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The Impact of Educational Furniture of Schools on Learning and Academic Achievement of Students at Elementary Level

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ABSTRACT

Accessing the summits of science and culture and further luster of every country in the scientific fields is rooted in education and training of that country, and supplying appropriate and efficient educational spaces, coordinated with country's educational system are the most important necessities to achieve this important principle. Therefore, this research has been performed to investigate Impact of Educational Furniture of Schools on Learning and Academic Achievement of Students at Elementary Level of the city of Ahvaz, at the southwest of the Islamic Republic of Iran year 2015-2016. At a cross-sectional study (2015-2016), a total of 210 students were selected randomly as sample of study. Cluster sampling was done by appropriate allocation and questionnaires were randomly divided among students. Data collection tools included Hermance's achievement motivation questionnaire and researcher-constructed questionnaire (observation checklist to examine the physical parameters of educational furniture in educational institutions) and interviews with students. Data of study were analyzed using SPSS- 21 software. The results obtained from this study showed that appropriate educational furniture has positive impact on the ratio of learning and educational progress of students at elementary level ($P < 0.05$). Suggested that required efforts are done to design educational furniture such as table and bench for various grades of elementary level in every region according to the existing anthropometric dimensions database.

Key Words: Educational Furniture, Educational Institutions, Elementary School, Academic Achievement, Students.

INTRODUCTION

Accessing the summits of science and culture and further luster of every country in the scientific fields is rooted in education and training of that country, and supplying appropriate and efficient educational spaces, coordinated with country's educational system are the most important necessities to achieve this important principle [1, 2]. Children compose about 25 percent of the population of developing countries, that 99 percent of them are attending at schools [3]. The students spend relatively a lot of time in schools, and most of these times they are sitting on the benches [4]. They learn sitting habits during this period [5]. The ergonomic chair and appropriate situation of body location while performing activities has high importance for adults. However, less attention has been paid to this issue in the lesson classes in which most young people spend most of their time [6]. Sitting with wrong posture during a long time can be irritating [7]. In ergonomics, the anthropometric data (measurement of body dimensions) is used for designing work spaces, furniture, and clothes [8]. Regarding the difference of anthropometric dimensions of various nations and races, every community needs its specific anthropometric data [9]. For this reason, many studies have already been performed in Isfahan, Mazandaran, Qazvin, Kerman, Hamedan, Fars, Yazd and etc. [5-8]. Provinces of Iran. Also, many studies have been carried out outside of Iran in this regard [10-15]. The health and performance of students and teachers are influenced by the internal environment of school buildings such as lighting educational spaces, schools' open space, noise in educational institutions, educational spaces painted, indoor temperature, air quality and etc [16-19]. Learning composes the main and central part of every human's life; learning is also impacted

by surrounding environment, that such environments themselves will be composed of elements that have various features and qualities and become significant in relation to each other [20]. Thus, in order to achieve the desired goals in the educational spaces, it is required to consider more the ergonomics in designing schools, and to exploit environment psychology studies in designing them as well, so that the spaces can be designed that are related to the students' spirit that ultimately causes the flourishing of their talents [21]. Inappropriate use of educational furniture in the schools, and hence students sitting on inappropriate bench and inappropriate situation of body can result in abnormalities of the spinal cord, back pain, neck pain, fatigue, and discomfort, and finally disturbance in learning process and educational progress of students [5-15]. Therefore, this research has been performed to investigate The Impact of Educational Furniture of Schools on Learning and Academic Achievement of Students at Elementary Level of the city of Ahvaz, at the southwest of the Islamic Republic of Iran year 2015-2016.

MATERIALS AND METHODS

At a cross-sectional study in 2015 to 2016, the population of the study included all male elementary school students in Ahvaz, (South-west of Iran), of whom 210 students were selected randomly as the sample of the study. Questionnaires were randomly distributed among students. Also, in this research, the sample data were selected from the different educational areas including educational area no. 1: 50 students, No. 2: 41 students, No.3: 59 students and No. 4: 60 students. The ethical considerations necessary to satisfy the respondents were observed and they were ensured that their views will be kept confidential. Also, participation in the study was voluntary. Observation checklist to examine the physical parameters of educational furniture in educational institutions: due to there is no standard questionnaire related to subject of study, after interviews with a number of teachers and experts organization development, equipping and modernization of schools, environmental health and collect their views and taking into account the scientific principles, a questionnaire was developed. Then, by conducting pre-test (among 30 students), reliability and validity of questionnaire was calculated. Their validity was confirmed by content and construct validity was confirmed by a number of experts and their reliability was calculated and confirmed by Cronbach's alpha (87%).

Academic Achievement Motivation Questionnaire of Hermance (16-19)

▪ It is one of the most common paper and pencil questionnaire to assess the need for achievement. Hermance (1977) constructed this questionnaire based on experimental and theoretical knowledge about the need for achievement and studying the related literature related. The initial questionnaire included 29 questions developed based on ten characteristics that distinguish people who have high achievement motivation with those who have low achievement motivation. To prepare materials of questionnaires, Hermance considered ten characteristics of people as based in selecting questions:

- High level of desire;
- Strong motivation for upward mobility;
- Long resistance facing with assignments or moderate difficulty level;
- Willingness to reattempt in doing assignments;
- Dynamic perception of time, the feeling that things happen quickly;
- Foresight;
- Paying attention to merit criterion in selecting friends, colleagues and model;
- Recognition through good performance at work;
- Doing job well;
- Low risk behavior.

Hermance found these ten characteristics was acquired on the base of previous research and he selected them as guide for selecting the questions. After trial implementation and analyzing the questions and calculating the correlation of individual questions with total test, 29 questions were selected as final questionnaire of achievement motivation. It should be noted that after analyzing the questions, no significant question about the tenth characteristics was included in the final questionnaire. Therefore, the final questionnaire was constructed only on the basis of nine characteristics. The questions of questionnaire were stated as incomplete sentences and multiple options were given for each of the. To equalize the value of questions, four options were written for all 29 questions. The options were given score in terms of intensity of motivation of achievement from high to low or low to high. Scoring the questionnaire was conducted based on nine characteristics that questions were developed based on them. Some of the questions were written positively, while other groups of them were written negatively.

To each question of this questionnaire (observation checklist to examine the physical parameters of educational furniture in educational institutions), the minimum score (0) and maximum score (2) were assigned, in the other hand:

- (0): If the school has not met the standard principles at all in the studied component (non-standard);
(1): If the school has met the standard principles relatively in the studied component (semi-standard);
(2): If the school has met the standard principles fully in the studied component (standard).

Given the number of questions in observation checklist [5], the minimum score obtained by each school (completely non-standard), and the maximum obtained score by in terms of studied components, researcher marks each item in terms of meeting the standards according to three standard option of standard, semi-standard and non-standard. According to the observation checklist, standard schools were those schools which required the min score based on confirmation of modernization, development and equipping of schools organization. Data of study were analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) and inferential statistics (factor analysis, t-test, Kolmogorov - Smirnov test and one-way ANOVA analysis) at SPSS- 21 software. In this section, the descriptive statistics related to observation, a checklist to examine the impact of physical variables of educational furniture on learning and achievement questionnaire of students was provided. Then, statistical hypotheses were examined in the data analysis section. To examine the normal distribution of data, Kolmogorov-Smirnov test was used. Then, to examine the hypothesis of study, structural equation and Pearson correlation coefficient were used, while single-sample t-test, independent two-sample t-test and ANOVA were used to examine the sub-hypotheses of study.

RESULTS

For investigating students' amount of learning and academic achievement (including 29 questions of 4 options), the Hermans' standard questionnaire was used as a research tool and for studying physical variables of educational furniture in educational spaces (including 5-question of the standard, semi-standard and non-standard of 3- option) a researcher-made questionnaire; given the age of the respondents, the method of interview was used in completing questionnaires. By completing questionnaires and interview, some parents or teachers of students were also present. Based on (Table1) in which the demographic characteristics of the students have been specifically mentioned, from between 210 elementary students samples under study, 11 students were from elementary second grade, 38 students from third grade, 63 students from fifth grade and 73 students from sixth grade. Also in terms of age characteristics of the students under question, 15 students were 7-year old, 21 students 8-year old, 38 students 9-year old, 63 students 10-year old, and 73 students 11-year old. For investigating the normality of the distribution of data related to the noise of educational spaces, amount of learning and academic achievement, in (Table1) the Kolmogorov-Smirnov test (by accepting the null hypothesis at the error level of 5%) has been used. Results showed that the educational furniture in educational institutions was equal to 1.16 ± 0.135 , learning 0.34 ± 1.04 and academic achievement 0.42 ± 1.09 . In (Table.2), regarding 9 questions related to the check-list of variables of educational furniture in educational institutions with three options standard, medium and non-standard, the amount of point and score of students has been stated. The first question was about the school furniture is not broken or of sharp and dangerous edges. In this case, 32(13.5%) students have selected the standard option, 52(22.4%) students the medium option and 72 (30.4%) students non-standard option. The mean and standard deviation (SD) of this question have been 2.95 ± 1.20 . The second question asked was about the Classroom chairs are single; 19 (8.0%) individuals have selected the option standard, 55(23.2%) individuals the option medium and 93 (39.2%) individuals the option non-standard. The mean and standard deviation of this question have been also 2.97 ± 1.03 . The third question asked was about the Classroom desk height is 56 to 62 cm. (Measured by the researcher); 34(14.3%) individuals have selected the option standard, 64(27.0%) individuals the option medium and 94(39.7%) individuals the option non-standard. The mean and standard deviation of this question have been also 2.67 ± 1.03 . The fourth question asked was about the height of classroom chairs is 44 to 46 cm. (Measured by the researcher); 38(16.0%) individuals have selected the option standard, 51(21.5%) individuals the option medium and 98 (41.4%) individuals the option non-standard. The mean and standard deviation of this question have been also 2.71 ± 1.05 . The fifth question asked about the Educational furniture has a convenient location for the placement of a student's bag; 24 (10.1%) individuals have selected the option standard, 33(13.9%) individuals the option medium and 85 (35.9%) individuals the option non-standard. The mean and standard deviation of this question have been also 3.13 ± 1.08 . The sixth question asked about the upper and lower edge of the chair back-rest has been well deepened; 33(13.9%) individuals have selected the option standard, 48(20.3%) individuals the option medium and 88 (37.1%) individuals the option non-standard. The mean and standard deviation of this question have been also 2.48 ± 1.06 in (Table3).

Table (4) shown that, there was a significant relationship between the impact of educational furniture of schools, and educational achievement of elementary students ($P < 0.05$). Also in this research there was not observed any relationship between amount of learning and academic achievement and the demographic variables under investigation such as age, education level, education district of education place etc. ($P > 0.05$).

Table 1: Demographic information of students

| Variables | Number and percentage of Students |
|-------------------|-----------------------------------|
| Educational grade | |
| 2 | 11(5) |
| 3 | 25(12) |
| 4 | 38(18) |
| 5 | 63(30) |
| 6 | 73(35) |
| Total | 210(100) |
| Age | |
| 7 | 15(7) |
| 8 | 21(10) |
| 9 | 38(18) |
| 10 | 63(30) |
| 11 | 73(35) |
| Total | 210(100) |
| Educational area | |
| 1 | 50(24) |
| 2 | 41(20) |
| 3 | 59(27) |
| 4 | 60(29) |
| Total | 210(100) |

Table 2 Examination of normal distribution of data

| Factors | Number of questions | Eigen value | Percentage of variance | Cumulative variance percentage |
|-----------------------|---------------------|-------------|------------------------|--------------------------------|
| Educational furniture | 6 | 1.57 | 3.15 | 54.29 |

Table 3: Frequency and percentage of respondents regarding to the n educational furniture on learning and academic achievement

| Questions | Response | | | Mean± SD | P-value |
|---|----------------|----------------|--------------------|------------|---------|
| | Standard N (%) | Moderate N (%) | Non-standard N (%) | | |
| School furniture is not broken or of sharp and dangerous edges. | 32(13.5) | 53(22.4) | 72(30.4) | 2.95(1.20) | 0.597 |
| Classroom chairs are single. | 19(8.0) | 55(23.2) | 93(39.2) | 2.97(1.03) | 0.586 |
| Classroom desk height is 45 to 50 cm. (Measured by the researcher) | 34(14.3) | 64(27) | 94(39.7) | 2.67(1.03) | 0.564 |
| The height of classroom chairs is 32 to 37 cm. (Measured by the researcher) | 38(16.0) | 51(21.5) | 98(41.4) | 2.71(1.05) | 0.552 |
| Educational furniture has a convenient location for the placement of a student's bag. | 24(10.1) | 33(13.9) | 85(35.9) | 3.13(1.08) | 0.544 |
| The upper and lower edge of the chair back-rest has been well deepened. | 33(13.9) | 48(20.3) | 88(37.1) | 2.84(1.06) | 0.540 |

Table4: Chi-square goodness of fit test and observed and expected frequency

| Variables | Observed frequency | Expected frequency | Remaining | P-value |
|-----------------------|--------------------|--------------------|-----------|---------|
| Students' perspective | Standard | 83 | 79 | 3.0 |
| | Moderate | 83 | 79 | 31.0 |
| | Non-standard | 45 | 79 | 34.0 |
| | Total | 210 | | |

DISCUSSION

The results obtained from this study showed that appropriate educational furniture has positive impact on the ratio of learning and educational progress of students at elementary level. Therefore, we can say that the results of this study are in line with those of studies conducted by Dotterer et al [20], Da Silva et al [13], Lewinski [22] Douglas et al [23], Brunswik et al [24], Rosenfield et al [25] while it was not consistent with results of study conducted by Moeinpour et al. [21]. We argue that the seat arrangement is a potent means to efficiently manipulate the physical characteristics of the classroom to ensure high performance of both students and teachers. Douglas and Gifford's [23] research incorporated a lens model approach ("a probabilistic representation of the way perceivers use environmental cues to draw inferences about the environment," p. 296), which was originally developed by Brunswik [24]. Students and professors, who evaluate classroom physical characteristics, might not at first glance be related to issues of academic performance. However, Douglas and Gifford's [23], at the outset of their study modified a lens model to suit their needs. Students and professors in this study judged how friendly the classroom was and how much they preferred it. Douglas and Gifford [23] explain how friendliness and overall preference was described on the questionnaire. Friendliness was defined as "(...) how warm, comfortable, etc., the room makes you feel, in your own opinion." Overall preference was defined as "a global rating of all factors that you consider important to the classroom environment" (p. 298). Each participant was shown two photos of 35 various classrooms,

and she evaluated them on the scale just described. Surprisingly, only three characteristics of the classroom explained between 40 and 57% of the variance in the evaluation of friendliness and overall preference by both students and professors. In this study, both groups preferred sociopetal arrangements of seats. Sociopetal arrangement is defined as a placement of chairs and tables in a way that it allows for a greater social interaction amongst students and professors. Two other notable properties were a view of the outdoors and comfortable seats. Not surprisingly, quality of seating was more significant for students, as teachers tend to have comfortable seats owing to their higher status. Douglas and Gifford [23] pointed out that users of classrooms did not rate highly such classroom properties as brightness, room size and aesthetic complexity. Douglas and Gifford's [23] investigation offers no insights regarding how these various classroom properties are related, nor if they individually or together actually relate to the learning process. However, we argue that it is reasonable to assume that physical characteristics known to elicit positive feelings and make people comfortable in the learning environment must necessarily be correlated with stronger student performance. Being in an appealing classroom, therefore, is far preferable to being in a classroom without sociopetal seating arrangements, a view to the outdoors, and comfortable seats. This assertion remains to be tested, however. Rosenfield et al. [25] tested how desk and chair arrangement affected students' behavior. Elementary school children were measured according to their on-task behaviors, such as hand-raising, discussion comment, questioning/pupil request, listening, out-of-order comment, and speaking; and on their off-task behaviors, such as disruptive conduct, withdrawal, and aggression. The dependent variables mentioned above were clearly defined and measured by trained evaluators. The possible desk arrangements were clusters, rows, and circles. Results showed that students seated in circles showed the most on-task behaviors. The second-best arrangement of desks and chairs was a cluster arrangement, and the least effective was desks arranged in rows. As expected, such variables as sex, age, and attitude toward studying affected students' scoring, too.

CONCLUSION

Working or studying in a comfortable environment enhances not only well being, but also satisfaction and therefore productivity and learning. Educational ergonomics focuses on the interaction between educational performance and educational design. By improving the design or pointing out the possible problems, educational ergonomics can be utilized to have positive impacts on the student performance and thus on education process. In many schools, there is not proportion between students' anthropometric dimensions and the dimensions of existing tables and benches. In spite of the difference among body dimensions of the students of various elementary levels, there is not a specific order in using the table and bench with different dimensions, and it is sometimes observed that in one school the same size of table and bench is used for all levels. This causes, for instance, the seat height and table for lower grade students and the seat depth for higher grade students do not fit, that causes physical problems and hence disturbance in learning process and educational progress of students in long term, and makes the optimum and efficient education and training to face with problem. Thus, it is suggested that required efforts are done to design educational furniture such as table and bench for various grades of elementary level in every region according to the existing anthropometric dimensions database.

LIMITATIONS

1. Impossibility of generalizability of the research results to schools in other cities, due to students' anthropometric dimensions, geographical and climatic conditions of metropolis Ahvaz.
2. The dispersion of research population and non-equality of facilities in schools in metropolis Ahvaz.
3. The use restriction of questionnaire as the only means of data collection and the impossibility of doing quality works in this regard, including interview with managers, parents and experts in ergonomics
4. The absence of standards according to which the quality of available possibilities and resources can be evaluated.
5. Given the age of the students and the lack of understanding of some of the questions, which can be considered as one of the limitations of the present research, the teachers were asked to distribute the questionnaires and read the questions one by one in plain language to students so that they can have an understanding of appropriate response to the questions.

Conflict of interest

The authors declare no conflict of interest.

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