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*International Journal of Current Research*
*Vol. 3, Issue, 11, pp.187-190, November, 2011*

**INTERNATIONAL JOURNAL OF CURRENT RESEARCH**

**ISSN: 0975-833X**

## RESEARCH ARTICLE

# PERCEPTIONS ON PRIMARY MENTAL ABILITIES OF SECOND YEAR MEDICAL STUDENTS IN MAURITIUS

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**ARTICLE INFO**

*Article History:*
Received 18th August, 2011
Received in revised form
19th September, 2011
Accepted 17th October, 2011
Published online 20th November, 2011

*Key words:*
Education,
Learning,
Medical,
Perception,
Primary mental abilities,
Students.

**ABSTRACT**

**Aims and Objectives:** Primary mental abilities play a major role in learning process. The present study was done to understand perceptions of learners on their primary mental abilities of learning.
**Methods:** An 8-item questionnaire with modified Likert-like scale was administered to 245 students in Mauritius while being in second year of graduate medical program. Data was arranged, analyzed, and classified, and percentages were calculated.
**Results:** The learners recorded highest percentages for perception of having good verbal fluency and inductive reasoning (77.1% each). Much lower percentages were recorded for verbal comprehension (24.1%), "memory capacity" (33.9%), and "comprehension of scientific terminology" (57.1%). Values were 67.3% for perceptual speed, 66.5% for spatial ability, and 64.5% for numerical ability.
**Conclusion:** Learners recorded perception of good abilities for verbal fluency and inductive reasoning, and also perceptual speed, spatial ability, and numerical ability. Verbal comprehension, memory capacity, and comprehension of scientific terminology had lower values. These findings are useful to learners and instructors to understand the areas to be focused upon during teaching and learning, and to appropriately modify the curriculum delivery. This work also provided a useful questionnaire for knowing learners' perceptions on primary mental abilities.



## INTRODUCTION

Intelligence and learning is composed of many different abilities. Extensive work on factor analysis of general intelligence was done by Louis Thurstone, a psychologist and psychometrician. His work established seven different primary mental abilities, which take part in learning process. These include verbal comprehension, verbal fluency, numerical ability, spatial ability, memory capacity, perceptual speed, and inductive reasoning (Thurstone, 1938). These are the abilities in learners to perform specific tasks. Verbal comprehension is the ability to comprehend and understand the words and the language. Verbal fluency is the ease in expression of the language. Numerical ability is to understand the concept when the subject matter contains numbers or formulae or simple calculations. Spatial ability involves capacity to learn with visuals such as images, pictures, diagrams, graphs, curves, and other such objects. Memory capacity is the ability to memorize facts and information learnt recently or over the past. Perceptual speed is ability to perceive speedily the data and information presented in the form of pictures, visuals, flow charts, tables, diagrams, and make conclusions. Inductive reasoning is the ability to explain, analyze, justify, argue, make a choice, and such tasks based on logical thinking and reasoning with background of known facts. In addition to these seven abilities, the learners often face problems in getting accustomed to understanding and applying the complex or clumsy scientific terminology involved in various courses or sciences (Mutalik M and Mutalik Maitreyee, 2011). Many researchers have worked on finding out learning style preferences of students including those in medical programs. These methods are based on classifying the learning styles in to known four learning styles (visual, auditory, read-write, and kinesthetic – called VARK) or their variations (Johnson, 2009). However, the knowledge of students' perceptions of their own primary mental abilities indicates their preferred mode of curriculum delivery, and will be especially useful to individualize the method of curriculum delivery for a particular group (Hawk and Shah, 2007). Estimation of the primary mental abilities for specific tasks is a complex psychometric process; however, learners can subjectively identify which of the tasks they feel are comparatively easy or difficult for them (Jager and Mengelkamp, 2007). Hence the present study was taken up with an objective of knowing the perceptions of second year undergraduate medical students in Mauritius about their comfort in learning process pertaining to the eight different abilities mentioned earlier. The knowledge of abilities of a particular group or class of students would provide guidelines to the learners and their instructors regarding the areas that they need to work upon to help the

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learning process, and for appropriate modification of curriculum delivery (Print, 1996).

## METERIALS AND METHODS

A validated 8-item questionnaire was administered to 245 students in Mauritius while being in their second year of graduate medical program during the year 2010-11. The perceptions about ability or comfort on a particular item were recorded using a modified Likert-like forced-choice response scale of 1 to 3 in the increasing order ("poor", "average" or "good") for a particular ability (William, 2006). Each item was constructed to indicate a particular primary mental ability as shown in Table 1. An informed written consent was obtained from the students. They had a choice of dropping out from the study. They were explained the academic purpose, meaning of the items, way to record the response, and the importance of thoughtful and honest recording of self-perception. They were asked to choose by making a tick mark in front of only one of the three boxes provided in front of each item to indicate their perception whether they feel they are "poor" or "average" or "good" on a particular item. The data was arranged, analyzed, and classified. The data being descriptive, it was expressed as percentages and was presented in the form of tables. Column charts were constructed to highlight the important findings.

**Table 1: Questionnaire items and their correlation with a primary mental ability**

| No | Statement | Primary mental ability |
|---|---|---|
| 1 | I am more comfortable with the subject matter delivered in words, and it is easier for me to understand the verbal matter rather than the matter in the form of pictures, diagrams, graphs or such items. | Verbal comprehension |
| 2 | I face no language problem (English) expressing my concepts fluently in words as far as the subject matter is concerned. | Verbal fluency |
| 3 | I face no language problem as far as the scientific terminology of various subjects/courses in the academic program that I have undertaken. | Verbal comprehension of scientific terminology of the subject/course |
| 4 | I am comfortable in learning the subject matter if it involves mathematics, math calculations or formulae. | Numerical abilities |
| 5 | I am more comfortable with the subject matter involving actual specimen, models, samples or images, pictures, charts, diagrams, graphs, curves, tables etc. | Spatial abilities |
| 6 | I am comfortable memorizing the various facts and information on the subject matter. | Memory capacity |
| 7 | I am comfortable in speedily understanding, comparing, and discussing with help of visuals such as specimen, models, images, pictures, graphs, curves, diagrams, tables etc. | Perceptual speed |
| 8 | I am comfortable with the subject matter that involves reasoning, analysis, justifying, explaining, or choosing between right and wrong, and such tasks. | Inductive reasoning |

**Table 2. Data in percentages - Perceptions for verbal comprehension, verbal fluency, numerical ability, and comprehension of scientific terminology**

| Primary Mental Ability (n=245) | Poor (%) | Average (%) | Good (%) |
|---|---|---|---|
| 1. Verbal Comprehension | 39.6 (n=97) | 36.3 (n=89) | 24.1 (n=59) |
| 2. Verbal Fluency | 6.5 (n=16) | 16.3 (n=40) | 77.1 (n=189) |
| 3. Scientific Terminology | 15.1 (n=37) | 27.8 (n=68) | 57.1 (n=140) |
| 4. Numerical Ability | 15.5 (n=38) | 20.0 (n=49) | 64.5 (n=158) |

**Table 3: Data in percentages (Perceptions for spatial ability, memory capacity, perceptual speed, and inductive reasoning)**

| Primary Mental Ability (n=245) | Poor (%) | Average (%) | Good (%) |
|---|---|---|---|
| 5. Spatial Ability | 10.2 (n=25) | 23.3 (n=57) | 66.5 (n=163) |
| 6. Memory Capacity | 31.4 (n=77) | 34.7 (n=85) | 33.9 (n=83) |
| 7. Perceptual Speed | 6.1 (n=15) | 26.5 (n=65) | 67.3 (n=165) |
| 8. Inductive Reasoning | 6.5 (n=16) | 16.3 (n=40) | 77.1 (n=189) |

## RESULTS

Out of 254 students, 245 participated in the study and completed the questionnaire correctly. (Response rate 96.5%). The age was in the range 19 to 26 years with an average age of 20.38, with standard deviation of 1.22. Mode and median both were 20 each. The percentage of learners with perception of "good" ability for verbal fluency and inductive reasoning was highest (77.1% each). The next in order was the perception of "good" ability by 67.3% for perceptual speed, 66.5% for spatial ability, and 64.5% for numerical ability. Comparatively much lower percentages for "good" ability were recorded for verbal comprehension (24.1%), memory capacity (33.9%), and comprehension of scientific terminology (57.1%). Out of the first four abilities (verbal comprehension, verbal fluency, numerical ability, and comprehension of scientific terminology), verbal comprehension ability (item 1) was perceived to be "poor" by 39.6% and "average" by 36.3% students. Another item with perception of low percentage for "good" ability was the comprehension of scientific terminology (item 4), for which 15.1% students expressed to have "poor" and 27.5% to have "average" ability. The data for perception of these first four primary mental abilities is presented in Table 2. Column chart highlights the important findings and is presented in Figure 1. Out of the next four items (spatial ability, memory capacity, perceptual speed, and inductive reasoning), memory capacity was the only one scoring low (33.9%) for "good" ability. For this item, 31.4% perceived to have "poor", and another 34.7% perceived to have "average" memory capacity.

The data for perception of these four primary mental abilities is presented in Table 3. The findings are highlighted by the column chart as shown in Figure 2.

Figure 1: Perceptions on verbal comprehension, verbal fluency, numerical ability, and scientific terminology

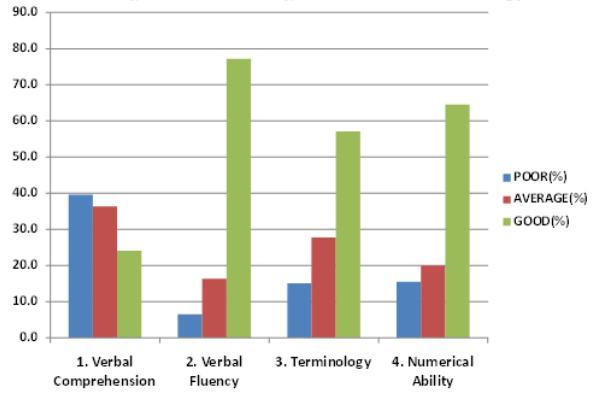
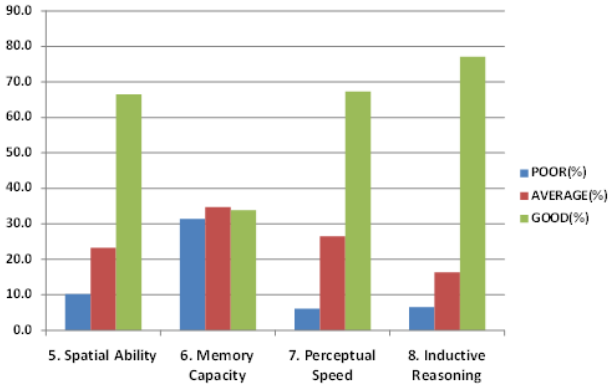



Figure 2: Perceptions on spatial ability, memory capacity, perceptual speed, and inductive reasoning




## DISCUSSION

The present 8-item questionnaire-based study was designed with a purpose of understanding the self-perceptions of learners regarding their primary mental abilities. The perceptions of having "good" ability were expressed for verbal fluency, inductive reasoning, perceptual speed, spatial ability, and numerical ability. Thus the study was useful in identifying the strong domains of primary mental abilities of these learners. The abilities perceived to be comparatively less were verbal comprehension, memory capacity, and ability to understand complex scientific terminology of various courses or subjects. Thus this study was useful in identifying the deficient areas of primary mental abilities of the learners.

Spatial ability and perceptual speed are the primary mental abilities mainly based on visual learning. They are mainly governed by the right side of the human brain (Ryan-Krane and Tirre, 2005). Perceptions of having good abilities in these two areas indicated the need for appropriate shifting of curriculum delivery from "auditory" learning (for example, didactic lecturing) to more "visual" learning (for example, visuals, power point presentations, images, charts, diagrams, pictures, models, specimen, samples). The psychometric studies have shown that "auditory" processes impart more of a passive learning, while "visual" learning is a more active process. Spatial ability and perceptual speed therefore help to strengthen the ability of word comprehension and memory capacity, and are also known to decrease the burden on the memory capacity (Curry, 1999). Since spatial ability and perceptual speed perception was found to be on highest side in this set of learners, these abilities could be utilized to improve their weaker abilities of verbal comprehension, memory capacity, and comprehending complex scientific terminology in course subjects (D'Souza *et al*., 2008). Spatial ability and perceptual speed are mainly based on diagrams, pictures, images, graphs, curves, charts, tables, and such material. More inclusion of these visuals during the teaching-learning process thus would be helpful (Milner and Goodale, 2006). Spatial ability and perceptual speed both are applied to a great extent in the medical studies and clinical practice, in diagnosis, interpretation, and management strategies. Encouraging these abilities would prove to be beneficial to the learners from the point of their future clinical skills in various branches of medicine. Another finding was positive perception of good numerical ability. This indicates that the learners would be more comfortable in learning with appropriate use of numbers and simple numerical operations in various course areas wherever possible. A positive and encouraging finding also was good abilities of inductive reasoning. This ability has immense importance in the courses of medicine where logical reasoning is applied in the processes of analysis and interpretation of the clinical history, physical examination, laboratory data, coming to the diagnosis, and then the management strategies. Inductive reasoning ability can be further encouraged and explored by creating tasks that appeal logical reasoning and analysis such as – "justify", "criticize", "comment", "argue", and such other items. This would reduce the burden on memorization and help to understand and remember the facts and information by logical reasoning process (Cockcroft and Israel, 2009). Perception of lower abilities of verbal comprehension underscores the need for systematized efforts for improvement in English language comprehension. Self-perception of lower memory capacity also highlights the need for appropriate modification in the volume of the course content and search of innovative methods to strengthen the memory capacity (D'Souza *et al*., 2008). Confucius, a well-known Chinese philosopher, summarized the cognitive process as – "I hear, I forget. I see, I remember. I do, I understand." While putting it in this way, Confucius was mentioning the importance of seeing the things and actually performing the tasks. It is a favorable finding in the present study that the visual learning-based capacities (spatial ability and perceptual speed), numerical abilities, and inductive reasoning were perceived to be good. Therefore, exploring these capacities would be helpful to strengthen the weaker capacities, namely the verbal comprehension (language-based and scientific terminology-based) and memory (Vaillancourt, 2009). The present study thus provided an insight into both strong as well as weak primary mental abilities in these learners, and suggested directions for appropriate modification in methods of curriculum delivery. This study provided a useful, respondent-friendly, short, and simple questionnaire for recording self-perception of primary mental abilities in learners. All the questionnaire-items are applicable to general processes in learning in any field of education, and this questionnaire can serve as a tool for similar studies in any group of learners, with appropriate modification. This is a descriptive study of the perceptions of learners, and hence is liable to subjectivity. Variable capacities of individuals to identify own strengths and deficiencies can influence their perceptions.

## CONCLUSION

An effort to understand the self-perceptions of learners on their primary mental abilities is useful to identify their

strengths and deficiencies to carry out specific tasks. It also provides guidelines on appropriately molding the methods of curriculum delivery so that the learners would be more comfortable with their current educational program. Since the abilities such as spatial and numerical abilities, and perceptual speed, and inductive reasoning are known to minimize the burden on verbal and memory capacities, more inclusion of visuals during delivery of curriculum would be one of the key modifications in delivery of curriculum.

**ACKNOWLEDGMENT**

The authors wish to heartily acknowledge the students who participated in this study.

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