

An examination of the effect of loneliness on the innovative behavior of health science faculty students

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Abstract

Background: Contributing to the innovative behavior of individuals in the health management process is a desirable condition for increased health institution performance. The relationship between the sense of loneliness and individual innovation behaviors has not been studied and relevant literature is extremely limited. The purpose of this research was to examine the effect of an individual's sense of loneliness on their innovative behavior.

Methods: The research was performed between January and October 2018. The effects of loneliness feelings on the individual innovative behaviors of 451 health science faculty students were measured. The data were collected using the "Individual Information Form," the "individual innovation scale," and the "University of California Los Angeles loneliness scale." The reliability and validity of the scales were tested with Structural Equation Modeling.

Results: It was found that the female participants showed exhibited more innovative behavior than the men. However, there was no significant difference in the loneliness status of participants by gender. A group of 23-year-old individuals showed a significant difference in the risk taking dimension compared to other age groups. First-grade students had more points in the experimental openness and opinion leadership sub-dimension than the other classes. It was observed that the behavior is molded as the education level increases. The regression models showed that loneliness has a negative effect of -0.254 on experiential openness and the leadership of ideas, and has a negative effect of -0.216 on risk taking. There was no effect of the sub-dimensions of loneliness on change resistance. Moreover, on the individualistic behavior of physical loneliness, a -0.267 negative effect was observed. Emotional loneliness has no effect on the sub-dimensions of individual innovation. Finally, the total sense of loneliness was found to have a negative effect on total individual innovation.

Conclusions: The study results clearly show that physical loneliness has a negative effect on individual innovation. It can be said that individuals living in social environments exhibit more innovative behaviors. However, emotional loneliness has no significant effect on innovative behavior. In this context, designing social spaces in health institutions will stimulate individuals' innovative behaviors.

Keywords: Loneliness; Innovative behavior; Health science

Introduction

The innovative attitudes and behaviors of employees have become a critical issue for businesses that continue to operate under modern disruptive competitive conditions. For this reason, innovation has long been regarded as the most important source of economic development and business growth. How to improve innovation in businesses is a topic of interest for both managers and entrepreneurs.^[1,2] Academic research shows that innovation plays a central role in businesses. Macro-level evidence is supported by empirical studies showing that the level of technologic innovation, particularly at the firm and industry level, is a significant contributor to economic

performance.^[3] Hence, it is inevitable that businesses focus on innovation.

Competitiveness and the rapidly changing environment have been linked to the participation of everyone working in the organization within an interdisciplinary framework, rather than leaving high innovation performance to a few distinguished individuals working in research and development.^[4] In addition, it is very important for health institutions to standardize their diagnosis and treatment behaviors and to strengthen control over medical quality.^[5] In this context, businesses and academics have recently increasingly discovered the importance of individual innovative behavior and have attempted to define individual characteristics that anticipate such behavior.^[6]

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Innovation results from change and is often destructive, risky, and costly. Innovation also requires persistence to change the existing order.^[7]

Individuals must have individual innovativeness and selectivity characteristics to adapt to the developments and innovations that take place in every aspect of society.^[8] According to Li *et al*,^[9] innovation is defined as the combination of new ideas, including new concepts, science, technology, and theories. In terms of organizational behavior, innovation is defined as the application of creativity. Innovative individuals reveal the secret needs of their customers and perform top-level performance by creatively and effectively solving problems.^[10] Thus, innovative individuals are the foundation of innovative organizations.

Previous research has identified factors that initiate creative action, such as a mental schema, motivation, and reasons for employees deliberately engaging in creative initiatives.^[11] However, little is known about how someone's innovative behavior can manifest in an organization. For example, teams are units in almost any organization and social context. Simultaneously, the development of individual innovation is related to different disciplines such as education and management.^[6] The aim of the present research is to discuss whether there is a relationship between an individual's innovative behavioral characteristics and the level of socialization.

The aim of discussing this relationship is to uncover why it works in modern organizations whilst noting that one of the most important problems of individuals living in cities is loneliness. According to Yaşar,^[12] loneliness is a concept that is applied to individuals who cannot find their mental expectations in normal circumstances and who lack close, special relationships. Dahlberg *et al*^[13] define loneliness as the inconsistency between the desired and actual social relations of the individual. According to the authors, living with feelings of loneliness is not only a problem in and of itself, but also has negative effects on quality of life and physical and mental health. Tejada *et al*^[14] reported that personality traits are associated with an individual's sense of loneliness.

While the importance of open and effective information sharing among individuals for the development of innovation in organizations is noted in the literature,^[15-17] Batistic^[18] stated that institutionalization and socialization tactics within an organization could negatively affect the innovation process. In this context, the relation, if any, between the innovative attitudes and behaviors of the individual and loneliness is the fundamental problem addressed by studying this relationship.

Zhong *et al*^[19] described innovative behavior as the ability of the individual to produce original and potentially useful ideas, including the process of putting new ideas into practice. According to Li and Zheng,^[20] innovative behavior is the creation, promotion, and implementation of innovative thinking in an organization to enhance personal and organizational performance, enabling employees to use innovative thinking styles and to respond

quickly and accurately to changes in customer demand. This behavior is a process of creating new problem solving methods, and starts with defining the problem, finding a solution, and applying these solutions to the organization.^[21] Newman *et al*^[22] stated that innovative behaviors, defined as employees' ability to produce and implement new ideas, are critical in terms of organizational innovation and ongoing competitive advantage. According to Korzilius *et al*,^[23] the innovative behaviors are important assets that enable an organization to succeed in a dynamic business environment.

Innovation as a mentality addresses the internalization of innovation by the individual members of the institution and the development of a supportive culture throughout the organization. When innovation encourages employees and the organization as a whole to innovate, it accelerates the emergence of appropriate innovations.^[24] Dyer *et al*^[25] expressed that there are 5 known skills that represent the distinctive features of organizations that advance new ways of thinking and encourage and support innovation. These skills are: (1) *Association*, to reveal the connection between questions, problems, or ideas from unrelated areas; (2) *To ask questions*, to challenge common wisdom; (3) *Observation*, to examine the behavior of customers, suppliers, and competitors to identify new methods of doing things; (4) *Practice*, to build interactive experiments and to provoke what is outside the usual reaction to see what insights may appear; and (5) *Network*, to meet people from different perspectives. Thus, innovative behavior requires the exchange of knowledge and ideas with others, according to the nature of the employees. The innovative behavior of employees provides concrete benefits to the firm as it must lead to a final output.^[26]

Loneliness is defined as the inconsistency between the levels of an individual's desired and achieved social relations.^[13] According to Lamster *et al*,^[27] it is the desire for a distant perception of the inner distance to other people, and therefore a satisfactory and meaningful relationship. Loneliness in everyday life represents a context in which individuals do not have the opportunity for social interaction or the exchange of information. However, loneliness is also a situation that allows individuals to be free from social constraints, demands, and expectations, and to think and act without social pressure.^[28] Thus, it can be said that loneliness has a positive effect on innovative behavior.

According to Bozorgpour and Salimi,^[29] loneliness is an important indicator for life satisfaction and fragility factors. Loneliness is a basic phenomenon of life, and for this reason, it can be experienced at different levels by everyone at any stage of life. However, the characteristics that lead to social isolation in individuals may differ.^[30] For example, individual, self-perception, self-awareness, lack of self-confidence, or environmental factors, factors such as the loss of relatives, the effects of risk factors such as divorce, migration, social pressure, uncertainty, chaos, social interaction, and a lack of communication can trigger one another and leads to the alienation or loneliness of the individual.^[31] From this viewpoint, Seçim *et al*^[32] divided the individual's sense of loneliness into physical loneliness

and psychologic loneliness. Physical loneliness refers to when there are no other people around, but psychologic loneliness is a state in which one who feels lonely even in large crowds. Thus, it is important to determine the causes of loneliness.

Methods

Ethical approval

The study was conducted in accordance with the *Declaration of Helsinki* and was approved by the local ethics committee of the Sabahattin Zaim University (No: 3438). All patients signed an informed consent form prior to the start of the study, and all centers were monitored by an independent institution. The study was performed between January and October 2018.

Conceptual framework and research hypotheses

The purpose of this study was to examine the effect of university students' sense of loneliness on their innovative behavioral skills. The research model that develops in this context is shown in Figure 1.

When the concept of loneliness is examined, the 2 proposed sub-dimensions of loneliness^[32] should be considered, namely, *physical loneliness* and *psychologic loneliness*. Physical loneliness can be expressed as the absence of an accepted place in society, and emotional loneliness as the absence of an object of love in an individual's life.^[33] In this context, when the individual's loneliness situation is considered, these 2 sub-dimensions must be examined together. Individual innovative behavior consists of the sub-dimensions of *experience openness*, *risk taking*, *change resistance*, and *opinion leadership*, as developed by Hurt *et al*^[34] and the validity and reliability analysis conducted by Kılıçer and Odabaşı^[35] in Turkish. The exploratory factor analysis conducted by the authors of this study consists of a total of 3 sub-dimensions the endpoint creativity scale, experimental openness and thought leadership, and risk taking and change resistance. The research model developed in this context is shown in Figure 1. The study's main hypothesis can be expressed as follows.

H₁: Individual loneliness has a significant negative effect on individual innovation behavior.

No existing research on health faculty students examines the link between an individual's sense of loneliness and individual innovativeness. In this context, it is expected that this research will provide a unique contribution to the relevant literature.

Individual information form

In the individual information form (IIF) created by the researchers, the participants were asked about personal information such as age, gender, education level, the grade they were in, their family structure, and their parents' attitudes. In the form, there were a total of 8 questions, 3 of which were open ended.

Individual innovation scale

The individual innovation scale (IIS) was developed by Hurt *et al*^[34] in 1977, and was based on the original "innovativeness scale" developed by Kılıçer and Odabaşı^[35] to measure the innovativeness of individuals. It is a Likert-type measurement with 5 options. Twelve of the scales were positive (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18, and 19) and 8 were negative (4, 6, 7, 10, 13, 15, 17, and 20). The innovation score at scale is calculated by adding 42 points to the total score obtained by subtracting the total score from the negative items taken from the positive items; the lowest score is 14 and the highest score is 94. Individuals can be categorized in terms of innovation according to the scores calculated on the scale. If the calculated score is over 80 points, it is interpreted as "Innovative," between 69 and 80 points as "Leader," between 57 and 68 points as "Interrogator," between 46 and 56 points as "Skeptic," and below 46 points as "Traditionalist." In addition, it is not generally evaluated on the level of individual innovation. Individuals with scores higher than 68 are considered highly innovative, while those with scores lower than 64 are interpreted as lacking innovation.

In the IIS, "resistance to change" is composed of 8 items (4, 6, 7, 10, 13, 15, 17, and 20), while "experiential openness" consists of 4 sub-dimensions of 5 items (2, 3, 5, 14, and 18) and 2 items of risk taking (16 and 19). The common variances of the 4 factors identified as related to the items range from 0.415 to 0.628. The reliability coefficient for the whole scale was 0.82, while the "resistance to change" reliability coefficient of the size was 0.81, "the opinion leadership" reliability coefficient of the size was 0.73, the "experience openness" reliability coefficient of the size was 0.77, and for "risk taking" the reliability of the size coefficient was 0.62.

In this study, the factor structure of the scale determined by Kılıçer and Odabaşı^[35] was tested by confirmatory factor analysis. Confirmatory factor analysis is a type of structural equation model (SEM) that measures the relationship between observed variables and latent variables.^[36] In the study, the most commonly used goodness of fit indexes were used in the literature. The

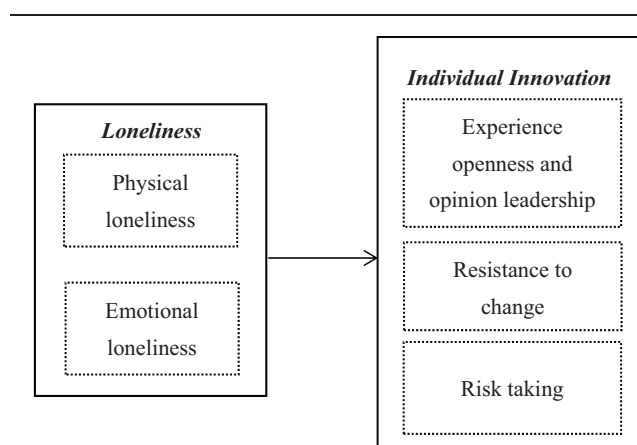


Figure 1: The relationship between the two constructs.

Table 1: Individual innovation scale confirmatory factor analysis index values^[37–43]

Index	Normal value	Allowable value	Individual innovation scale
χ^2/SD	<2	<5	6.205
GFI	>0.95	>0.90	0.815
AGFI	>0.95	>0.90	0.762
CFI	>0.95	>0.90	0.757
RMSEA	<0.05	<0.08	0.108
RMR	<0.05	<0.08	0.092

Sources: Şimşek, 2007; Hooper and Mullen 2008; Schumacker and Lomax, 2010; Waltz, Strickland and Lenz 2010; Wang and Wang, 2012; Sümer, 2000; Tabachnick and Fidell, 2007. χ^2/SD : Chi-squared index/standard deviation; AGFI: Adjusted goodness-of-fit index; CFI: Comparative fit index; GFI: Goodness-of-fit index; RMR: Root mean square residual; RMSEA: Root mean square error of approximation.

Table 2: Individual innovation scale factor structure

Constructs	Item	Factor loading	Explained variance	Cronbach alpha
Experience openness and opinion leadership (eigenvalue=6.541)	Q16	0.778	30.357	0.901
	Q4	0.764		
	Q3	0.736		
	Q9	0.734		
	Q18	0.726		
	Q11	0.709		
	Q19	0.667		
	Q5	0.663		
	Q12	0.659		
	Q1	0.591		
	Q4	0.591		
	Q8	0.554		
	Q2	0.488		
Resistance to change (eigenvalue=2.286)	Q13	0.733	11.132	0.609
	Q7	0.682		
	Q17	0.578		
	Q10	0.504		
Risk taking (eigenvalue=1.442)	Q15	0.740	9.858	0.624
	Q20	0.712		
	Q6	0.605		
Total variance (%)		51.347		

goodness of fit indexes (GFIs) after confirmatory factor analysis are shown in Table 1.

The results of the analysis showed that the compliance statistics calculated by the confirmatory factor analysis were not within an acceptable level with the previously determined factor structure of the scale. Exploratory factor analysis was used to determine the factor structure on the sample of the scale. An explanatory factor analysis method was used to reveal the structural validity of the scale. The result of the Barlett test ($P < 0.001$) showed that there was a correlation between the variables that were used in the factor analysis. As a result of the test ($KMO = 0.875 > 0.60$), it was determined that the sample size was sufficient for factor analysis.

When the number of factors to be measured was determined, the scree plot was examined and found to be smoothed after the third factor. The factor structure is evaluated by repeating the factor analysis according to the

number of factors to be protected according to the break point in the graph of the scree plot.^[44] Factor analysis of the scale was repeated and the 3-factor structure was assessed. Experience openness and opinion leadership was the first factor, the second was resistance to change, and the third was risk taking. The factor structure of the scale is shown in Table 2.

The overall reliability of the scale was found to be very high at Cronbach alpha = 0.869. According to the Cronbach alpha and the reported variance value for reliability, the IIS is understood to be a valid and reliable tool.

The University of California Los Angeles loneliness scale

The scale was developed by Russell, Peplau, and Ferguson.^[45] The scale, prepared in the form of 4 Likert types, consists of 20 statements that only reflect how people describe their experiences. The scale was later revised by Russell, Peplau, and Cutrona^[46] and finally by

Russell.^[47] The University of California Los Angeles loneliness scale (UCLA LS) was first translated into Turkish and used by Yaparel in 1984. Later, it was taken up by Demir^[48] and the translation work was finalized and the Cronbach Alfa internal consistency coefficient was calculated as 0.96. The scale consists of 1 factor. Ten of the items of the UCLA LS, which is a 4-point Likert type, are positive (1, 4, 5, 6, 8, 9, 10, 15, 16, 20), and 10 are negative (2, 3, 7, 11, 12, 13, 14, 17, 18, 19). The rating of the items in the measure range from 1 with the statement “I never experienced this situation” to 4, which means “I experience this often.” The individual receives the opposite points (1–4, 2–3, 3–2, and 4–1 points) to the options marked in questions 2, 3, 7, 11, 12, 13, 14, 17, 18, and 19. The highest score that can be taken from the scale is 80 and the lowest is 20. High scores indicate that individuals are experiencing more loneliness.^[48] Following the confirmatory factor analysis, the criteria for goodness of fit are given in Table 3.

Table 3: Loneliness scale confirmatory factor analysis index values^[37–43]

Index	Normal value	Allowable value	Loneliness scale
χ^2/SD	<2	<5	5.455
GFI	>0.95	>0.90	0.820
AGFI	>0.95	>0.90	0.773
CFI	>0.95	>0.90	0.777
RMSEA	<0.05	<0.08	0.099
RMR	<0.05	<0.08	0.064

Sources: Şimşek, 2007; Hooper and Mullen 2008; Schumacker and Lomax, 2010; Waltz, Strickland and Lenz 2010; Wang and Wang, 2012; Sümer, 2000; Tabachnick and Fidell, 2007. χ^2/SD : Chi-square index/standard deviation; AGFI: Adjusted goodness-of-fit index; CFI: Comparative fit index; GFI: Goodness-of-fit index; RMR: Root mean square residual; RMSEA: Root mean square error of approximation.

The results of the analysis showed that the compliance statistics calculated by confirmatory factor analysis were not within an acceptable level with the previously determined factor structure. Exploratory factor analysis was used to determine the factor structure on the sample of the scale. An explanatory factor analysis method was applied to reveal the structural validity of the scale. The results of the Barlett test ($P < 0.001$) showed that there was a correlation between the variables analyzed by factor analysis. As a result of the test ($KMO = 0.880$), the sample size was determined to be sufficient for factor analysis. When the number of factors was determined and the scree plot was examined, it was found to be smoothed after the second factor. Factor analysis of the scale was repeated and the 2-factor structure was examined, namely, the first factor of physical loneliness and the second of emotional loneliness. The factor structure of the scale is stated in Table 4.

Since the factor load of item 4 in the scale was below 0.45, it was removed. The overall reliability of the scale was found to be very high at $\alpha = 0.889$. It has been understood that the loneliness scale is a valid and reliable instrument according to the alpha and the disclosed variance value for reliability.

Data collection

In the Faculty of Health Sciences, students were informed about the pre-course research in their classes and written and verbal approvals were given. The students who agreed to participate in the survey received a questionnaire containing the questions of the “Personal Information Form,” IIS, and the “UCLA LS” in the classroom environment. The students filled in the data collection form. In the study conducted with the distributor method

Table 4: Loneliness scale factor structure

Constructs	Item	Factor loading	Explained variance	Cronbach alpha
Physical loneliness (eigenvalue=6.741)	U19	0.777	27.141	0.865
	U6	0.738		
	U10	0.727		
	U16	0.718		
	U5	0.685		
	U20	0.649		
	U8	0.594		
	U11	0.552		
	U15	0.533		
	U1	0.513		
	U9	0.485		
Emotional loneliness (eigenvalue=1.840)	U7	0.707	18.026	0.794
	U3	0.686		
	U13	0.634		
	U17	0.603		
	U18	0.573		
	U14	0.544		
	U12	0.534		
	U2	0.519		
Total variance (%)		45.167		

under the control of the researcher, the response time took about 5–7 minutes.

Statistical analysis

The SPSS 25.0 statistic software (IBM Inc., Armonk, NY) was used to analyze the data. The distributions of the questions were interpreted as frequency and the scale scores as percentages were interpreted as mean, standard deviation. Prior to the relational analysis, the total scores of innovation and the loneliness scale calculated for each participant were subjected to normality tests. Tabachnick and Fidell^[43] state that skewness and kurtosis values should vary between -1.5 and $+1.5$ in order for the data to show normal distribution. According to this, the total scores of the IIS (skewness = -0.926 ; kurtosis = 0.888) and the UCLA LS (skewness = -1.226 ; kurtosis = 0.987) were found to provide the normality condition. In the case of 2 groups in a comparison of quantitative data, an independent samples *t* test was used for the comparison of parameters between the groups. The 1-way analysis of variance test and the Bonferroni test were used to determine the group causing the difference in the case of more than 2 groups in the comparison of quantitative data. The results were evaluated at a 95% confidence interval and a $P < 0.05$ significance level [Table 5].

Results

As seen in Table 6, the participants were 143 (31.7%) nutrition and dietetics, 149 (33%) social service, 103 (22.8%) nursing, and 56 (12%) health management students. According to the age group of the students, 35.9% (162) were aged 19 and 56.3% of the students were female (254). According to the classroom situation variable, the students are divided into 2 classes as 166 (36.8%). In addition, 66 of the students (14.6%) were educated about innovation, 86% of family members were elementary family members, 55.9% were parents, 63.2% were living in metropolitan areas, and 55.9% defined their family as a protector.

It was found that the female participants showed exhibited more innovative behavior than the men. However, there was no significant difference in the loneliness status of participants by gender. In this context, it cannot be said that the reason for more innovative behavior among women is due to their being more social. However, when individual innovative behavior was analyzed by age variable, it was found that 23-year-old individuals showed a significant difference in the risk taking dimension compared to other age groups. According to the participant segments, it did not make a significant difference in terms of innovative behavior. When the relationship between educational attainment and innovative behavior was examined, it was seen that first-grade students had more points in the experimental openness and opinion leadership sub-dimension than the other classes. When this group's scores on the loneliness scale were examined, it was seen that the same group showed significant differences in the physical loneliness sub-dimension. They were found to exhibit more innovative behavior as the feeling of

Table 5: Descriptive statistics of health science faculty students ($n=451$)

Parameters	Number	Percent
Department		
Nutrition and dietetics	143	31.7
Social service	149	33.0
Nursing	103	22.8
Health management	56	12.4
Total	451	100.0
Age		
18 years	61	13.5
19 years	162	35.9
20 years	137	30.4
21 years	52	11.5
22 years	23	5.1
23 years and over	16	3.5
Total	451	100.0
Gender		
Female	254	56.3
Male	197	43.7
Total	451	100.0
Educational status		
First	134	29.7
Second	166	36.8
Third	96	21.3
Fourth	55	12.2
Total	451	100.0
Training on innovation		
Yes	66	14.6
No	385	85.4
Total	451	100.0
Family type		
Elementary	63	14.0
Extended	388	86.0
Total	451	100.0
Place of residence		
Village	5	1.1
County	105	23.3
City	56	12.4
Metropolis	286	63.2
Total	451	100.0
Parental attitude		
Inconsistent	35	7.8
Democratic	121	26.8
Protector	252	55.9
Authoritarian	43	9.5
Total	451	100.0

loneliness decreased. When the study of innovation education was examined, it was found that participants who did not receive education showed more resistance to change. This result shows that training on innovativeness makes participants more open to change. When the impact of the locality on the innovative behavior was examined, it was observed that people living in villages showed less innovative behavior and felt more alone. It was found that individuals with elementary families exhibited more innovative behavior. Remarkably, individuals with large families felt more physically lonely. Individuals who experienced democratic parenting received higher scores

Table 6: Comparison of the participants' descriptive statistics with the loneliness measure point average ($n=451$)

Parameters	Physical loneliness		Emotional loneliness		Loneliness scale total	
	Mean	SD	Mean	SD	Mean	SD
Gender						
Male	17.44	5.80	14.48	4.67	34.02	9.46
Female	18.43	7.19	14.51	4.99	35.12	11.20
<i>t</i>	-1.571		-0.054		-1.103	
<i>P</i>	0.117		0.958		0.271	
Age years						
18	19.24	7.52	15.29	5.06	36.78	11.74
19	17.19	5.87	14.26	4.62	33.61	9.47
20	18.13	7.20	14.08	4.32	34.21	9.60
21	17.11	0.60	13.82	4.72	32.96	9.94
22	18.04	0.79	14.18	3.88	34.72	10.47
23	19.15	1.49	17.10	5.88	38.45	10.74
24	18.42	1.30	16.21	7.33	36.63	14.63
<i>F</i>	1.026		2.064		1.517	
<i>P</i>	0.408		0.056		0.171	
Department						
Nutrition and dietetics	18.46	6.65	14.49	4.89	34.78	10.53
Social service	18.14	6.66	14.25	4.69	33.82	10.59
Nursing	16.80	5.91	14.03	4.70	32.77	9.43
Health management	17.66	6.27	14.93	4.86	35.72	10.34
<i>F</i>	1.447		0.744		1.770	
<i>P</i>	0.229		0.526		0.152	
Educational status						
First	21.13	6.89	14.97	4.83	36.29	10.84
Second	16.62	5.73	14.22	4.87	33.10	9.49
Third	18.25	6.61	14.38	4.67	34.45	10.01
Fourth	17.96	6.65	14.34	4.87	34.41	11.08
<i>F</i>	3.952		0.650		2.411	
<i>P</i>	0.008		0.583		0.006	
Training on innovation						
Yes	15.78	4.65	13.56	4.24	30.96	7.94
No	18.23	6.65	14.65	4.89	35.10	10.50
<i>t</i>	-3.678		-1.899		-3.715	
<i>P</i>	<0.001		0.061		<0.001	
Place of residence						
Village	30.25	7.50	15.25	1.50	48.50	9.00
County	19.45	6.62	16.44	5.72	38.32	11.22
City	20.87	8.79	14.89	5.27	37.78	12.76
Metropolis	16.55	5.26	13.70	4.14	32.28	8.53
<i>F</i>	16.528		8.909		14.922	
<i>P</i>	<0.001		<0.001		<0.001	
Family type						
Elementary	24.51	5.81	24.43	4.81	34.07	9.75
Extended	27.14	9.26	27.87	4.81	37.14	12.74
<i>t</i>	-2.184		-0.665		-1.826	
<i>P</i>	0.032		0.507		0.028	
Parental attitude						
Inconsistent	16.88	5.94	13.68	4.89	32.28	9.91
Democratic	17.14	5.93	14.56	4.96	34.11	10.10
Protector	18.63	6.95	14.67	4.90	35.28	10.78
Authoritarian	16.40	4.58	14.02	3.74	32.97	7.24
<i>F</i>	2.168		0.502		1.223	
<i>P</i>	0.072		0.734		0.300	

SD: Standard deviation.

Table 7: Comparison of the participants' descriptive statistics with the individual innovation scale point average ($n=451$)

Parameters	Experience openness and opinion leadership		Resistance to change		Risk taking		Individual innovation scale total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender								
Male	47.49	8.56	10.09	2.25	10.24	2.54	71.90	10.86
Female	49.81	7.57	9.98	2.24	10.19	2.55	74.07	9.82
<i>t</i>		3.002		0.514		0.228		2.192
<i>P</i>		0.003		0.608		0.820		0.029
Age								
18 years	47.21	10.35	10.08	2.35	10.38	3.22	71.64	13.39
19 years	48.72	7.761	10.05	2.20	10.32	2.14	73.19	9.84
20 years	48.83	7.22	9.94	2.12	9.49	2.32	72.31	8.78
21 years	48.49	8.55	10.29	2.47	10.84	2.67	73.86	11.92
22 years	45.54	10.91	10.31	2.19	10.68	2.99	70.50	12.95
23 years	51.30	5.45	9.60	2.08	10.80	2.50	75.95	8.78
24 years	49.05	8.48	10.05	2.79	10.78	3.17	73.73	10.30
<i>F</i>		1.166		0.332		2.767		0.784
<i>P</i>		0.324		0.920		0.012		0.583
Department								
Nutrition and dietetics	47.67	8.65	10.06	2.33	10.16	2.59	72.00	11.17
Social service	47.58	8.91	10.32	2.31	10.33	2.48	72.19	10.62
Nursing	48.41	7.06	9.57	2.06	9.95	2.15	71.99	8.91
Health management	49.80	8.16	10.25	2.22	10.44	2.77	74.60	10.57
<i>F</i>		1.942		2.253		0.505		1.974
<i>P</i>		0.122		0.081		0.492		0.117
Educational status								
First	51.18	9.70	10.23	2.43	10.34	2.86	71.82	12.54
Second	49.41	7.17	10.09	2.11	10.27	2.27	73.84	9.047
Third	49.04	7.16	9.54	2.15	9.91	2.40	72.55	8.86
Fourth	48.07	8.71	10.37	2.23	10.32	2.78	72.83	11.45
<i>F</i>		2.030		2.269		0.611		0.955
<i>P</i>		0.019		0.080		0.608		0.414
Training on innovation								
Yes	48.51	9.63	9.04	2.03	10.21	2.44	71.83	10.86
No	48.50	7.96	10.21	2.23	10.22	2.56	73.02	10.40
<i>t</i>		0.006		-3.982		-0.041		-0.853
<i>P</i>		0.996		<0.001		0.967		0.394
Place of residence								
Village	51.50	3.00	7.00	2.00	6.00	0.00	67.75	0.50
County	48.61	8.69	10.25	2.37	10.32	2.69	73.22	11.64
City	48.80	4.81	10.28	2.34	9.71	2.49	72.53	6.79
Metropolis	48.36	8.63	9.95	2.15	10.34	2.46	72.82	10.70
<i>F</i>		0.236		3.161		4.786		4.170
<i>P</i>		0.871		<0.001		0.003		0.044
Family type								
Elementary	49.34	7.174	10.11	2.29	10.42	2.50	74.02	9.42
Extended	43.34	11.72	9.63	1.88	8.98	2.45	65.60	13.36
<i>t</i>		3.943		1.570		4.243		4.812
<i>P</i>		<0.001		0.117		<0.001		<0.001
Parental attitude								
Inconsistent	48.91	7.13	9.74	2.47	9.14	2.27	7.76	1.31
Democratic	51.40	7.33	10.57	1.94	10.48	2.60	9.05	0.82
Protector	47.00	8.55	9.73	2.28	10.21	2.52	10.90	0.68
Authoritarian	48.88	7.32	10.62	2.26	10.44	2.56	10.53	1.60
<i>F</i>		8.283		5.199		2.670		9.361
<i>P</i>		<0.001		0.002		0.047		<0.001

SD: Standard deviation.

Table 8: The average scores of individual innovation scale and loneliness scale of health science faculty students ($n=451$)

Scales	Mean	SD	Min	Max
Individual innovation scale				
Experience openness and opinion leadership	48.510	8.217	19.00	65.00
Resistance to change	10.046	2.246	4.00	15.00
Risk taking	10.223	2.547	3.00	15.00
Individual innovation scale total	72.849	10.468	41.00	96.00
Loneliness scale				
Physical loneliness	17.880	6.459	11.00	44.00
Emotional loneliness	14.498	4.814	8.00	30.00
Loneliness scale total	34.503	10.266	20.00	65.00

Max: Maximum; Min: Minimum; SD: Standard deviation.

Table 9: Regression analysis showing the effect of participants' sense of loneliness on individual innovation behaviors

Regression model	Independent variables	Dependent variable	Standard. β	Sig.	Adjusted R^2	t	F	Model Sig.
Model 1	Physical loneliness	Experiential openness and opinion leadership	-0.254	<0.001	0.053	-4.509	13.618	<0.001
	Emotional loneliness		0.491	0.623		0.491		
Model 2	Physical loneliness	Resistance to change	-0.032	0.586	-0.001	-0.545	0.782	0.458
	Emotional loneliness		-0.035	0.551		-0.597		
Model 3	Physical loneliness	Risk taking	-0.216	<0.001	0.053	-3.834	13.631	<0.001
	Emotional loneliness		-0.037	0.518		-0.548		
Model 4	Physical loneliness	Individual innovation behavior	-0.267	<0.001	0.067	-4.762	17.205	<0.001
	Emotional loneliness		-0.001	0.992		-0.010		
Model 5	Loneliness	Individual innovation behavior	-0.239	<0.001	0.055	-5.225	27.300	<0.001

Model Sig.: Significance level of the model; Sig.: Significance level.

for innovative behaviors, and no significant difference in terms of individual loneliness was found in this context [Table 7].

Table 8 shows the following results: the sub-dimension of the "experience openness and opinion leadership" mean (48.510 ± 8.217), the "resistance to change" sub-dimension mean (10.046 ± 2.246), the "risk taking" sub-dimension mean (10.223 ± 2.547), the "IIS total" mean (72.849 ± 10.468), the LS "physical loneliness" sub-dimension mean (17.880 ± 6.459), the "emotional loneliness" sub-dimension mean (14.498 ± 4.814), and the "LS total" (34.503 ± 10.266).

When the effects of physical and emotional loneliness variables on the influence of the experiential openness and opinion leadership variable are examined, it is observed that physical loneliness has a negative effect on experiential openness and opinion leadership ($\beta = -0.254$). Emotional loneliness was found to have no significant effect on experiential openness and opinion leadership. When the effects of physical and emotional loneliness variables on the change resistance variable were examined, it was determined that physical loneliness and emotional loneliness had no significant effect on resistance to change ($P > 0.05$). When the effects of physical and emotional loneliness variables on risk taking variables were examined, it was observed that physical loneliness has a negative effect on risk taking ($\beta = -0.216$). Emotional loneliness

was found to have no significant effect on risk taking. When the total effect of the variables of physical and emotional loneliness on individual innovative behavioral variance is examined, it is observed that physical loneliness has a negative effect on individual innovative behavior ($\beta = -0.267$). Emotional loneliness was found to have no significant effect on individual innovative behavior. Finally, total loneliness was found to have a negative relationship with total innovative behavior ($\beta = -0.239$). Thus, the H_1 hypothesis, which is the research hypothesis, has been accepted.

The findings have shown that the physical loneliness of individuals has a negative effect on their innovative behavior. In this context, it is expected that the socialization of employees within businesses will help individuals to exhibit more innovative behaviors. The increase of communication channels between individuals has an extremely critical presupposition for innovation.

Discussion

In a disruptive competitive environment, businesses' survival depends on their ability to develop beyond traditional competition methods. That is why businesses need to devote themselves to innovation and make innovation a policy of their organizations. In the past, the focus of businesses on innovation has been discussed in a very broad perspective. According to the report

"Innovation and Growth" published by the Organization for Economic Co-operation and Development (OECD) in 2007,^[49] innovation and the ability to successfully demonstrate innovation was predicted to be an important determinant of the global competitive power of markets and nations over the following decade. As the report foresaw, in the decade that passed since its publishing, significant developments have occurred in the focus of businesses and countries with respect to innovative politics. In this context, both scientists and different industries have defined many innovations. In these definitions, while focusing on products, processes, and strategies, the relationship between the individual and innovation as a psychologic entity has been ignored. However, health enterprises are systems of individuals and it is not yet possible for them to undertake innovation processes without the individual.

This research is based on the individual as an innovation unit while considering the health field as the sector of study. Therefore, loneliness, which is one of the most important problems of modern humans, and innovative behavior are taken together. Could loneliness be a major obstacle to innovative behavior that requires open communication with the outside world? Based on this question, the research hypothesis was developed. The researchers aimed to test the argument that loneliness should have a negative impact on innovative behavior. Data were collected from health faculty students using the IIF, IIS, and UCLA LS. After the validity and reliability of the scales were determined with the SEM, the dimensions of loneliness and individual innovation were revealed. The data were analyzed using the SPSS 25.0 statistical package program.

There are many factors that affect innovative behavior. However, when these factors are examined, human psychology is revealed as the basis of all. For example, Bawuro *et al*^[50] stated that workplace happiness, organizational climate, affective commitment, and transformational leadership effectively influence innovative behavior. Bednal *et al*^[51] reported the effect of transformational leadership on innovative behavior. Zhou and Velamuri^[52] conducted research on key factors affecting innovative behaviors. These factors are reward and share, cross-functional cooperation, company innovation strategies, transformational leadership styles, leadership support, training, relationships between leaders and employees, group composition, resources and time, and praise. These studies emphasized the importance of the leader in innovative behavior.

In this context, the research hypothesis was tested using a regression analysis of the main theme of the study, which was that the feeling of loneliness would have an adverse effect on innovative behavior. Here, the regression analysis revealed that the emotional longevity of an individual was not found to have a significant effect on innovative behaviors, whereas physical loneliness was found to have a negative and significant effect on innovative behaviors. The negative impact rate obtained was -0.267 . Thus, there is a very clear finding to understand, develop, and manage the underlying causes of individual innovative

behaviors. If healthcare organizations want to be competitive, they have to build innovative organizational structures. When establishing such structures, they should prevent individuals from experiencing physical loneliness. It is inevitable for health institutions to develop individuals into innovation politics, especially by saving them from the feeling of physical loneliness.

Singh and Sarkar^[53] found that self-determination in the relationship between psychologic empowerment and innovative behavior is the factor that effects innovative behavior. However, job involvement has no direct or indirect effect. Taghipour and Dezfali^[54] examined the relationship between organizational culture and innovative behavior. According to the authors, an open and free working environment, a harmonious organizational climate, and a warm sense of family have positive effects on innovative behavior. These findings support our research results. Ng and Lucianetti's^[55] social-cognitive theory argues that there are 2 important psychosocial factors that influence innovative behavior, namely, organizational trust and perceived respect. In an individual who feels psychologically safe, his or her anxiety over engaging in new initiatives decreases. The findings of our research are similar to this result. Physical loneliness reduces an individual's confidence in the environment and leads to anxiety in performing innovative behaviors.

The research has clearly shown that workplaces and organizational cultures should encourage significant cooperation from inter-individual competition. It is physical loneliness in particular, that is, the fact that there is no one around to contact the individual that is turning him or her into an operational machine. Therefore, when the individual becomes an employee of his/her student, he/she should exhibit their presence in the form of a continuous social touch.

It was found that women exhibited more innovative behavior than men. This is contra Cropley and Cropley^[56] who did not find a significant difference between gender and innovation capacity. Likewise, Leonga and Rasli^[57] did not find a significant difference between gender and innovative business behavior. Kabasheva *et al*^[58] found that women's perception of innovation is more appropriate than that of men. The present study also supports the results of this research.

However, there was no relationship between loneliness and the gender of the participants. This is in line with Shankar *et al*^[59] who found that social isolation is gender independent. Likewise, in Hawkley and Cacioppo's^[60] study, gender-independent results were obtained with respect to loneliness. The results of our study showed that loneliness was unrelated to gender for the individual.

Additionally, it was found that 23-year-old individuals showed a significant difference in the risk taking dimension compared to other age groups. According to the participant segments, this did not make a significant difference in terms of innovative behavior. When the relationship between educational attainment and innovative behavior was examined, it was seen that first-grade students had

more points in the experimental openness and opinion leadership sub-dimension than the other classes. It was observed that the behavior is molded as the education level increases. However, the education process should be designed in such a way that the individual is considered to be more free.

Another point of interest of our research is that inhabitants of villages exhibited fewer innovative behaviors and also felt more alone. Physical loneliness is a negative condition for an innovation ecosystem. Thus, more innovative behavior is expected from individuals living in metropolitan areas. Individuals living in democratic families are also more innovative, while individuals feel more alone. These results once again reveal the link between culture and innovative behavior.^[61]

This study has several limitations. First, it was only conducted with students from the faculty of health sciences. Second, participants live in Istanbul, which is Turkey's largest metropolitan city. It is a limitation that the research was conducted with university students living in a metropolis. Third, the sample size of 451 participants is another research limitation. Research with a bigger sample size may exhibit different relationships and effects.

In light of these limitations, further research can be conducted in different sectors and in different age groups. The development of tools and methods for implementation through empirical information gathered in the field will ensure that healthcare enterprises and nations are more competitive on the global stage. Simultaneously, qualified information accumulating in the academic field will lead to the development of new researchers. In this way, this research aims to provide a unique contribution to the relevant field.

Conflicts of interest

None.

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