

Sense of Direction & Mental Rotation Among College Students

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ABSTRACT

Introduction: The Sense of direction is understood as “knowledge of the body’s facing direction relative to a stable spatial framework anchored to the environment” (Sholl et al., 2006). Mental rotation is understood as “a dynamic process which requires mentally rotating a stimulus in order to align it with another reference stimulus, judging whether both stimuli are the same” (Shepard and Metzler, 1971). The above variables seem to vary across gender. **Method:** Sense of direction has been measured using Santa Barbara Sense of Direction Scale (Hegarty et al., 2002) and mental rotation has been assessed using Mental Rotation Task (Collins & Kimura, 1997). The sample comprised of 143 (81 males and 62 females) subjects between age ranges of 18-22 years with mean age as 21.54 years. Analysis of variance was used for analysing the results. **Results:** Sense of direction and mental rotation seems to vary amongst college students as a result of gender. **Conclusion:** Males were found to have better sense of direction than females, no significant differences were found in the performance of males and females in mental rotation in our study.

Keywords: *Mental Rotation, The Sense of Direction, Spatial Skills*

Spatial skills are essential in an individual’s day to day activities and help with complex problem solving (Alvarez-Vargas et al., 2020).

One such skill is sense of direction which is defined as the capacity to find our way in an environmental space (Burte & Montello, 2017).

Sense of direction has also been understood as “knowledge of the body’s facing direction relative to a stable spatial framework anchored to the environment” (Sholl et al., 2006).

Pointing towards unseen locations, estimation of the distance (Kozłowski and Bryant, 1977), learning spatial layouts of the environment and constant updating of the space (Hegarty et al., 2002) are all related to the ability of sense of direction. This ability relies heavily on the integration of both visual and nonvisual cues (Cullen & Taube, 2017).

Males have been found to outperform females in navigation tasks and seem to have better sense of direction than their female counterparts (Boone, Gong, & Hegarty, 2018).

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Received: January 08, 2022; Revision Received: February 25, 2022; Accepted: March 14, 2022

Sense of Direction & Mental Rotation Among College Students

Another important skill individuals require for effective resolution of day to day problems is mental rotation.

Mental rotation is defined as “a dynamic process which requires mentally rotating a stimulus in order to align it with another reference stimulus, judging whether both stimuli are the same” (Shepard and Metzler, 1971).

Mental rotation is also understood as “to mentally rotate 2D and 3D shapes and objects” (Alvarez-Vargas et al., 2020).

Research has found that males perform better in mental rotation as compared to females (Debelak et al., 2014; Voyer & Jansen, 2016).

Voyer et al. (1995) indicates a positive relationship between effect size and age, indicating that mean differences between the sexes increases with age.

By adulthood, these sex differences in mental rotation gets established (Uttal et al., 2013) Sex differences in mental rotation gets stabilised after puberty (Voyer et al., 1995).

Objectives of the Study

- To observe the differences in sense of direction across gender.
- To observe the differences in mental rotation across gender.

Hypotheses

- It is expected that males will perform better on sense of direction in comparison to their female counterparts.
- It is expected that males will perform better on mental rotation in comparison to their female counterparts.

METHODOLOGY

Sample

A sample of 143 (81 males and 62 females) subjects in the age range of 18-22 years (Mean age of the sample -21.54 years) was taken.

Measures used

- **Personal Data Schedule:** Information of the sample such as age, gender, education, etc. was collected via this personal data schedule. Informed and free consent was obtained from the participants.
- **Santa Barbara Sense of Direction Scale (Hegarty et al., 2002):** It is a 15 item self-report scale measuring the sense of direction in an individual. Each item is rated on a 7-point Likert Scale ranging from “Strongly Agree” to “Strongly Disagree” according to how frequently or infrequently the statement applies to them. Higher scores indicate higher levels of sense of direction in any individual.
- **Mental Rotation Task (Collins & Kimura, 1997):** Eleven different 2-D objects (from Collins & Kimura, 1997) were used to create the experimental trials. The participant has to then choose from two object options, one of which was a rotated version of the object presented initially. The task difficulty increased with the objects being presented. Performance of the subject was judged terms of correct

Sense of Direction & Mental Rotation Among College Students

responses given by the subject by allocating one mark to the correct and zero mark to the incorrect response.

Statistical Technique

Significance of differences between the means of scores of variables across different levels was calculated through Student's t test.

Exclusion Criteria

- Psychopathological cases were excluded.
- Subjects with history of any major accident were excluded.

RESULTS AND DISCUSSIONS

The aim of the study was to observe the differences between sense of direction and mental rotation across gender. The subjects were administered with sense of direction scale along with mental rotation task. The interpretation was made using t-test. The results of the study are presented in the tables.

Table: 1 N, Mean, SD and t-value of sense of direction across gender.

Gender		N	Mean	Std. Deviation	t-value
Sense of direction	Male	81	72.41	12.66	2.39*
	Female	62	67.16	13.38	

*Significant at the 0.05 level

Figure No. 1:- Showing mean trends of sense of direction across gender.

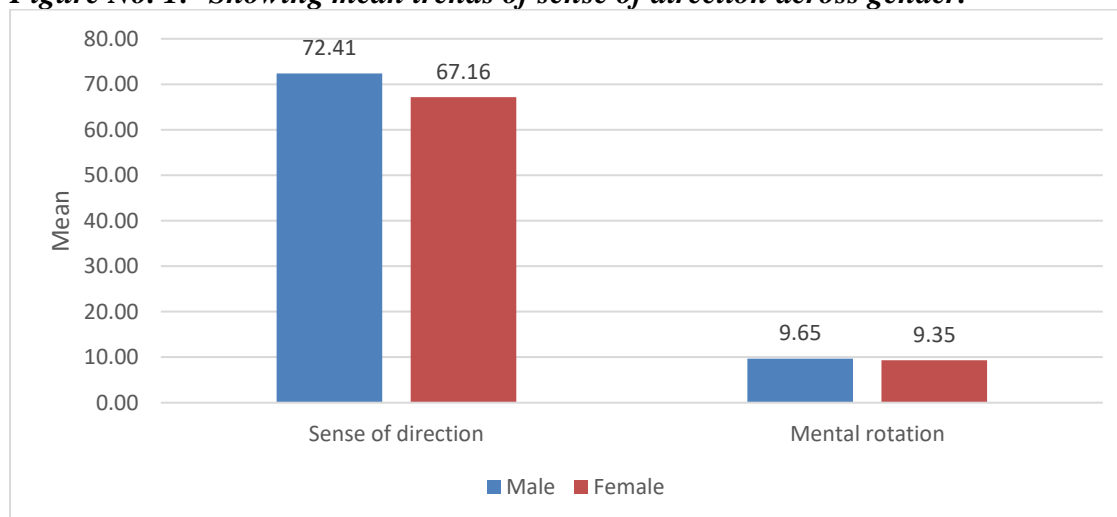


Table: 1 and Fig No. 1 gives means, SDs and t-value of sense of direction across gender. Males have higher mean score in sense of direction (72.41) than their female (67.16) counterparts. The t-value is 2.39 which is significant at 0.05 levels. This reveals that there exists a significant difference in sense of direction between the two groups of males and females. Therefore, males would perform better on tasks requiring sense of direction as compared to females.

This is also supported by various studies in the literature (Boone, Gong, & Hegarty, 2018) which have indicated that males outperform females in navigation tasks and seem to have better sense of direction than their female counterparts.

Sense of Direction & Mental Rotation Among College Students

Table: 2 N, Mean, SD and t-value of mental rotation task scores across gender.

Gender		N	Mean	Std. Deviation	t-value
Mental rotation	Male	81	9.65	1.63	1.002
	Female	62	9.35	1.94	

Figure No. 2: Showing mean trends of mental rotation task scores across gender.

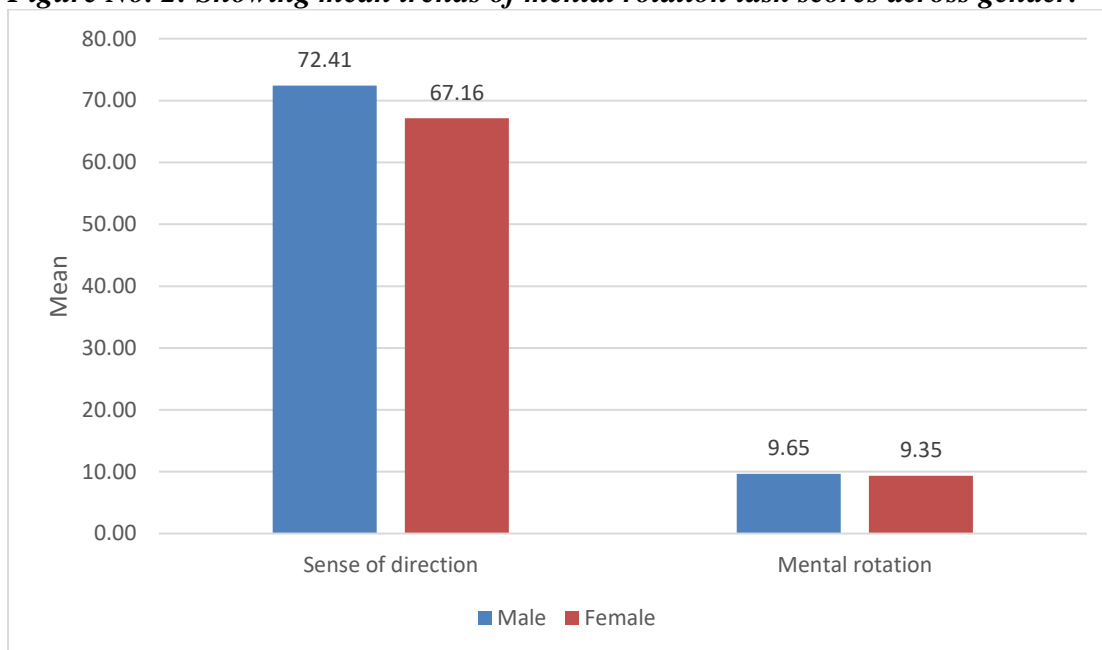


Table: 2 and Fig No. 2 gives means, SDs and t-value of mental rotation task scores across gender. Males have higher mean score on mental rotation task (9.65) than their female (9.35) counterparts), but the t-value of 1.002 has come out to be non-significant. This reveals that though there exists a difference in males and females in mental rotation but these differences are not significant in the study.

This could be explained by the findings that males have a greater advantage in comparison to females (Voyer et al., 1995). As our study utilised 2D figures, therefore the difference in performance across the gender has come out to be insignificant.

Limitations of the Study

- A laboratory study could shed better light on the data.
- The sample size of the study could have been larger.
- Utilising 3D figures in the mental rotation task could shed better light on the data.

CONCLUSION

Males were found to have better sense of direction than females, no significant difference were found in the performance of males and females in mental rotation in our study.

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Sense of Direction & Mental Rotation Among College Students

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Acknowledgement

The author(s) appreciates all those who participated in the study and helped to facilitate the research process.

Conflict of Interest

The author(s) declared no conflict of interest.

How to cite this article: Dalal N. & Singh I. (2022). Sense of Direction & Mental Rotation Among College Students. *International Journal of Indian Psychology*, 10(1), 757-761. DIP:18.01.078.20221001, DOI:10.25215/1001.078