METHODOLOGY
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3.1. EXPERIMENTAL DESIGN
The design constituted of two levels of spatial metacognition, two levels of interrupted multitasking and two levels of music. The design is 2x2x2 ANOVA with repeated measures on last two factors.

3.2 METHOD AND PROCEDURE OF PHASE I
The study was carried out in two phases. The phase wise description is as given below:-

3.2.1. Sample: An initial sample of four hundred girl subjects was randomly chosen, in the age range between 14 to 18 years, from various Government Model Schools of Chandigarh.
Spatial metacognition level was ascertained for each subject. Kindly, low and high spatial metacognition groups were arrived at, with the help of performance scores on spatial metacognition task, and analysed in terms of means, SDs etc. Means +/- ¼ SD was utilized for the above.

3.2.2. The spatial metacognition experiment:
3.2.3. Material –
1. A total of 225 pictures were used. Out of these, 222 unrelated photos of inanimate structures were used. These photographs consisted of 74 pictures each of such one dimensional, two dimensional and three dimensional structures. Three dummy pictures which did not belong to any of the above dimensions were also used. All the pictures were black and white and of the same size.
3.2.4. Description of Conditions of Presentation-
Fifteen trials were given to each subject. The pictures were presented under three conditions indicated below:

a. **Blocked condition**: Under blocked presentation, 5 three dimensional pictures were presented together. Likewise, 5 two dimensional pictures were presented together. Also, 5 single dimensional pictures presented together.

b. **Unblocked condition**: Herein, 15 pictures of all the dimensions (i.e. 5 of each dimension) were mixed and presented randomly.

c. **Control/Baseline condition**: This condition also comprised of 15 pictures but herein 4 three dimensional, 4 two dimensional, 4 single dimensional and 3 dummy (which did not represent to any specific dimension) pictures, were presented in random order.

**In all, fifteen such trials were given to each subject. i.e. 225 pictures were presented, as under:**

![Diagram showing the conditions of presentation](image)

**Figure No.3.1: Detailed description of the Conditions : Phase-I**
3.2.5. Description of one trial:

Each trial comprised of either control or blocked or unblocked conditions in a random order. There were presentations of 15 pictures as per detail of pictures given in the above flow chart, per trial. Hence each condition was presented five times each in a total of fifteen trials, to the subject. After each trial, the subjects were asked to orally or manually represent pictures. Paper and pencil was given to the subjects for the purpose.

Time given for the above was not limited but the subjects were asked to proceed at a normal pace without stopping.

After every session there was a rest pause of 2 minutes.

After each trial subjects were asked to represent pictures in any order by writing a descriptive line about the picture or by drawing a shape.

In keeping with the normal scoring procedure for metaprocesses, the scoring was based on strategy use, as subjects used strategy for reproduction of the pictures.

Specifically, for each chunking of same dimensional pictures done by the subject, ‘2’ marks were given for each picture chunked. There was no mark for no chunking.

For example- if three pictures of the same dimension were reproduced by the subject in a row, i.e. clustered the marks allocated were six (6).

The present spatial metacognition experiment is based on the strategy of clustering, in line with earlier studies of metacognition. The
level of clustering awareness is supposed to result in an equivalent performance level of spatial metacognition.

Here clustering means that at the time of reproduction, strategic learners cluster those pictures, which belong to the same dimension. (Clustering: clubbing of pictures on the basis of dimensionality at the time of reproduction)

It may be noted that, blocked condition of presentation of different dimensions of picture is an aid to reduce learners’ disorientation in spatial metacognition task. Such dimension-based clubbing of pictures can facilitate subject’s understanding of the task. Generally, a blocked condition of presentation helps subjects by providing a visual structure consisting of nodes and links that represent the learning components and the relationships among different dimensions of pictures.

The unblocked condition and control conditions are classified by the scope of the presentation content, i.e. pictures of different dimensions. Specifically, the unblocked condition is used to put more cognitive load on subjects as they have to outline the structure of the entire presentation content in order to identify and club the pictures of different dimensions later on, Thus unblocked condition requires that the subjects plan their activities more effectively. On the other hand, control condition is a baseline data yielding condition containing 3 dummy pictures as well.

3.3. METHOD AND PROCEDURE OF PHASE II
3.3.1. Sample:
The final total sample comprised of a total of 256 subjects i.e. 128 subjects in the, high spatial metacognition group and 128 subjects in the low spatial metacognition group, an equal number as shown in Figure No. 3.2.
Figure No. 3.2:- Sample on both phases.

Phase I

Total sample 360

Phase II

Low Spatial Metacognition group
128

High Spatial Metacognition group
128
3.3.2. Material used:
2. Interruption material (e.g., a skull, question mark and one additional mental rotation cube on the screen etc.)
3. Music used for both levels consisted of A.R. Rehman’s instrumental music piece titled ‘Himalaya’ and recorded natural music i.e. chirping of birds.

The high and low spatial metacognition groups classified in phase-I were asked to perform on the mental rotation task under the two conditions of interrupted multitasking and two levels of music.

3.3.3. Description of Spatial Cognition Task:
The mental rotation task

Shepard & Metzler (1971) was used for the purpose. The experiment was carried out individually.

Research participants had to make judgments about 3-D objects patterned after the ones first used by Shepard & Metzler. This involved paired presentation wherein the presented 3D objects would be either identical or mirror image reversals of each other. In each pair, the object on the left was to be presented in an upright position and the object on the right is rotated. The research participant's job was to determine as rapidly as possible whether the figures are the same (i.e., a copy that differs only in rotation angle) or different (i.e., mirror image objects). Responses were judged for correctness.
3.3.4. Administration of tool:

In the present study, 24 trials of the rotation task were given to each group.

The each trial consisted of 16 presentations wherein each presentation comprised of a pair of 3D objects. The pair was organised either as 1) identical object pair or as 2) mirror image pair. There were 16 possible object pairs and the presentation of each pair was done at random.

Specifically, on each trial, a different set of the 16 possible object pairs was presented in random order. Out of these, eight were identical object pairs and eight were mirror images pairs, given randomly. The individual pairs were functionally distinguished by their angular discrepancy, measured clockwise and going from 0° to 315° in 45° steps.

The research participant's job was to determine as rapidly as possible whether the figures are identical (i.e., a copy that differs only in rotation angle) or mirror images (i.e., different). Responses were given by the subjects by pressing one of the two keys designated as “Yes” or “No” on the key board. The responses were judged for accuracy of perception based on comparison of object pairs. One presentation was of 4 seconds. After each trial there was a rest pause of 4-5 minutes.

3.3.5. Scoring

Scores were given on the basis of ‘Yes’ (score of ‘one mark’) and ‘No’ (zero score). A score of ‘one mark’ was given to ‘Yes’ and ‘zero mark’ was given to a ‘No’.
3.3.6. Description of conditions:

A) Interrupted multitasking conditions
   a.1) Low interrupted multitasking condition- Interruption was created thrice, at regular intervals (e.g. a skull and question mark or cross mark etc. flitting across the screen) during each performance trial.
   a.2) High interrupted multitasking condition- Interruptions were created five times, at regular intervals as in (e.g. a skull, question mark, an additional cube in the task image etc.) during each performance trial.

B) Music conditions-
   b.1) Instrumental music condition- Herein, instrumental music was played for ten minutes prior to as well as during each performance trial.
   b.2) Natural music Condition- Natural music was played 10 minutes prior to as well as during each performance trial.

By way of design, six trials each were carried out under individual levels of all the conditions of both the variables (i.e. music and interruption linked multitasking). Resulting in a total of 24 trials as mentioned earlier.

3.4. STATISTICAL ANALYSIS
Keeping in view the objectives of the study a 2 x 2 x 2 repeated measures ANOVA with repeated measures on the last two factors as well as descriptive statistics and t-tests were also used.
Figure No. 3.3:- Detailed description of conditions in Phase II.