Ontology Space International Journal
ISSN: 2345-6450
OISSN: 2423-7299
Autumn 2022, Vol. 11, Issue 4, No. 43, Pages: 47-57
Journal homepage: soij.qiau.ac.ir

Investigating the Role of Physical Learning Environments in The Formation of Personal Behaviors Toward a High-Quality Learning Process

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Received: 28 August 2022 - Accepted: 30 January 2023
Doi: 10.22094/SOIJ.2023.1966482.1513

Abstract

This study evaluates specific elements and models used in physical learning environments and their effects on student behaviors. Specifically, the study evaluated behavioral and environmental factors and their impact on educational qualities. These behaviors include: motivation, peer interaction, team working, critical thinking, and creativity. The study further evaluated the association between two groups of behavioral and environmental factors with two closed-ended questionnaires with a sample size of n=384. The questionnaires' reliability was calculated with Cronbach's alpha. The results from the confirmatory factor analysis (CFA) and Structure Equation Modeling (SEM) revealed that the questionnaires had excellent measurement properties. The collected data was analyzed using a descriptive and inferential statistics technique. The research hypotheses were tested using the SEM technique. In consequence, learning quality within SEM modules was shown to be dependent on external triggers. Conclusions for adequate educational settings to develop educational environments are discussed. The flexibility of design studios' furniture arrangement and also use of architectural elements in design studios ranked the highest as the impressive environmental features in the study. At least 3.5 meters ceiling height for design studio ranked the lowest in the study. The richness of the findings shows that this was a relevant and efficient data collection strategy for the purpose of this study.

Keywords: Physical learning environment; Personal behavior; Education; Learning process; Structural Equation Modeling

1. Introduction

Learning environment points out to both place and space like classrooms and libraries. And indeed, much of the recent century learning occurs in physical places like these. Learning environments are the structures, implements, and communities that inspire students and teachers to procure the knowledge and skills the recent century requires. Scientific study shows how physical learning environment such as Classrooms, yards, civic, recreational, and food-related spaces affects student achievement (Fraser, 2015; Dilbil and Basaran, 2017; Han et al., 2019; Tapia-Fonllem et al., 2020). Positive investigation of the environment terminates in a higher place identity. It points out that the designer can strengthen the relationship between a person and the environment by detecting and enhancing the effective environmental factors (Karimifard and Tabatabaei Malazi, 2017). The significance of developing the abilities of students to consume the wealth of information in today's world is undeniable. It is expected that students can identify the values underlying divergent views on personal and social issues, and apply essential thinking skills, creativity and different perspectives in selections and judgments on issues and quandaries at both personal and social levels. Therefore, an adequate learning environment is considered a stable combination of activity and environment, and, the coordination of environment and behavior is the consistent relationship between these two. The learning environment also can be named as a distinctive feature of students' experience in school (Kulakow & Raufelder, 2020).

The appropriate learning process can be identified by a series of behaviors in students. Alijani and Karimiazeri (2021) concluded that the physical learning environment can modify education quality and lead to students' optimized behaviors. They collected the ideal behaviors of students as the result of studying in a high-quality learning environment. Now, this paper investigates how environmental factors affect some behaviors such as creativity (Baghaei Daemei and Safari, 2018; Richardson and Mishra, 2018), motivation (Dunn and Kennedy, 2019; Raufelder and Kulakow, 2021), peer interaction (Brouwer et al., 2019), team working (Oyelere et al., 2021) and critical thinking (Cheng et al., 2017).

The main hypothesis of the research is that there are significant relationships between behavioral and environmental factors and a model can be conducted to show them. The research's sub-hypotheses, environmental factors, can affect the targeted behaviors of the study. In order to achieve high-quality educational environments, this study tries to clarify the effects of

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Environmental changes on each of the targeted behaviors through Structural Equation Modeling (SEM) models. The SEM technique is used to show the relationships.
The research highlighted several characteristics of the environment and conditions that are most effective in promoting creativity, motivation, peer interaction, team working, and critical thinking. Physical learning environments can provide opportunities for different types of students (Burnard and Grainger, 2006) and to offer opportunities to employ a learner's own learning strategies (Thuneberg and Salmi, 2018).

2. Research Background

In recent years, the ability of educational facilities to create a conductive learning environment has been considered as a growing concern. Learning follows the procedure by which scientists discover cognizance by accumulating experimental evidence, by building upon critical analyses, by probing for independent attestation, and by integrating outcomes from observations or experiences (Keselman, 2003; Kuhn, 2005; Burnard, 2015). Research on physical, social, and academic circumstances of the educational environment has got important as a result of the theoretical relevance of behavior and environment, the new understanding about the significance of social interactions in the learning environment, and questions about the targets of modern educational world (Aldridge and McChesney, 2018; Lundberg and Abdelzadeh, 2019). Undoubtedly, a deliberate learning environment can play an important role in the recent century learning process (Szpytma et al., 2019).

3. Theoretical Framework

Behavior is the activity of an organism interacting with its environment (Doron and Parot, 1999). The term refers to all activities in general or to a given activity. It also refers to the adaptive responses assembly that a body equipped with the nervous system performs as a response to the stimuli of environment which are also objectively observable (Neveanu, 1978). Environment is also where the human life exists, happenings occur, and thoughts are made (Kheyrossadat, 2020).
Fig.1. Research objectives Creativity is one of the enchanting aspects of the human mind that can modify old ideas to new innovations (Heap, 1989). Creativity enables the learner to outreach inconsequent thinking to achieve new heights of productivity and consent (Baghaei Daemei et al., 2017). Creativity can be enhanced through environmental process (Kalantari et al., 2020)
According to Eccles and Wigfeld, (2020), motivation is determined by two keywords : self-efficacy (i.e., success expectation) and innate value. Innate value is associates with the expected pleasure of participating in activities, while self-efficacy demonstrates expectations of success or learners' beliefs in their own capability to fulfill upcoming works.
There are four kinds of interactions. The learner-tutor interaction, the learner-learner interaction, the learner-content interaction and the learner-interface interaction. Learner-learner interaction or Peer interaction refers to the interaction between peers or affiliates. The peer assists as a source of knowledge, stimulation, guidance and evaluation. This kind of interaction exists to various levels in all educational environments, formally or informally. (Mattheos, 2004). Many researchers consider peer interaction as one of the most efficient learning resources (Wagner, 2010).
Team working can help team members to reach the team's goals, which provides the chance to take full advantage of individuals' association to the team's achievement (Oyelere et al., 2021). Critical thinking is a kind of deliberate thinking through which the thinker routinely imposes criteria and mental standards on the thinking, taking responsibility the enhancement of thinking, enlightening the raising process of the thinking in accordance with the standards, evaluating the efficacy of the thinking according to the goal, the criteria, and the standards.

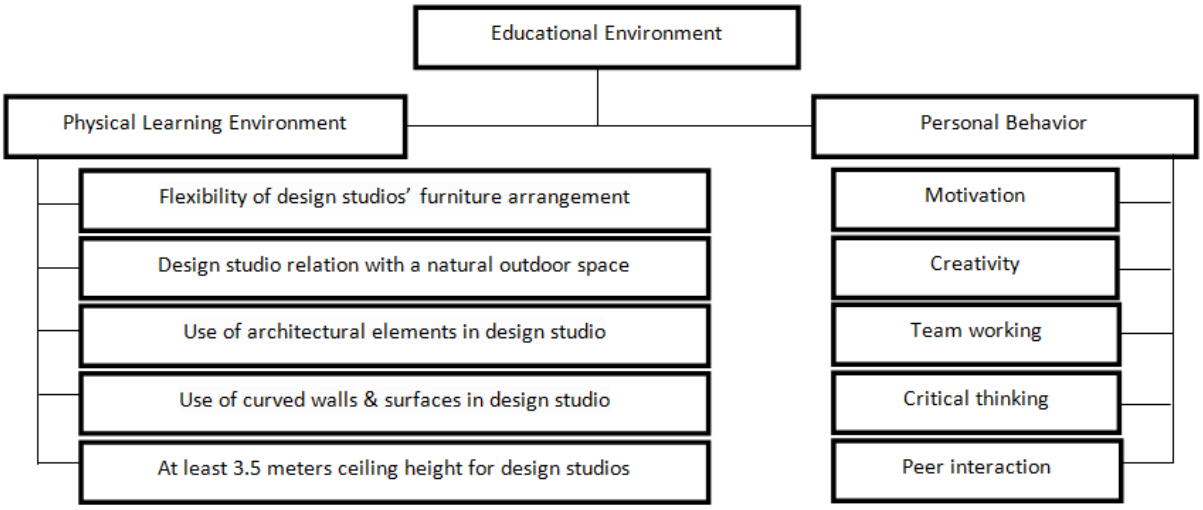

Fig. 1. Depicts the research objectives.

As it is Shown in Figure1, educational environment is examined in two dimensions: Physical learning environment and personal behavior. Each of these dimensions is investigated through five chosen factors. The effects of these factors on each other is studied further in this research.

4. Research Methodology

Survey-based research gathers participants' responds with a questionnaire to analyze the characteristics of a specified group. This method can be quantitative, using numerical values; qualitative, with open-ended questions; or an integration of both (Ponto, 2015).

In the first phase, the theoretical framework, including a set of environmental and human factors in fostering a high-quality education were extracted. Then, semi-structured interviews are conducted with five psychological experts (educational sphere) and architects. Based on the literature review and semi-structured interviews in accordance to the Delphi method, five behavioral priorities are chosen. Effective changes in learning environments are also examined and five priorities are selected as the most influential environmental factors. Figure 1 depicts the research objectives.

In the next phase, two questionnaires are designated to ask about research variables. One is to ask about targeted behavioral factors with 22 questions including 2 descriptive questions about participants' age and level of education, and 20 questions about 5 targeted behavioral factors. The other questionnaire is about environmental factors with 20 questions. The questionnaires consist of four questions for each factor.

Example of behavioral variables questions:

To what extent does motivation affect students learning ability?

To what extent does motivation modify unfavorable traits?

To what extent is motivation necessary in educational environments?

To what extent does motivation enhance students' interpersonal skills?

-Example of environmental variables questions:

To what extent is it necessary to use curved walls & surfaces in design studio?

To what extent does the use of curved walls & surfaces enhance environmental order?

To what extent are you agree with use of curved walls & surfaces in design studio?

To what extent does the use of curved walls & surfaces make the learning environment more pleasant?

The same type of questions are used for other variables. Questionnaires are used to collect data. The development of the research questionnaires is achieved following a rigorous process conducted over two years that included (1) document analysis, (2) in-depth interviews, (3) onsite visits, and (4) expert review. The questionnaires' validity and reliability are checked and proved successful:α = 0.78 and α= 0.95.

Four different questions are assigned for each of the variables in the questionnaires, and the Likert scale is used for answers to discover the percentage of participants' agreement with each question. Participants are asked to answer both questionnaires.

Participants are students of the University of Guilan, which is one of the largest universities located in Guilan, Iran (N=384). 46.35% of participants (n=178) are 18-22 years old, 20.83% of them (n=80) are 22 to 26 years, 16.40% of them (n=63) are 26 to 30, 8.86% of them (n=34) were 30 to 34, and the rest 7.56% are 34 years old or more. Participants were bachelor, master, and doctoral students. The majority (57.58%) are Bachelor students (n=221), 34.37% are Master students and about 8.05% are Doctoral students (n=31). The study followed the empirical permission requirements and ethical principles.

The following statistical analysis methods are applied:

4.1

The most important central indexes and dispersion indexes are calculated. Among the central indicators, the mean and for dispersion indices, the standard deviations of variables have been used.

4.2

Various methods are used to test the normality of the data, including the distribution form or the calculation of the inclination and skewness of the research variables. Kolmogorov-Smirnov and Shapiro-Wilk techniques are also used to determine the normal data distribution at a significant level of 0.05. The distribution of variables is considered as normal if the inclination and data slope are between 2and-2 (habibpour and safari, 2012; George and Mallery, 2010).

4.3

The relationship between latent factors (Behavior and Environment) and observable variables (questionnaires' variables) are shown by factor loading. The factor loading is considered to be between zero and one. The relationship is considered weak if the factor loading is less than 0.3. If the factor loading is between 0.3 and 0.6, it is good and is more than 0.6 is highly acceptable. The T-test is also used to examine the significance of the relationship between the variables. Since significance is checked at the error level of 0.05, if the observed factor loading is calculated with a T-value is less than 1.96, it is not significant (Klein, 2010: 55).

4.4

Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) are used as statistical techniques to diminish the observed variables into a smaller group of latent variables by examining the covariation among the observed variables (Schreiber et al., 2006). Latent variables cannot be observed directly, like tendencies, beliefs, or success. In many studies, researchers are more interested in such variables. Authors usually use latent variables to illustrate unobserved

variables in researches. In this study, it is tried to gain information about latent factors (behavior and environment) through observable variables (10 variables of questionnaires). Confirmatory factor analysis is one of the most important tools that allows the researcher to check the correctness of observable variables structures. In other words, this technique tests the hypothesis if there is a relationship between observable and latent variables (Kalantari, 2012). Structural equation modeling (SEM) has become a leading tool for investigating relationships among latent variables (Deng et al., 2018; Hooman, 2008).

Many fit indices are used in the SEM method, among which the Chi-square (χ 2) statistic is used as it is the most common one (Lehman et al., 2013), other frequently used fit indices are often considered in SEM are RMSEA, convenient fit <.08, good fit <.05 (Byrne, 2010), and indices of NFI, GFI, NNFI, IFI, and AGFI were used.

4.5

The correlation coefficient is also used to assess the relationship strength of two variables. The correlation coefficient is meaningful in the interval between +1 and −1. Values between 0 and 0.3 show a weak positive relationship. Values between 0.3 and 0.7 show a reasonable positive relationship, while values between 0.7 and 1.0 show a powerful positive relationship (Ratner, 2009).

5. Results and Findings

Cronbach's alpha is used to determine questionaries' reliability .The alpha values for the all the variables (ranging from .55 to .98) indicated a satisfactory level of internal consistency for statistical consideration (Kalantari, 2012). The questionnaires variables (10 items), behavioral questionnaire's Cronbach's scored α=.78, environmental questionnaire, α=.95; the reliability of the behavioral variables were just sufficient reliable, with following Cronbach's α: Motivation, α=.66; Team working, α=.74; Creativity, α=.62; Critical thinking, α=.59;Peer interaction, α=.55.

Cronbach's α of environmental variables were also as follow:

- At least 3.5 meters ceiling height for design studios, α=.61
- Design studio relation with a natural outdoor space, α=.77
- Use of curved walls and surfaces in design studio , α=.74
- Use of architectural elements in design studio, α=.89
- Flexibility of design studios' furniture arrangement, α=.98

To test the research hypothesis, confirmatory factor analyses were further conducted. The standard factor loading for verifying the power of the relationship between each factor (latent variable) and its observable variables (questionnaire items) was obtained greater than 0.3 in all cases. Therefore, the questionnaires' factor structure is valid.

The principal component analysis on the variables resulted to two components. The first component was labelled Behavior and it consisted of five variables (component loadings: .412–.655). The first component (Behavior) consisted of: 1) Motivation (.592), 2) Creativity (.56), 3) Critical thinking (.412), 4) Team working (.655), and 5) Peer interaction (.502). The second component (environment) consisted of: 1) At least 3.5 meters ceiling height for design studios (.692), 2) Design studio relation with a natural outdoor space (.585), 3) Use of curved walls and surfaces in design studio (.685), 4) Use of architectural elements in design studio (.81), and 5) Flexibility of design studios' furniture arrangement (.952). The factor scores of these components were used in the further analyses in table1 and table2. The cultivars of th following tables are calculated using SPSS software and Includes descriptive statistics for all the variables used in the research.

Table1
Descriptive Statistics of the Research Variables

Variables	Mean	Std. deviation	Variance	Skewness	Kurtosis
Behavior	3.33	.41	.269	.193	**.905**
Motivation	3.35	.72	.523	.258	**.137**
Creativity	3.31	.68	.466	-.018	**.261**
Critical thinking	3.19	.62	.354	.354	**.924**
Team working	3.54	.75	.557	.121	**.503**
Peer interaction	3.18	.64	.409	-.182	**.172**
Environment	3.25	.42	.178	.121	**.503**
At least 3.5 meters ceiling height for design studios	3.21	.61	.375	-.156	**1.083**
Design studio relation with a natural outdoor space	3.17	.66	.436	-.132	**1.015**
Use of curved walls and surfaces in design studio	3.21	.70	.487	-.302	**.908**
Use of architectural elements in design studio	3.42	.58	.334	.021	**-.257**
Flexibility of design studios' furniture arrangement	3.26	.71	.500	-.150	**.500**

Based on the results of Table 1, team working had the highest mean that showed the participants more tendencies to students' team working in educational environments. Also the mean of all variables were higher than 3 which indicate the utility of these variables in terms of respondents. Team working also had the highest standard deviation and variance.

Table 2.
Data Normal Distribution Test

Variables	K-S Value	Level of Significance	Status
At least 3.5 meters ceiling height for design studios	1.46	.319	Normal
Design studio relation with a natural outdoor space	1.43	.321	Normal
Use of curved walls and surfaces in design studio	1.130	.332	Normal
Use of architectural elements in design studio	1.199	.276	Normal
Flexibility of design studios' furniture arrangement	1.119	.366	Normal
Behavior	1.289	.121	Normal
Motivation	1.184	.283	Normal
Creativity	1.156	.296	Normal
Critical thinking	1.200	.274	Normal
Team working	1.148	.321	Normal
Peer interaction	1.102	.381	Normal
Environment		.062	Normal

According to Table 2, the Level of Significance given in all cases has a meaningful value greater than .05. Therefore, there is no reason to rule out the null hypothesis based on the normalization of the data. In other words, the distribution of research data is normal and parametric tests can be performed.

5.1 CFA of questionnaires

LISREL software was used in this study to run a confirmatory factor analysis (CFA) of the research hypothesis. The factor loading and T-Value statistics are shown in Table 3.

Table 3.
Factor Loading and T-Value of Questionnaires

Behavior	**Questions**	**Factor loading**	**T-Value**	**Environment**	**Questions**	**Factor loading**	**T-Value**
Motivation	Q4	0.49	9.11	At least 3.5 meters ceiling height for design studios	Q1	0.97	27.03
	Q7	0.75	13.36		Q11	0.68	4.53
	Q12	0.62	10.73		Q13	0.58	6.79
	Q19	0.51	8.19		Q18	0.54	11.44
Team working	Q3	0.79	14.30	Design studio relation with a natural outdoor space	Q2	0.65	15.75
	Q9	0.81	17.51		Q7	0.62	14.17
	Q11	0.55	12.04		Q9	0.58	14.30
	Q18	0.47	8.71		Q19	0.49	10.66
Peer interaction	Q10	0.37	6.56	Use of curved walls and surfaces in design studio	Q3	0.35	7.10
	Q14	0.56	12.46		Q8	0.98	27.59
	Q16	0.49	11.12		Q15	0.43	9.83
	Q21	0.59	10.28		Q20	0.98	7.18
Critical thinking	Q5	0.53	8.37	Use of architectural elements in design studio	Q4	0.33	7.66
	Q15	0.44	6.90		Q5	0.98	26.70
	Q17	0.31	4.42		Q10	0.97	26.16
	Q22	0.37	4.91		Q12	0.96	25.40
Creativity	Q6	0.63	12.57	Flexibility of design studios' furniture arrangement	Q6	0.96	26.77
	Q8	0.61	12.77		Q14	0.92	24.95
	Q13	0.61	11.55		Q16	0.98	27.64
	Q20	0.38	7.39		Q17	0.95	25.97

5.2 SEM path analysis

In this section, the research model is evaluated. The standard factor loading and t statistics are calculated for confirmatory factor analysis and modeling of structural equations. The IDs for the model variables are displayed In Table 4:

Table 4
ID of Model Variables

Variables	ID
At least 3.5 meters ceiling height for design studios	FZ
Design studio relation with a natural outdoor space	AM
Use of curved walls and surfaces in design studio	SA
Use of architectural elements in design studio	FF
Flexibility of design studios' furniture arrangement	GR
Behavior	RF
Motivation	EN
Creativity	KH
Critical thinking	SH
Team working	MS
Peer interaction	TA
Environment	MH

The structural equation model (SEM) has been used to measure the effects of behavioral and environmental variables on each other. The final model is presented in Figure 2.

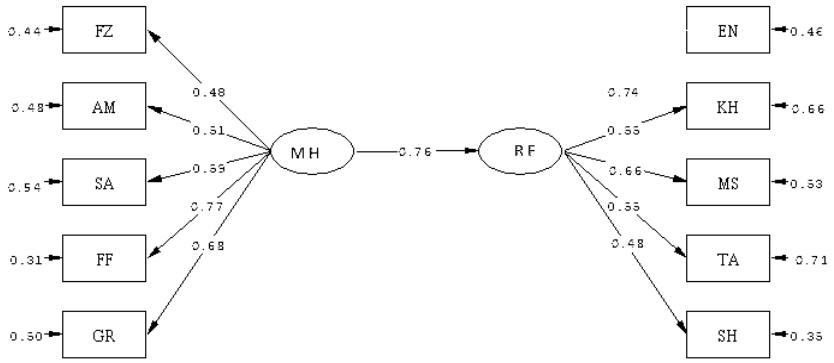

Fig. 2 The Final Path Model

Behavior is used as a covariate to control its effects on the measured variables of two questionnaires (Fig. 3). The final model containing only significant effects fitted the data well: χ^2=407.93, df=234, p=.000, NFI=.92, AGFI=.94, NNFI=.93, IFI=0.95, CFI=.96, RMSEA=.019 (Fig. 3).

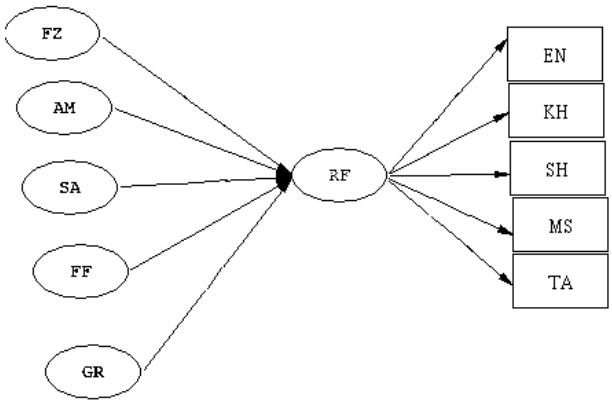

Fig. 3. Sub-Hypotheses Path Model

According to Figure 3, the effects of environmental factors on behavior (motivation, team working, creativity, critical thinking, and peer interaction) are the sub-hypotheses of the research.

5.3 Chi-Square the Goodness of Fit Test

$$\frac{\chi^2}{df} = \frac{407.93}{234} = 1.74$$

$$\frac{\chi^2}{df} = \frac{96.05}{45} = 2.13$$

Table 5 shows the model fit index of research main hypotheses and sub-hypotheses:

Table 5
Model fit index of Research Hypotheses

Index of goodness of fit	RMSEA*	GFI	AGFI	NFI	NNFI	IFI
Acceptable values	0.1>	0.9<	0.9<	0.9<	0.9<	0-1
Calculated values(Main Hypotheses)	0.019	0.96	0.94	0.92	0.93	0.95
Calculated values(Sub-Hypotheses)	0.045	0.96	0.94	0.92	0.93	0.95

* RMSEA: Root Mean Square Error of Approximation; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index; NFI: Normed Fit Index; NNFI: Non-Normed Fit Index; IFI: Incremental Fit Index.

The values of X2/ df are 1.74 and 2.13, which have good fit values of <3; It should be noted that all other fit indicators revealed that the data fitted the models properly. The Correlation coefficients of environmental and behavioral Variables are shown in table 6 and table 7:

Table 6.
Correlation coefficients of Variables (Environmental Variables)

Variables	User Involvement in Shaping Some Spaces	More Interior & Exterior Connections for Some Spaces	Curved & Combined Forms in The Volume of Buildings	Rich Details in The Environment, such as Cultural Elements	Private & public territories Separation
Behavior	.59	.63	.67	.72	.75
Environment	.48	.51	.59	.77	.68

Table 7.

Correlation coefficients of Variables (Behavioral Variables)

variables	Environment	Motivation	Creativity	Team working	Peer interaction	Critical thinking
Behavior	.76	.74	.55	.66	.55	.48

The analysis results are depicted in Fig. 1 and summarized in Table 6 and 7. They show that all hypotheses were supported.

6. Discussion

The present study explored the structure of learning environment for developing learning quality. It also examined the relationship between environment and the learning process and disposition. Three aspects of the research findings are discussed in the following sections:

6.1 The structure of physical learning environment for developing learning quality:

The environment can affect students' behavior through its components. Five features of a high-quality learning environment were examined in this study. Use of architectural elements in design studio has the greatest relationship with environment in comparison with other environmental variables of the study (Correlation coefficient: .77, T-Value: 5.37), while flexibility of design studios' furniture arrangement has the weakest relationship as a moderate relationship (Correlation coefficient: .48, T-Value: 16.86).

Flexibility of design studios' furniture arrangement, use of curved walls and surfaces in design studio, and design studio relation with a natural outdoor space have a stronger relationship with the environment in comparison with the weakest one with the correlation coefficients of .51, .59, and .68 respectively. These findings support the appropriateness of including them in the framework of a high-quality learning environment for a better learning process. When five dimensions of the environment were

added, the behavioral effects expanded from one dimension to five dimensions, thus providing a more complete framework for high-quality learning environment so as to assist the development of students' learning ability.

The structure of the learning environment has been examined in numerous studies. Choosing a deliberate structure like the Individualized Classroom Environment Questionnaire (ICEQ) is also popular among different ways of examining the learning environment (Fraser, 1990). Student's appreciations of learning environment effectiveness are another example of it (Del Puerto, 2011). In research done by Kenneth Tanner in 2014, some features of a high-Quality learning environment (Promenade, Pathways, and Circulation Patterns) were examined through a questionnaire to discover students' tendencies about them. In another research, several elementary schools of Rasht, Iran have been chosen as case studies to evaluate the impact of learning environment on students learning abilities. Flexibility of environment, outdoor space, and adequate light quality were considered as affective variables (Foroud et al., 2021).

The present study, through confirmatory factor analyses and structural equation modeling, examined five features of a learning environment as priorities of experts' interviews. The statistical tests confirmed that the model had good fit indices, showing that the physical learning environment can have a significant influence on users through different dimensions. Indeed, it is rather challenging to compare the findings produced by different research methods as considerable differences exist in the specific dimensions concentrating on enhancing specific behaviors. It is meaningful to investigate if the suggested structure revealed in the current study can be affirmed or further revised in future research.

6.2 The status of the behaviors through a high-quality learning environment:

Behavior management is an important factor in learning environment (Turano et al., 2005). A high quality learning process can be identified by students' behaviors. This study investigated five features as the result of a successful learning process. As indicated in Table 1, the average scores of student team working (M=3.54) was slightly higher than those of other dimensions, while the average scores of peer interaction (M=3.18) was the lowest one. The average scores of student motivation, creativity, and critical thinking were 3.35, 3.31, and 3.19 respectively. These statistics present team working as the most desired feature in physical learning environment. Since the differences among the mean score of each dimension were not so great, this section discusses the five dimensions of behavior.

Student's motivation can be highly affected by improved behavior through a successful learning process as it had the highest correlation coefficient among behavioral factors (Correlation coefficient: .74, T-Value: 5.63). Team working, creativity and peer interaction, and critical thinking were ranked next by correlation confidence of .66, .55, and .48 respectively.

While satisfaction and motivation ranked the highest in the studies of Hill and Epps (2010) and Kausar et al. (2017), accountability was chosen as the most effective behavior in the study of Turano (2005) as he emphasized that learning environment allows students to perform to their highest potential. Interactions are also considered as a significant factor of students in some researches that can play an important role in programs, selections and solutions (Schaps et al., 1997: 16). Peer interaction is also considered as a significant factor in some researches that can play an important role in programs, selections and solutions and also improving students' learning abilities (Shakeri et al., 2021). This difference may be attributed to some factors such as samples age, situations and priorities.

6.3 The relationship between the physical learning environment and learning quality:

Students' success can be highly influenced by the role of physical learning environment. The environment can help foster real learning. Two factors that can majorly affect the student's learning are Behavior and classroom management (Marzano and Marzano, 2003).

The present study included multiple perspectives of physical learning environment to improve learning quality by modifying or enhancing some behaviors. As indicated in figure 1, environment and behavior are highly correlated (Correlation coefficient: .76, T-Value: 8.74).

On the other hand, environmental variables of the study have good relationships with behavior separately. , Flexibility of design studios' furniture arrangement (Correlation coefficient: .75, T-Value: 8.77) and architectural elements in design studio (Correlation coefficient: .72, T-Value: 8.70) have strong relationship with behavior. Other three factors also have Convincing relationship with behavior by correlation coefficients of .67, .63, and .59. So changes in physical learning environment can have various impacts on behavior. It can leads to changes in behavioral features.

In different researches, various dimensions of physical learning environment were examined. The research of Azemati et al. (2016) examined creativity as the most significant behavior that should be enhanced in learning environments. They concluded that flexible forms and furniture, more interior and exterior connection, and also colors and lights play important roles to improve this ability in educational environments. In the research done by Mattheos (2004) Safety, private and public territories were stressed by most authors as important factors for increasing motivation. While school's sustainability, respectful atmosphere, and places to share ideas were useful environmental factors to enhance creativity in Kuo et al. research (2017).

5. Conclusion

The research highlighted several characteristics of the environment and conditions that are most effective in

promoting creativity, motivation, peer interaction, team working, and critical thinking. Physical learning environment as a key part of society to influence students behavior, should meet their needs (Vaziri and Rahbarimanesh, 2022) and provide opportunities for different types of students (Burnard and Grainger, 2006) and to offer opportunities to employ a learner's own learning strategies (Thuneberg and Salmi, 2018).

As indicated in the SEM analysis of this study, in addition to the mediation effects of environment and behavior, direct effects of environmental factors on targeted behaviors were identified. Flexibility of design studios' furniture arrangement and architectural elements in design studio ranked the highest as the impressive environmental features in the study. On the contrary, At least 3.5 meters ceiling height for design studios ranked the lowest in the study. Since high quality learning has been explicitly highlighted as a goal and assessment component, more attention should be paid to checking if the learning environment promoted in the Guide is consistent with the environment for successful learning process as suggested in this study.

To conclude, the rigor of the questionnaire development and various statistical methods such as factor analysis, reliability tests, the structural equation model, and CFA ensured that the environment and behavior and their five subscales had good measurement properties, and it gave legitimacy and appropriateness to the models based on two latent factors. Even though the method of using two different questionnaires for two latent factors, has its limitations, it can still be regarded as a very useful tool for understanding the delivery of multi-dimensional education programs.

Each subscale has its own indicators, so if potential users want to examine the practice of a program, they can simply select the suitable subscale(s) for achieving their purposes. Educators can also consider using the indicators developed in this study as a reference, as these have the potential to complement their teaching and delivery of learning programs. Some specific issues, topics, and problems identified in this study can provide a platform for future researchers to have meaningful conversations and conduct further studies.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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