol. 10, No. 2, pp. 409-420, Jul-Dec. 2015.
- [13] H. Selye, *The Stress of Life*, New York: McGraw-Hill, 1976.
- [14] N. Bilgel and N. Bayram, "Turkish Version of the Depression Anxiety Stress Scale (DASS-42): Psychometric Properties," *Archives of Neuropsychiatry/Noropsikiatri Arsivi*, Vol. 47, No. 2, pp. 118-126, Jun. 2010.
- [15] N. Hang-Yue, S. Foley, and R. Loi, "Work Role Stressors and Turnover Intentions: A Study of Professional Clergy in Hong Kong," *The International Journal of Human Resource Management*, Vol. 16, No. 11, pp. 2133-2146, Nov. 2005. [Article\(CrossRef Link\)](#)
- [16] K. Saki, "Treatment of Anxiety Disorders with Plants and Herbs," *International Journal of Green Pharmacy*, Vol. 12, No. 03, pp. s458-s462, July-Sep. 2018.
- [17] P. Vitasari, M. N. A. Wahab, A. Othman, T. Herawan, and S. K. Sinnadurai, "The Relationship between Study Anxiety and Academic Performance among Engineering Students," *Procedia-Social and Behavioral Sciences*, Vol. 8, pp. 490-497, 2010. [Article\(CrossRef Link\)](#)
- [18] J. C. Parker and G. E. Wright, "The Implications of Depression for Pain and Disability in Rheumatoid Arthritis," *Arthritis & Rheumatism: Official Journal of the American College of Rheumatology*, Vol. 8, No. 4, pp. 279-283, Dec. 1995. [Article\(CrossRef Link\)](#)
- [19] A. H. Alghadir and S. A. Gabr, "Hormonal Function Responses to Moderate Aerobic Exercise in Older Adults with Depression," *Clinical Interventions in Aging*, Vol. 15, pp. 1271-1283, Aug. 2020. [Article\(CrossRef Link\)](#)
- [20] E. H. Ha, K. J. Oh, D. H. Song, and J. H. Kang, "The Effects of Cognitive-Behavioral Group Therapy for Depression and Anxiety Disorders in Adolescents: A Preliminary Study," *Korean Journal of Clinical Psychology*, Vol. 23, No. 2, pp. 263-279, May 2004. [Article\(CrossRef Link\)](#)
- [21] M. Nelson and C. D. Johnson, "Individual Differences in Management Education: The Effect of Social Support and Attachment Style," *Academy of Educational Leadership Journal*, Vol. 15, No. 1, pp. 65-76, 2011. [Article\(CrossRef Link\)](#)
- [22] M. J. Mustafa, E. Hernandez, C. Mahon, and L. K. Chee, "Entrepreneurial Intentions of University Students in An Emerging Economy: The Influence of University Support and Proactive Personality on Students' Entrepreneurial Intention," *Journal of Entrepreneurship in Emerging Economies*, Vol. 8, No. 2, pp. 162-179, Jun. 2016. [Article\(CrossRef Link\)](#)
- [23] S. Wu and N. Tang, "Education Informatization and University Teaching Reform," in *Proc. of 2013 the International Conference on Education Technology and Information System (ICETIS 2013)*, Atlantis Press, 608-611, Jun. 2013.
- [24] R. Jan and A. A. Khan, "Emotion Mining Using Semantic Similarity," *International Journal of Synthetic Emotions*, Vol. 9, No. 2, pp. 1-22, Jul. 2018. [Article\(CrossRef Link\)](#)
- [25] M. Lindorff, "Determinants of Received Social Support: Who Gives What to Managers?," *Journal of Social and Personal Relationships*, Vol. 22, No. 3, pp. 323-337, Jun. 2005. [Article\(CrossRef Link\)](#)



- [26] D. Cukor, S. D. Cohen, R. A. Peterson, and P. L. Kimmel, "Psychosocial Aspects of Chronic Disease: ESRD as A Paradigmatic Illness," *Journal of the American Society of Nephrology*, Vol. 18, No. 12, pp. 3042-3055, Dec. 2007. [Article\(CrossRef Link\)](#)
- [27] K. McGonigal, *The Upside of Stress: Why Stress Is Good for You, and How to Get Good at It*, New York: AVERY, 2015.
- [28] C. Schaefer, J. C. Coyne, and R. S. Lazarus, "The Health-Related Functions of Social Support," *Journal of Behavioral Medicine*, Vol. 4, No. 4, pp. 381-406, Dec. 1981. [Article\(CrossRef Link\)](#)
- [29] E. Selkie, V. Adkins, E. Masters, A. Bajpai, and D. Shumer, "Transgender Adolescents' Uses of Social Media for Social Support," *Journal of Adolescent Health*, Vol. 66, No. 3, pp. 275-280, Mar. 2020. [Article\(CrossRef Link\)](#)
- [30] E. A. McConnell, M. A. Birkett, and B. Mustanski, "Typologies of Social Support and Associations with Mental Health Outcomes among LGBT Youth," *LGBT Health*, Vol. 2, No. 1, pp. 55-61, Mar. 2015. [Article\(CrossRef Link\)](#)
- [31] K. A. Villagonzalo, C. Arnold, J. Farhall, S. L. Rossell, F. Foley, and N. Thomas, "Predictors of Overall and Mental Health-Related Internet Use in Adults with Psychosis," *Psychiatry Research*, Vol. 278, pp. 12-18, Aug. 2019. [Article\(CrossRef Link\)](#)
- [32] X. Jin, "A Study on the Way to Improvement of Career Commitment and Life Satisfaction among Chinese Students Who Study in Korea," *International Journal of Advanced Culture Technology*, Vol. 8, No. 4, pp. 39-50, Dec. 2020. [Article\(CrossRef Link\)](#)
- [33] C. Hammond, *Learning To Be Healthy. The Wider Benefits of Learning Papers*, London: Institute of Education, 2002. [Article\(CrossRef Link\)](#)
- [34] F. Pajares, "Gender and Perceived Self-Efficacy in Self-Regulated Learning," *Theory into Practice*, Vol. 41, No. 2, pp. 116-125, Spring 2002. [Article\(CrossRef Link\)](#)
- [35] M. Parto, "Problem Solving, Self-Efficacy, and Mental Health in Adolescents: Assessing the Mediating Role of Assertiveness," *Procedia-Social and Behavioral Sciences*, Vol. 30, pp. 644-648, 2011. [Article\(CrossRef Link\)](#)
- [36] Y. Wang, D. Reitter, and J. Yen, "How Emotional Support and Informational Support Relate to Linguistic Alignment," in *Proc. of International Conference on Social Computing, Behavioral-Cultural Modeling and Prediction and Behavior Representation in Modeling and Simulation*, pp. 25-34, Jul. 2017. [Article\(CrossRef Link\)](#)
- [37] C. P. H. Langford, J. Bowsher, J. P. Maloney, and P. P. Lillis, "Social Support: A Conceptual Analysis," *Journal of Advanced Nursing*, Vol. 25, No. 1, pp. 95-100, Jan. 1997. [Article\(CrossRef Link\)](#)
- [38] P. T. Costa and R. R. McCrae, "The Five-Factor Model of Personality and Its Relevance to Personality Disorders," *Journal of Personality Disorders*, Vol. 6, pp. 343-359, Dec. 1992. [Article\(CrossRef Link\)](#)
- [39] K. I. Van der Zee and J. P. Van Oudenhoven, "The Multicultural Personality Questionnaire: Reliability and Validity of Self-and Other Ratings of Multicultural Effectiveness," *Journal of Research in Personality*, Vol. 35, No. 3, pp. 278-288, Sep. 2001. [Article\(CrossRef Link\)](#)
- [40] G. Alessandri, E. Perinelli, E. De Longis, W. B. Schaufeli, A. Theodorou, L. Borgogni, G. V. Caprara, and L. Cinque, "Job Burnout: The Contribution of Emotional Stability and Emotional Self - Efficacy Beliefs," *Journal of Occupational and Organizational Psychology*, Vol. 91, No. 4, pp. 823-851, Dec. 2018. [Article\(CrossRef Link\)](#)
- [41] G. Tabibnia and D. Radecki, "Resilience Training That Can Change the Brain," *Consulting Psychology Journal: Practice and Research*, Vol. 70, No. 1, pp. 59-88, Mar. 2018. [Article\(CrossRef Link\)](#)
- [42] T. Gao, X. Ding, J. Chai, Z. Zhang, H. Zhang, Y. Kong, and S. Mei, "The Influence of Resilience on Mental Health: The Role of General Well-Being," *International Journal of Nursing Practice*, Vol. 23, No. 3, e12535, Mar. 2017. [Article\(CrossRef Link\)](#)
- [43] G. A. Fordjour, A. P. C. Chan, and A. A. Fordjour, "Exploring Potential Predictors of Psychological Distress among Employees: A Systematic Review," *International Journal of Psychiatry Research*, Vol. 3, No. 1, pp. 1-11, Jan. 2020. [Article\(CrossRef Link\)](#)



- [44] S. A. Ahmed and Y. Çerkez, "The Impact of Anxiety, Depression, and Stress on Emotional Stability among the University Students from the View of Educational Aspects," *Propositos y Representaciones*, Vol. 8, No. 3, pp. 1-9, Sep-Dec. 2020. [Article\(CrossRef Link\)](#)
- [45] A. S. Yasin and M. A. Dzulkipli, "The Relationship between Social Support and Psychological Problems among Students," *International Journal of Business and Social Science*, Vol. 1, No. 3, pp. 110-116, Dec. 2010. [Article\(CrossRef Link\)](#)
- [46] N. El-Bassel, N. Guterman, D. Bargal, and K. H. Su, "Main and Buffering Effects of Emotional Support on Job—and Health-Related Strains: A National Survey of Israeli Social Workers," *Employee Assistance Quarterly*, Vol. 13, No. 3, pp. 1-18, 1998. [Article\(CrossRef Link\)](#)
- [47] H. Park, & S. Hahm, "Changes in Stress Mindset and EEG through E-Healthcare Based Education," *IEEE Access*, Vol. 7, pp. 20163-20171, Jan. 2019. [Article\(CrossRef Link\)](#)
- [48] I. K. Song and J. Chun, "Evolving Internet Information & Technology As Enablers for Creating Shared Values," *KSII Transactions on Internet and Information Systems*, Vol. 9, No. 1, pp. 309-317, Jan. 2015. [Article\(CrossRef Link\)](#)
- [49] S. Hahm, "Roles of Authentic Leadership, Psychological Empowerment and Intrinsic Motivation on Workers' Creativity in E-business," *Journal of Internet Computing and Services*, Vol. 19, No. 1, pp. 113-122, Feb, 2018. [Article\(CrossRef Link\)](#)



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