# The relationship between handedness and academic achievement in high school students of Sanandaj City, Iran

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## Abstract

**Short Communication**

**BACKGROUND:** Academic achievement is considered as one of the main results of the educational system and focusing on factors affecting it is of great importance. The present study was performed with the aim to determine the relationship between handedness and academic achievement in high school students in Sanandaj City, Iran, in 2016.
**METHODS:** This was a cross-sectional study the population of which included the high school students of Sanandaj and 2630 pupils were selected from among them. The study tool was the Annette's questionnaire. To measure the academic achievement, the average score of the first semester of the 2016-2017 school year of the students was used. The collected data were analyzed using the SPSS software and descriptive and statistical tests such as the Mann-Whitney and Kruskal-Wallis tests.
**RESULTS:** Among the samples, 7.7%, 87.4%, 4.9% were left handed, right handed, and of no handedness, respectively. The average score of handedness in the school children was 16.75 ± 11.99 out of 24. There was no relationship between academic achievement and handedness (P = 0.105).
**CONCLUSION:** The results suggested that other factors than handedness affect the success and academic achievement of the students.
**KEYWORDS:** Handedness, Students, Academic Achievement

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## Introduction

Handedness is defined as the dominant preference of one hand for performing functional assignments that can be accomplished with one hand.[1] About 90% of people are right handed.[2] Despite this fact, only in 70% of the left-handed individuals, the right hemisphere is dominant for language.[3]

Structural and functional cerebral hemispheres have differences, and each of them has been specially trained for certain cognitive functions.[4] Human beings and their natural abilities may be described as superior to the right or superior to the left.[5] There are three different, even contradictory approaches, most of them try to justify the relationship between superiority and mental abilities of the people.[6]

The rate of the right-handedness and left-handedness was 24.3% and 27.3%, respectively in the study by Noroozian et al.[7] The findings

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of the study by Solgi and Alipour indicated that the right-handed students had a higher level of self-awareness, alertness, and social skills compared to the left-handed ones.[4] In another study, the level of emotional reactivity and anxiety was higher respectively in the left-handedness and the right-handedness, and the difference was statistically significant, but there was no significant difference between the two groups in terms of stress and depression.[8] This study was carried out with the aim of determining the relationship between handedness and academic achievement in high school students of Sanandaj City, Iran, in 2016.

## Materials and Methods

This was a cross-sectional study and the population of which consisted of high school students in Sanandaj. Using the following sample size formula, based on previous studies[6] and with α = 0.05 and β = 0.2, the sample size was obtained as 2630.

$$n = \frac{(Z_{1-\frac{\alpha}{2}}+Z_{1-\beta})^2(S_1^2+S_2^2)^2}{(\bar{x}_1-\bar{x}_2)^2}$$

$$n = \frac{(1.96+0.86)^2(12.39+9.98)^2}{(15.87-16.11)^2} \approx 2630$$

The data collected using the Annette's handedness questionnaire. The questionnaire was developed by Annette in 1967 and its reliability was more than 0.80.[9] This questionnaire has been used in the studies by Bayrami et al.,[10] Taghizadeh et al.,[11] Azami et al.,[12] and Jahangiri and Rouhi[13] and its validity and reliability have been verified. The questionnaire included 12 items scored on a 5-point Likert scale. For each item, the subjects were asked about the preference in using the right or left hand and the scoring was based on the subject's response. The scores of +2, +1, and 0 indicated the options of the right hand

preference at all times, the right hand preference in most cases, and the lack of a preference for hand utilization, respectively. In addition, the scores -2 and -1 indicated the left hand preference in all cases and the left hand preference in most cases, respectively. The overall range of scores varied from -24 to +24 respectively for the left handedness and right handedness. Individuals who obtained a score of +9 or higher, -9 to +8, and -9 or lower in the test were regarded as the right-handed individuals, individuals without a preference, and the left-handed individuals, respectively.[9]

The data were analyzed using the SPSS software (version 20, IBM Corporation, Armonk, NY, USA). To describe the collected data, descriptive statistics including frequency and mean and standard deviation (SD) were used. The Kolmogorov Smirnov (K-S) test was used to examine the normal distribution of the data. Regarding the non-normal distribution of the data, the Mann-Whitney, Kruskal-Wallis, and Spearman correlation coefficient tests were utilized.

## Results

The rate of response to the questionnaire was 94.4% and the mean handedness score in the students was 16.75 ± 11.99. Moreover, the mean age of the subjects was 14.46 ± 1.42 years old, with the minimum and maximum age of 10 and 18 years old, respectively. Among the subjects, 190 (7.7%) and 2170 (87.4%) cases were respectively left-handed and right-handed and the others did not have a preference in using their hands.

The results of the study showed that there was a statistically significant difference between the educational grade and the academic achievement (P < 0.001). Other results and statistical analyses of this study are presented in tables 1 through 4.

**Table 1. Mean age, grade, and academic achievement in high school students in Sanandaj City, Iran, in 2016**

| Variables | Mean ± SD | 95% confidence interval |
|---|---|---|
| Age | 14.60 ± 1.42 | (14.55-14.66) |
| GPA | 17.00 ± 1.98 | (16.92-17.08) |
| Academic achievement | 16.49 ± 2.33 | (16.40-16.58) |

GPA: Grade point average

**Table 2. Relationship between handedness and academic achievement in high school students in Sanandaj City, Iran, in 2016**

| Handedness | Mean academic achievement | Mean grade of academic achievement | $X^2$ | df | P |
|---|---|---|---|---|---|
| Left-handed | 16.31 | 1220.16 | 4.503 | 2 | 0.105 |
| Right-handed | 16.48 | 1238.32 | | | |
| Non handedness | 16.90 | 1359.27 | | | |

Findings of table 2 showed that there was no significant statistical relationship between handedness and academic achievement in the studied students.

**Table 3. Relationship between academic achievement and gender in high school students in Sanandaj City, Iran, in 2016**

| Gender | Mean academic achievement | Mean grade of academic achievement | Z | P |
|---|---|---|---|---|
| Male | 16.61 | 1282.65 | -2.397 | 0.017 |
| Female | 16.41 | 1212.60 | | |

The results presented in table 3 revealed that there was a significant statistical relationship between gender and academic achievement in the students studied (z = -2.397, P = 0.017).

**Table 4. Relationship between age and academic grade with academic achievement in high school students in Sanandaj City, Iran, in 2016**

| Variables | Spearman correlation coefficient | P |
|---|---|---|
| Age | 0.029 | 0.149 |
| GPA | 0.90 | < 0.001 |

GPA: Grade point average

The results of table 4 showed that there was a significant relationship between GPA (grade point average) and academic achievement (r = 0.90, P < 0.001), but there was no significant relationship between the students' age and their academic achievement (P > 0.050).

## Discussion

This study, performed to examine the relationship between handedness and academic achievement among high school students in Sanandaj City in 2016, indicated that the amount of left-handedness among the studied students in this study was 7.7%. This rate has been reported to be between 6% and 20% in other studies.[14,15] The results of this study are consistent with the findings of the studies in Rajasthan[14] and Kenya.[15] The findings of this study indicated that academic achievement in the right-handed, left-handed, and double-handed students (without the preference of hand use) was not statistically significant. This finding is consistent with the findings of the study by Heydari et al.[2]

There are some points in examining the causes of differences, including the location of study, age of the subjects, and their educational levels. Other factors influencing the study results in most studies are cultural factors that can have a significant impact on the use of the tools. In some cultures, left-handed people are seen as people with disabilities, so they have to reluctantly use their right hand and be introduced as the individuals with right-handedness.

On the other hand, according to studies, the distribution and proportion of the left-handedness vary in different countries, regions, and times. This can be indicative of the impact of the mental development conditions, cultural factors, and changes in educational management.[2] The findings of this study showed that there was no significant difference between the scores of the male and female students and their handedness. This finding is consistent with the findings of the study by Alipour and Kalantarian.[6] The results of the study showed that there was a significant difference between the academic achievement and grade, the birth rate, the

parents' education level, the household economic status, and the presence of a person with genetic disorders in the family. These findings are as follows; the tenth grade had higher scores than the other grades, the students who were the first babies of the family also had higher academic achievement compared to others. This difference can be attributed to the fact that the first-born children have more opportunities and facilities, and most of them may be the only child of the family who are provided with more facilities and their parents spend more money on their success.

One of the most striking findings in this study was that the students living in a family with a member with a genetic disorder had a lower level of educational achievement compared to others. This finding, beside a genetic effect, could have other causes, including the negative impact of the people with disabilities in the family on other members, including students.

## Conclusion

The results of the study indicated that there was no significant statistical relationship between academic achievement and handedness. This valuable finding revealed that handedness do not play an important role in academic achievement of the students, however other factors contribute to the students' achievement as well.

## Conflict of Interests

Authors have no conflict of interests.

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