The Causal Model of Self-regulation in University Students based on Reducing Perceived Social Interactions during Covid-19: The Mediating Role of Adjustment to Online Learning

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Abstract

Introduction: This study aimed to explore the association between reducing perceived social interactions and self-regulation difficulties experienced during online studying, with mediating the role of students' adjustment to online learning.
Method: The research method was descriptive, of structural equations type. The statistical population included all students studying at Farhangian University of Kurdistan Province in the academic year of 2021-2022, from which 300 were selected by systematic random sampling. Glass's Interaction Questionnaire, Bouffard et al.'s Self-regulation Scale and Pavin Ivanec's Adaptation to Online learning scale were used to collect data. The data were analyzed with the Pearson correlation and structural equation analysis method through Spss 24 and Lisrel 8.8 software.
Results: According to the findings of the present study, students who perceive a greater decrease of academic social interactions, report more self-regulation difficulties during online studying. Furthermore, the perceived decrease of academic social interactions affects students' adjustment to online studying. This mediator, in turn, affects the level of experienced self-regulation difficulties.
Conclusion: Based on the findings, it can be concluded that adaptation to online environments in the relationship between reduced social interactions and self-regulation in students has a mediating role.

Keywords: Adjustment Online learning, COVID-19, Self-Regulation, Social Interactions

Introduction

Self-regulation is one of the most important concepts related to learning that has attracted attention. This construct was first introduced by psychologists and social cognitive researchers including Bandura in the 1960s [1]. Zimmerman, a theorist of social cognition theory, defined self-regulatory strategies as a type of learning in which learners personally initiate and direct their own efforts instead of relying on teachers, parents, or other educators for knowledge and skills. In other words, Zimmerman defined self-regulation in learning to active the participation of learners in terms of behavior, motivation, cognition and metacognition in the learning process in order to maximize learning [2]. Self-regulation in learning is directly related to academic motivation and is of great importance for human existence, because it is directly related to membership in groups and social acceptance. Basically, humans tend to receive most of what they need from other individuals [3].

One of the models that explains how perceiving a threat (e.g. Covid-19) affects health-related behaviors in humans is the Howard Leventhal self-regulatory model. This model states that parallel cognitive and emotional systems are activated when confronted with external and internal stimuli in three stages: 1- Perception of threat 2- Coping with threat and 3- Evaluation. According to this model, the degree and quality of social interactions play a decisive role in determining the self-regulatory strategy [4].

Social interaction is a "mutual or reciprocal action where two or more parties have an effect upon one another," during which "the customers' and the firms' value-creation processes are simultaneously occurring" [5]. In other words, social interaction represents two-way or multidirectional communication between actors [6]. Research has shown that social interactions play a major role in promoting the self-regulatory process in learners [7]. Self-regulated individuals try to actively participate in collective learning activities in order to achieve their learning goals [8]. The outbreak of Covid-19 disease, which rapidly emerged in the beginning of 2020, had a great impact on various aspects of people's lives and led to various actions at the community level aimed at social distancing. One of these measures was to turn face-to-face training into offline and online training [9]. In a short period, most of the university education activities were transferred to online educational environments. Although online education has advantages such as accessibility, affordability, and flexibility [10, 11], this change was largely unplanned for both university professors and students, so that many students' adaptation was affected [10, 12]. Recent studies indicate that students during the pandemic generally feel lonely [13]. This feeling of loneliness can be a source of stress for students and reduce social interactions. [14, 15]. Studies have shown that the Covid-19 pandemic has a significant effect on reducing students' social interactions [12, 16]. In a study conducted by Giusti et al. [17], university students perceived the absence of direct face-to-face contact as the most notable disadvantage of distance education during the pandemic, followed by reduced interaction with each other. Another study explored the potentials of online learning and obtained that the decrease of social interactions is one of the crucial barriers for students' online learning experiences [18].

It is specified that students' adjustment and learning difficulties during online studying could be related to a decrease of self-regulation and proneness to procrastination [19]. Giusti et al. [17] also reported difficulties regarding learning and self-regulation during distance education among university students. An additional challenge for the learning process during online education could likely be the possibility that the studying experience became a rather lonely experience, decreasing the usual academic interactions and networking [20]. In a study conducted by Pedrotti and Nistor [21], a surprisingly small proportion of university students used various self-regulation strategies in an online learning environment related to time management and planning their learning during the semester. Furthermore, they were mostly focused on the period before the exams, manifesting the tendency to procrastinate.

Adaptation to the online learning environment is another important variable that can play an important role in the quality of student learning during the COVID-19 pandemic. Muilenburg and Berge [18] obtained that learning motivation is also one of the students' concerns regarding online learning. Difficulties related to the learning process in the online learning environment can be related to various factors, such as a sense of cognitive overload and perceived competence in the use of technology [22]. Within the context of the pandemic, students also needed to adjust to new studying conditions, which could be more or less demanding and challenging for some students. Several recent studies which have focused on the effects of the pandemic on students' learning indicate that, during the transition to online education, students reported increased workload [10, 23, 24] and academic burnout [25]. Furthermore, students' adjustment and learning difficulties during online studying could be related to a lack of self-regulation and proneness to procrastination [19, 26]. It has been determined that the pandemic and new studying circumstances that downsized the usual range of academic interactions could pose a challenge for a significant number of students and their adjustment to the unexpected shift from onsite to online education[27-30].

Although the number of studies interested in various aspects of the transition to online studying is increasing, the incidence of the pandemic is still relatively new and has a broad potential for specific related issues that could be addressed and explored. Moreover, a better understanding of the factors that contribute to the quality of online studying experiences can have potential practical implications in planning measures to reduce the possibility of negative short-term and long-term effects on students' academic functioning and achievement. According to studies, the decrease in social interactions due to the spread of Covid-19 and problems related to adaptation to online learning have a clear relationship with disruption of the self-regulatory process among students. Despite the fact that a great number of studies confirm that social interactions can be closely related to self-regulation, only few studies have investigated the effect of the mediating role of adjustment to the online learning environment. Hence, the aim of this study was to investigate the causal modeling of self-regulation of university students based on the reduction of perceived social interactions with the mediating role of adaptation to online learning environments during the Covid-19 pandemic. The hypotheses of the present study were: 1. Reducing perceived social interactions has a direct effect on students' self-regulation, 2. Adaptation difficulties to online learning environments have a direct effect on students' self-regulation and 3. Reducing perceived social interactions through adaptation to online learning environments has an indirect effect on students' self-regulation.

Method
The study was a descriptive correlation performed with a structural equation modeling method. The statistical population of this study included all students studying at Farhangian University of Kurdistan Province of Iran in the academic year of 2021-2022. According to the announced statistics the number of students were about 2011. The sample size was calculated based on Kline's method [31]

of 10 to 20 times the number of model parameters. Therefore, 300 students were selected with systematic random sampling. Thus, through the list of members of the statistical population, sample members in all fields were selected according to the number of male and female students in each field. According to the limitations caused by social distancing, online surveys were utilized for data collection. The inclusion criteria included studying at Farhangian University and not having previous familiarity and experience with research tools through questions from themselves. The exclusion criteria included the absence of any criteria for entering the sample and also the student's refusal to answer the questions. Demographic data of the sample group showed that 47% (141 people) of the sample group were women and 53% (159 people) were men. The mean and standard deviation of the age of the sample group were 20.84 and 2.80, respectively.

In the present study, the following tools were used to collect data:

Perceived Social Interaction Questionnaire: This questionnaire has been designed by glass [32] and is a self-report tool that contains 30 items graded on a five-point Likert scale from one (not true at all) to five (absolutely true). It includes two factors of positive and negative thoughts about social interactions. The obtained score is the total score of the questionnaire and will range from 30 to 150, high score on this questionnaire indicates high social interaction. Chaimongkol et al. [33] reported the validity of the questionnaire through Correlation with the California Social Adjustment Questionnaire as 0.65 at the level of 0.001, which indicates the questionnaire has a high validity. They also calculated the reliability of this questionnaire to be 0.88 using Cronbach's alpha. Homaii and Fatemi ardestani [34] reported the Iranian reliability of the questionnaire to be 0.88, using Cronbach's alpha coefficient .The validity of this scale was calculated through the Correlation with California Social Adjustment Questionnaire as 0.70. In the present study, Cronbach's alpha coefficient was 0.93.

Self-regulation Scale: This scale contains 14 questions that was designed by Bouffard et al. [35]. In this scale, five options are considered for each item (strongly agree, agree, have no opinion, disagree and strongly disagree) scored from 5 to 1, respectively. Questions 5, 13 and 14 are reversely scored. Questions 3, 6, 9, 10, 13 are related to the metacognitive component of self-regulation and questions 14, 12, 11, 8, 7, 5, 4, 2, 1 are related to the cognitive component. The total score ranged from 14 to 70, that high score on this questionnaire indicates high self-regulation. Zimmerman and Kitsantas [8] reported the overall predictive validity of this scale as desirable. They reported the reliability by Cronbach's alpha method to be 0.86. In the Iranian version, the overall reliability coefficient of the questionnaire based on Cronbach's alpha was 0.71. The reliability of the cognitive strategies' subscale was 0.70 and the metacognitive subscale was 0.68. To determine its structure, the results of factor analysis showed that the correlation coefficient between the questions was appropriate and the measurement tool consisted of two factors. The value load related to the factors was acceptable and this tool was able to determine the self-regulatory variance by 0.52. The validity of the construct was also desirable [36]. In the present study, Cronbach's alpha coefficient for total score was 0.83, and for cognitive and metacognitive components was 0.85 and 0.79, respectively.

Adaptation to Online Learning Scale: Pavin Ivanec's adaptation online learning scale [37] was used to assess the student's self-reported general adjustment to online learning during the Covid-19 pandemic. This scale consists of five items on which students rated their overall adjustment on a five-point Likert scale from 1 (very poor) to 5 (excellent). The total score ranges from 5 to 25. A high score on this scale indicates high adaptation to online learning. In a study by Pavin Ivanec, the reliability of the questionnaire was calculated to be 0.90 using Cronbach's alpha coefficient and the reliability of this questionnaire was calculated to be 0.79 using the retest method [37]. The validity of this scale was confirmed in the study by Farsi et al. They reported the reliability of this scale using the Cronbach's alpha method to be 0.87 [38]. In the present study, Cronbach's alpha coefficient was 0.93.

The data were analyzed by descriptive and inferential statistics. Descriptive statistics were used to examine the Pearson correlation through SPSS 24 software. In order to determine the fit of the studied model, the structural equation analysis method was used through Lisrel 8.8 software.

Results

Descriptive statistics for the examined variables, as well as their correlations, are displayed in Table 1. The average values reveal that students encountered a moderate level of self-regulation difficulties during online studying, and they mostly experienced a reducing perceived social interactions in the online learning environment. Furthermore, students see themselves as relatively adjusted to the online learning environment. According to the data, there is a negative relationship between the components of cognition and metacognition of self-regulation and adjustment to online learning environment and there is a positive relationship with reducing perceived social interaction. All correlations were significant (P<0.01). Before using the structural equation modeling, univariate outlier data were analyzed using box diagrams and multivariate outlier data were analyzed by Mahalanobis statistic and excluded from the data set. The amount of observed skewness for the research variables is in the range of (2, -2). This indicates that the research variables are normal in terms of skew and their distribution is symmetric. The amount of kurtosis is also in the range (2, -2). This also indicates that the distribution of the studied variables has a natural kurtosis. Kolmogorov-Smirnov test was also used to evaluate the normality of multivariate data. The results showed that the distribution of scores in all four variables of the model is normal (P <0.01). To investigate multicollinearity, tolerance statistic and Variance Inflation Factor (VIF) were used (Table 1). According to this table, for all variables, the

variance inflation factor statistic was less than 10 and the tolerance statistic was more than 0.40; therefore, the assumption of multicollinearity is observed. Also, the Durbin-Watson test was used to test the assumption of errors independence and its value was equal to 2.08, which being in the range of 1.5 to 2.5 indicates compliance with the assumption of errors independence. Based on the significant binary correlation between the research variables in the next step, structural equation modeling was performed.

In the present study model, based on previous experimental findings, the variable of adjustment to online learning was considered as a mediator to explain self- regulation difficulties in university students. Table 2 shows the fitness indices of the model.

In general, considering the values of the fitness indices of the developed model and the limit of acceptable values mentioned in Table 2, the model presented in this research is acceptable. In other words, considering the optimal range for these indicators, the data largely support the theoretical model of the research. As a result, these indexes indicate the acceptability of the model. Figure 1, shows the research model.

The direct effects of reducing perceived social interaction and adjustment to the online learning environments on self-regulation are presented in Table 3. According to the table data, direct effect of reducing perceived social interaction on self-regulation is positive and significant; the adjustment to the online learning environments also has a direct and positive effect on self-regulation. To examine the indirect effect of reducing perceived social interactions on students' self-regulation through adjustment to online learning environments, the Sobel test was used. Also, the VAF test was used to determine the intensity of the indirect effect through the mediating variable. The results are presented in Table 4.

According to the results of Table 4, the hypothesis of the indirect effect of reducing perceived social interactions on self-regulation difficulties is confirmed. Thus, the variable of reducing perceived social interactions, in addition to the direct effect, also indirectly has a significant effect on students' self-regulation difficulties through adjustment to online learning environments. According to VAF statistic, 22.1% of the effect of reducing perceived social interactions on self-regulation difficulties can be explained by the adjustment to online learning environments.

Table 1. Means, SD, and Correlations between Explored Variables

Variables	M	SD	Skewness	Kurtosis	Tolerance	VIF	1	2	3	4
1- Cognition	27.16	5.37	-0.42	-0.324	0.90	1.10	-			
2- Metacognition	14.12	2.93	-0.31	-1.122	0.88	1.13	0.54**	-		
3- Adjustment to Online learning	17.72	2.03	0.11	-1.071	0.76	1.45	-0.42**	-0.49**	-	
4- Perceived Social Interaction	46.80	13.09	-0.21	-1.087	0.89	1.23	0.52**	0.61**	-0.32**	-

Note: ** = p < 0.001

Table 2. Model Fit Indices

Indicator	df/X²	RMSEA	GFI	AGFI	CFI	NFI	NNFI	IFI
Amount	2.27	0.024	0.97	0.98	0.99	0.98	0.98	0.97
Acceptable level	≤ 3	≤ 0.08	≥ 0.90	≥ 0.80	≥ 0.90	≥ 0.90	≥ 0.90	≥ 0.90

Table 3. Direct Effects Analysis

paths	β	t	SE	p
From reducing perceived social interaction to self-regulation difficulties	0.41	5.12	0.08	P<0.01
From adjustment to the online learning environments to self-regulation difficulties	-0.31	-4.11	0.10	P<0.01
From reducing perceived social interaction to adjustment to the online learning environments	-0.26	-3.74	0.11	P<0.01

Table 4. Indirect Effect Analysis

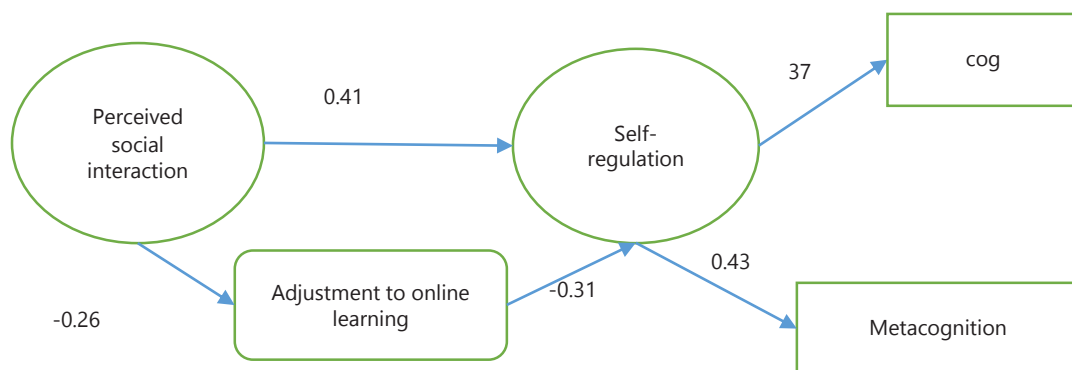| Hypothesis	T-sobel	β	VAF	Result
Perceived social interaction ⟶ adjustment to the online learning ⟶ self-regulation difficulties	2.27	0.14	0.22	Confirm

Figure 1. The experimental model of the effect of reducing perceived social interactions on students' self-regulation through adjustment to online learning environments.

Discussion

The main purpose of this study was to investigate the mediating role of students' general adjustment to online studying in the relationship between perceived social interactions in the online learning environment and students' self-regulation difficulties during online studying caused by the pandemic. The results showed that the proposed model had a good fit. In general, all direct and indirect paths had significant relationships.

The first hypothesis of the present study that the reduction of social interactions due pandemic has a direct effect on students' self-regulation was confirmed. This result is in line with previous studies [29, 39-41]. One explanation for the results of this study could be that social interactions in the academic context can be of relevance for students' self-regulation and motivation, both in the pre-pandemic time and during the pandemic. Self-regulation can be influenced by various factors, social interactions being among the most important. According to Zimmerman theory, self-regulated learners need to expand their social interactions to achieve the cognitive, metacognitive, and management of learning ability and skills.

The second hypothesis of study that adaptation difficulties to online learning environments have a direct effect on students' self-regulation was confirmed. This result also supports the findings of recent studies [30, 42], that focused on pandemic-related effects on students' lives and different aspects of their academic functioning. In explanation of this results, a decrease of social interactions in an academic context is a possible source of students' stress and can affect their everyday life functioning, including self-regulation, academic functioning and worrying about their academic assignments.

The third hypothesis of study that reducing perceived social interactions through adaptation to online learning environments has an indirect effect on students' self-regulation was confirmed. There is no study that is exactly in line with this finding, but there are some studies that confirm these results [28, 37]. In explanation of this results, students who experience a greater decrease of academic interactions also perceive their lives as being more disrupted due to the pandemic. A higher level of perceived life disruption is further positively associated with experienced learning and self-regulation difficulties during online studying. Therefore, students who experience a greater decrease of academic social isolation are also generally less adjusted to transition to online studying, and poorer adjustment negatively affects their self-regulation in an online environment. Previous studies have also reported that adjustment difficulties and pandemic-related worries could reflect on learning and concentration during online education [17], which can be supported by the results of this study. The obtained results add to the current base of knowledge on the possible adverse effects of academic social isolation in an online educational environment. It seems that nowadays it has become even more prominent since changes in the organization of educational processes during the

pandemic concern a much larger number of students worldwide. In addition, the pandemic's negative effects are often discussed in the literature from the perspective of students' well-being. Namely, considering the ages of students, it should be noted that social interactions in that period of life, i.e., in emerging adulthood, are an important part of the identity formation process [43], and that this period of life is characterized by the process of exploration of potential life directions and possibilities. Social interactions play a significant role in these processes from adolescence, and satisfying and quality relationships contribute to psychological well-being and mental health [44]. According to Clair et al. [45], the youngest adults have experienced a greater decrease of social isolation during the pandemic than other adults, whereby the perception of social isolation is also associated with well-being. Similarly, Rodriguez-Besteiro et al. [46] also point out that university students are one of the most affected groups by the pandemic since they are exposed to delays in academic activities and concerns regarding the economic situation. Therefore, in the times of the pandemic, reduced social interactions can also be related to generally poorer adjustment to this adverse situation, especially for the younger students who, according to Babicka-Wirkus et al. [27], demonstrate more difficulties in coping with pandemic-induced stress. The same authors obtained that seeking emotional support is among the dominant coping strategies with stress during the pandemic. However, it should be noted that the options of seeking emotional support are, due to social distancing measures, also somewhat reduced and less available than usual, which could further reflect on students' increased senses of loneliness. In addition, a significant increase in the time spent in front of a computer screen during online education can also contribute to these feelings of loneliness and undermine students' mental and physical health.

The present study had some limitations. For instance, the cross-sectional study, the use of self-report tools, and the sample being limited to the students in Farhangian University of Kurdistan Province. Therefore, it is suggested that the same study be performed in other cities with other samples and its findings be compared with the findings of the present study. It is suggested that other methods of data collection such as interview (individual, family) and observation be used to obtain more complete and accurate information. Also, Based on the findings of similar studies, it is suggested that in future studies, the role of subscales of the studied variables along with other variables such as perceived stress, psychological needs, learning styles etc. be investigated by modeling the structural equations.

Conclusion

This research evaluated a mediation model to investigate the mediating effect of adaptation to online environments in the relationship between reduced social interactions and self-regulation in students. The results of this study demonstrate the important role of reducing social interactions in weakening students' self-regulatory skills,

which in this regard, the more adjustment with online learning environments moderates this effect. Therefore, on the basis of the results of this study, it is necessary to introduce certain measures aimed to support students in their adjustment to online studying. This primarily refers to students who are more sensitive to the decrease of social interactions, whereby faculty management and staff could invest additional efforts to introduce more interactive tools in the educational process and student networking. Additional efforts could also be invested in teaching students how to better manage and organize their time for academic assignments in these specific circumstances.

Conflict of Interest

The author declares no competing interests.

Ethical Approval

All ethical principles were considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information.

Acknowledgment

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