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# SPATIAL ABILITY AND CHILDHOOD TOYS: A PHENOMENOLOGICAL ENQUIRY FROM CHILDREN'S PERSPECTIVE

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**Abstract:**
The present phenomenological study explores how school students see their childhood toys as facilitator or inhibitor of spatial ability in learning science in the school. Specifically, the aim was to elicit, describe, and analyze the background, perspectives and experiences of the students that contributed in developing their spatial ability. For this purpose, twenty-four students of Grade X who have compulsory science were selected. Upon identifying two groups of high spatial performers and low spatial performers, qualitative techniques were used to gather data. The tools and techniques included personal in-depth interviews, focus group discussion, observations, and think aloud task performances. Data was analyzed through the data explicitation processes suggested by Giorgi, providing textural and structural descriptions from every participant. Quality of engagement with childhood toys emerged as a major themes that marked out the differences between both the groups. This may help stakeholders such as educators, teachers, parents, students, and curriculum developers in understanding the lasting role of childhood toys on development of spatial abilities which influence the learning of school science.

**Keywords:** spatial ability, lived experiences, childhood experiences, phenomenological enquiry, childhood toys

## 1. Introduction

This phenomenological study explores how school students see their childhood toys as facilitator or inhibitor of spatial ability in learning science in the school. To begin, the central question, around which the study revolved, to be addressed was: "How do students experience spatial ability phenomenon in learning science at school level?"

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Through exploring and grasping their experiences and perspectives, one would gain insight into the dynamics of their spatial ability.

Definitions of spatial ability continue to be unmet with consensus among the scholars and researchers, despite the research of the said field can be traced as far back as 1920s (Sorby, Leopold, & Gorska, 1999). Alternatively, spatial ability can be proposed as a collective of specific skills (Voyer, Voyer, & Bryden, 1995). Attempts have been made by theorists of numerous schools – art, engineering, education, math, and cognitive psychology etc. – to precisely define the concept in question. In order to do so, they have proposed combinations of the concepts 'spatial' and 'visual' with 'skill,' 'perception,' 'relations,' 'imagery,' 'cognition,' 'ability', 'reasoning,' 'orientation,' and 'rotations.' As a root of success, spatial ability is not only accredited in the field of sciences, but also in mathematics, technology, art, medical field, engineering, architecture, and design (Hegarty, M., 2007; Hegarty, Cohen, C., M., Keehner, M., Montello, D. R., & Lippa, Y, 2007). This emphasizes the critical necessity for interventions to enhance the students' spatial ability.

### 1.1 Research Questions

The present study sought to elicit, describe, and analyze the background, experiences, and perspective of students with diverse spectrum of spatial ability. In order to do so, the researcher addressed:

- What childhood experiences do students report as contributing in their ability or inability to succeed in spatial tasks in learning school science?

### 1.2 Significance of the Study

Due to the nature of the research questions, it best seemed to adopt a phenomenological approach in the present research study. By doing so, I would gain access to the minds and views of students possessing high and low spatial ability, i.e. analyzing their spatial ability in process when they are posed with spatial task and how the participants connect it with their childhood experiences.

## 2. Methodology

Two sections of Grade X were selected for the study as they had compulsory science. Data sources were selected through qualitative research techniques such as personal interviews, spatial tasks, observations, and focus group interviews.

Initially, twenty-four students were selected and categorized on their score of the Vandenberg Mental Rotation Test. The highest score scored was 11 out of the maximum 20, while the lowest score was 1. Among them, 12 students were chosen for in-depth personal interview. They were categorized in two groups on the basis of the scores obtained by the participants on the Vandenberg Mental Rotation Test. Participants who scored 5 or above were placed in the high spatial participants (HSP) group. Simultaneously, participants with scores 5 or below were placed in low spatial

participants (LSP) group. Similarly, the remaining 12 students were formed into two groups of six students, having either high spatial ability or low spatial ability, for focus group interviews.

The in-depth interviews were scheduled for three sitting with each lasting for 60 minutes. On the other hand, the focus group meetings lasted for one hour in addition to 30-minute question-and-answer session. The interviews were digitally recorded and transcribed further for analysis. In the first interview, person background, experiences, and life history were collected in the participant's own words. The second interview focused to identifying and understanding students' spatial problem-solving skill.

There were four applied problems from NCERT science book involving a degree of spatial ability. They were asked to visualize the problems and then transform the same onto the paper as a drawing. Follow-up was conducted through the third interview.

The purpose was to collect data on the reflections of the participants' experience while they were solving the spatial problem presented in the previous interviews. Following the interviews, focus group interviews were conducted the students were asked questions belonging to both the first and third in-depth interviews. The reason behind asking the same question in a group environment was to notice if the response of a student in group environment remained the same as the one given during the individual interview.

**2.1 Data explicitation**

There are three steps to data explicitation, they are: bracketing, intuiting, and describing as suggested by Giorgi (1985) and Mohler (2008). Bracketing involved conduction of epoch. It was done with the intention to let go of preconceptions. This way the phenomenology would remain unaffected with bias. Intuiting allows the research to create meaning units derived from the textural descriptions revealed. Based on similarity or dissimilarity, the meaningful units were evaluated to see if they can be categorized or combined. In this step structural descriptions are created for the meaning units developed in the previous step. They are in psychological terminology with relevance to the phenomenon in question.

In the present study, when participants were inquired regarding experiences that they believe affected their spatial ability, a large number of them reported play activities with toys. The toys included in physical toys, tinker, and puzzle toys, especially wooden or plastic building blocks, play dough. Furthermore, almost all high spatial ability participants (HSP) indicated playing with building blocks, puzzle toys, or tinker toy in their childhood. Whereas, only three of the low spatial ability participant (LSP) reported the same. Two LSPs reported having access to building blocks but these blocks were of no interest to them as a child. In addition, four participants from the high spatial focus group (HFG) reported playing with building blocks and playdoh.

It was, indeed, unsurprising to come across the discovery that HFGs and HSPs recalling play with block toys and accept the role it played building their spatial ability.

This is supported by the literature on spatial ability (Brosnan, 1998). The surprise came in when three of the LSPs, namely P12, P11, and P10, also accepted that playing with block toys. Despite having this experience, their scores on the MRT were low and they had good academic performance (average 70% - 80%) in the class. To investigate further, I revisited the initial data; exploring whether different degrees of playing with block toys plays different roles in affecting spatial ability. The exploration led to the confirmation that the degree indeed may be attributed as per them affected the spatial ability. For instances, the statements made by LSPs regarding playing with block toys in comparison to HSPs, showed shallow depth of play, less time invested, and personal value given to the play activity. Here is a statement by P10:

> *"I played [with] plastic building blocks when I was a kid. I also have a younger brother. Um, mom-dad told me to play there [with the brother]. Played with building blocks, played outside too. I didn't like girl things. Had fun outside."*

Simultaneously, participants P12 and P11 displayed slightly more interest in playing with building blocks in their childhood. Following is an extract from P11's interview:

> *"Oh I liked plastic puzzles a lot, big fan. Like anything you can build things with. I enjoy that type of toys, work with my hands and all, playing always like that."*

Following is what P12 stated:

> *"I played really with block toys... cylinder shape, rectangular, and square shapes. Ah, we were playing a lot. Bunch of plastic toys for puzzle, too. I played."*

The following were the statements of the three LSPs who reported having playing with building block toys. However, only upon comparing their statements with those of the HSPs' we will the differences in the degree to which they played with them and how it affects their respective spatial ability skill. P03, a HSP, had the following discussion:

> *P03: "Oh yes I like building toys a lot, sir. Even you were talking in the class. My all-time favorite toy while growing, both wooden and clay ones [building blocks]. I put things together, build them, whatever it is. I was fanatic about it."*
> *Researcher: "Did you have different kinds of building block toys?"*
> *P03: "Yes! six-seven types. My bed will be covered by them. table was also covered by them when we play. I mean, I… when I told mom I am the chosen one to play with building blocks. Mom replied saying all the toys really keep me busy. It is so satisfying to see things fit. Fun to hold different pieces together in different dimensions."*

P03 continued explaining how much the building block toys were close to him for several minutes. Similarly, the P02 remarked: "*I was into plastic puzzles, my aunt gave it to me. Puzzle lover, outdoor lover, loved video games, too*." The remaining HSPs remarked in the same manner which strengthens my belief that their degree of involvement with building block toys were higher than that of LSPs.

**2.2 Emergent Themes and Essences (Findings)**

The combination of textural and structural descriptions provided a full expository on the essence of the student's experience of the spatial ability. Through the data explicitation exercise uncovered experiences with childhood toy as one of the major theme. It was found that HSP in comparison to LSP were move engaged in playing with building block toys, puzzle and tinker toys, and toys which required hands-on activity.

## 3. Conclusion and Discussion

Though conclusion cannot be strongly draw, these statements however act as evidence that building block toys and puzzle toys affected the spatial ability performance of the students. For example, students who played with such toys extensively had higher MRT scores as compared to students who did not play with such toys extensively. Other play activities also emerged, but amongst them building blocks and puzzle games were the recurring activities.

The main debate that occurs in the research of spatial ability is that of the nature versus the nurture debate. Proponents of both are in an attempt to ascertain whether nature or nurture causes and improves spatial ability performance. Proponents of the nurture school argue that childhood experiences, including playing and having access to toys, affect spatial ability performance. (Stumpf & Kieme, 1989; Berry, 1971; Conner, Serbin, & Schackman, 1977). Research on relationship between spatial ability and toys have been conducted (Fisher-Thompson, 1990; Tracy, 1990; Vandenberg, Kuse, & Vogler, 1985).

On the other end are the nature proponents who argue that genetics, heredity, and/or hormones predispose individuals with a certain degree of spatial ability abilities (Hall & Kimura, 1995; Sanders, Cohen, & Soares, 1986; Mann, Sasanuma, & Masaki, 1990). As the research progressed, modern day theorists believe that spatial ability is affected by both nature and nurture factors (Brosnan, 1998; Harris, 1978; Vandenberg, Stafford, & Brown, 1968).

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