

Assessing the Cognitive and Psychomotor skills among Ist year undergraduates during practicals

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Abstract

The acquisition of cognitive and psychomotor skills is highly important for a successful professional⁽¹⁾. It implies assessment of the above mentioned domains becomes mandatory for medical students. An attempt has been made to assess the cognitive and psychomotor skills in the practicals(Precipitation reactions of Proteins), for undergraduate students. Precipitation of proteins by neutral salts is the preliminary test which comes under the must know' area of the I M.B.B.S curriculum.

Aim is to evaluate the psychomotor and cognitive skills amongst I M.B.B.S students, on the basis of their performance and interpretation of Precipitation of proteins by neutral salts (Half and Full saturation test) .

Methodology: Evaluation was done by the faculty of biochemistry at S.V.S Medical College, Mahabubnagar, Telangana. A pre-determined check list which encompasses the cognitive and psychomotor domains was framed so as to provide an objective evaluation and avoid bias.

Results: 62.7 % students followed the instructions meticulously, 56.0% students could achieve the desired psychomotor skills, only 61.3%% knowing the significance of the constituents used, 64.7% were able to tell the principle, 92.7% were able to interpret the test appropriately.

Conclusion: Emphasis should be laid on the procedural skills, underlying principles and interpretation of qualitative tests.

Keywords: Cognitive skills, Psychomotor skills, OSPE (objective structured practical examination)

INTRODUCTION

Psychomotor learning is defined as learning new actions or reapplying the existing ones by modifying them. Psychomotor learning involves consistent and integrated operation of processes related to affective and cognitive functions. Individuals learn manual skills with the support of visual perception as well as exploring objects by touching^(2,3). The medical and paramedical profession, in its many facets, makes extensive use of the three major learning domains – cognitive, affective, and psychomotor⁽⁴⁾. Evaluation of cognitive and psychomotor skills is a pre requisite in the assessment of learning. OSPE (objective structured practical examination) is the most common method of assessing procedural skills and cognitive skills which utilize predetermined checklists in this assessment format⁽⁵⁾. Medical under graduates have to understand, perform and interpret a wide range of procedures in their medical curriculum⁽⁶⁾. Precipitation of proteins by neutral salts is the preliminary test which a student of I M.B.B.S must know and perform.

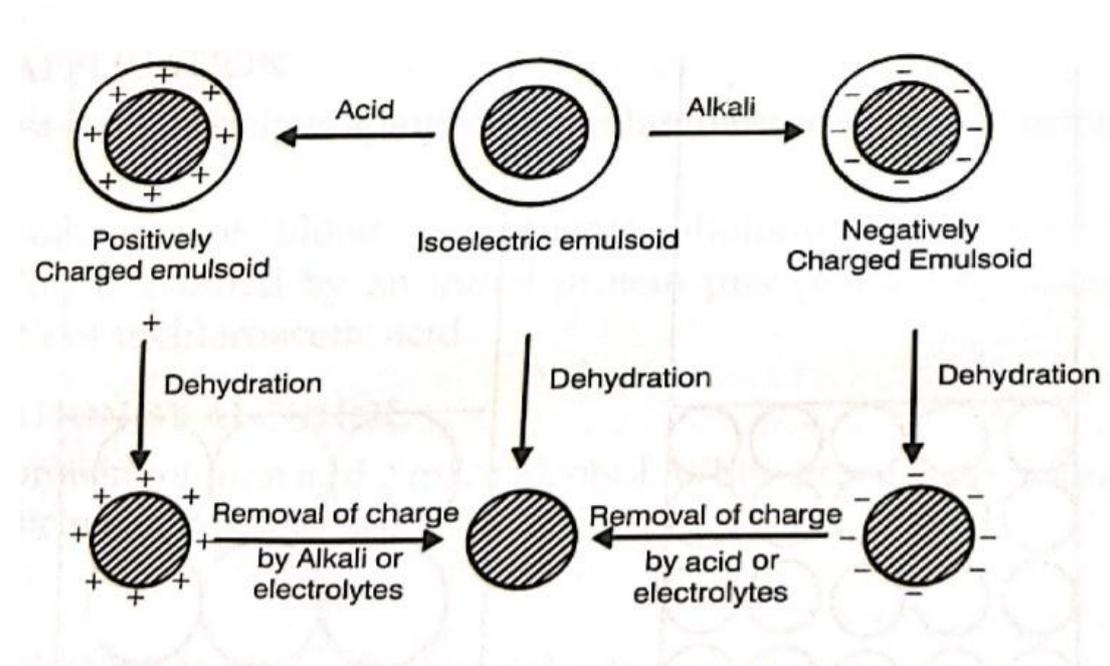
Proteins are large molecules with a definite size, shape and charge. Solubility of a protein depends on the proportion and distribution of polar hydrophilic groups and non polar hydrophobic groups in the molecule^(7,8). Proteins, which are colloidal in nature, are kept in solution by two factors.

- i. Electric charges: A large number of electric charges are present on the surface of protein molecules. The same charged particles repel each other and prevent their precipitation.
- ii. Shell of hydration: A film of water called as shell of hydration surrounds protein molecules, which also prevents precipitation of proteins.

If both the factors are removed, the particles will come closer and get precipitated. Ammonium sulphate neutralizes the electric charges present on protein particles and also remove the shell of hydration as it has greater affinity for water than the colloid. The abundance of the salt ions, decreases the solvating power of salt ions, thereby decreasing the solubility of the proteins and results in precipitation. At low concentrations of salt, solubility of the proteins usually increases slightly (salting in). But at high concentrations of salt, the solubility of the protein drops sharply (salting out). The amount of ammonium sulphate required to precipitate the colloid depend upon the surface area of the particles. The larger the surface area, the larger the electric charges and larger the shell of hydration. Thus, the smaller molecules like albumin having relatively large surface area (in a fixed amount of a given solution) are precipitated by full saturation with ammonium sulphate. Larger molecules like casein and gelatin have smaller surface area and get precipitated by half saturation. Peptones are very small molecules, thus have very large surface area

and do not get precipitated even with full saturation.

Figure 1:



Half saturation with saturated ammonium sulphate solution:

To 3ml of albumin solution add an equal volume of saturated ammonium sulphate solution. Mix well and allow to stand for 5 minutes. Filter and perform the Biuret test with the filtrate using equal volume of 40% NaOH and 2 drops of 1% CuSO₄.

Violet colour indicates albumin is not precipitated by half saturation with saturated ammonium sulphate solution.

(40% NaOH is added to overcome the interference by ammonium ions which can obscure the violet colour of protein by forming deep blue cuprammonium ion [Cu(NH₃)₄⁺⁺].

Full saturation with solid ammonium sulphate crystals:

To 3ml of albumin solution add solid ammonium sulphate with mixing until the solution is saturated (i.e. there should be some undissolved salt at the bottom of the contents). Let this stand for 5 minutes. Filter and perform biuret test with the filtrate using an equal volume of 40% NaOH and 2 drops of 1% CuSO₄.

Blue colour indicates that albumin is precipitated by full saturation with ammonium sulphate.

METHODOLOGY

In our study we assessed 150 students of I M.B.B.S(2015-2016 batch) in the department of Biochemistry S.V.S Medical college , Mahabubnagar, Telangana state. Each student were provided Albumin solution and were asked to perform Half and Full saturation tests. The students were given a prior demonstration about the procedure of the tests and were also taught the principle and interpretation of this test. A Check list was prepared by the faculty of Biochemistry to assess the cognitive and psychomotor domains of the students.

The check list was as follows :

- 1) Whether the student dispensed equal amount of (3ml) protein and ammonium sulphate solution?
- 2) Whether the student able to fold the filter paper correctly?
- 3) Whether the student was able to dispense equal amount of filtrate and 40%NaOH solution?
- 4) Does the student know the significance of the constituents used in the test?
- 5) Was the student able to understand the underlying principle of the test?
- 6) Was the student able saturate the solution correctly by adding solid ammonium sulphate crystals?
- 7) Was the student able to interpret the test results properly?

This was followed by a discussion amongst the faculty with regard to the mistakes done by the students and how to overcome these mistakes.

STATISTICAL ANALYSIS

Data was summarized by percentages for categorical data.

RESULTS

From table 1 and figure 2: Out of a total of 150 students, 90.7% could perform the test and manage get the desired results inspite of not doing meticulously the procedure as was taught to them, 82.0% of students were able to fold the filter paper correctly while performing the test, 56.0% of students were able to saturate the solution with solid ammonium sulphate crystals, only 61.3%% were able to tell the significance of the constituents used, 64.7% were able to tell the principle , 92.7% were able to interpret the test appropriately and 62.7% students meticulously followed the instructions and performed the test successfully.

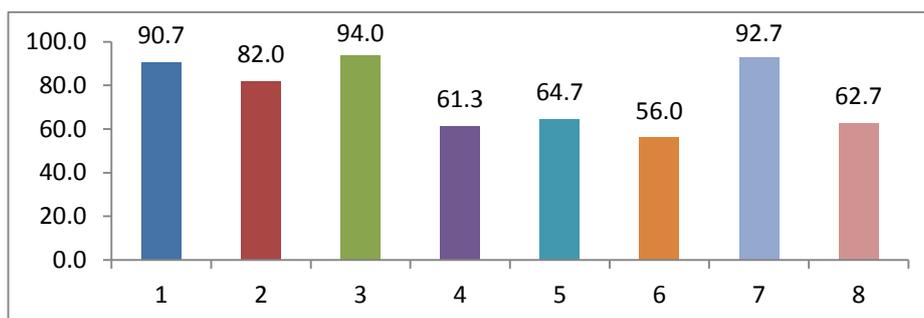


Figure 2: Shows the observations of the teachers, monitoring the students performance in the form of a Simple bar diagram

Table 1: Gives the observations of the teachers , monitoring the student’s performance in the practical

SI. No.	Observations (for total of 150 students)	No. of students	% of students
1.	No. of students able to perform the test and manage to get results?	136	90.7%
2.	No. of students able to fold the filter paper correctly?	123	82.0%
3.	No. of students able to dispense equal amount of filtrate and 40%NaOH solution?	141	94.0%
4.	No. of student are aware of the significance of the constituents used in the test?	92	61.3%
5.	No. of students able to understand the underlying principle of the test?	97	64.7%
6.	No. of students able saturate the solution correctly by adding solid ammonium sulphate crystals?	84	56.0%
7.	No. of students able to interpret the test results properly?	139	92.7%
8.	No. of students who meticulously followed the instructions and performed the test successfully	94	62.7%

DISCUSSION

Only 62.7 % of the students followed the instructions meticulously while performing the test. Surprisingly, 90.7% could achieve the desired result. This can be attributed to the nature of the test. 56.0% of students were able to saturate the solution with solid ammonium sulphate crystals, only 61.3%% were able to tell the significance of the constituents used, 64.7% were able to tell the principle , 92.7% were able to

interpret the test appropriately . Similarly, Johannesson et al. reported that the students in their study needed repetition so that a target skill is accommodated ⁽²⁾. Similarly, Pierce and Baillie and Curzio reported that the students in their studies had decreased level of anxiety after the laboratory practices ⁽⁹⁻¹¹⁾. This data clearly recognizes the need to have more emphasis on the procedural skills and underlying principles and interpretation of qualitative tests along with the quantitative tests.

CONCLUSION

Broadly tests can be classified either as qualitative or quantitative. Qualitative tests usually assess cognitive skills. Quantitative tests give us an insight into the pipetting ability of the students who are being assessed and thereby one can assess the procedural skill competency. Nevertheless, Cognitive and procedural skills must be developed simultaneously in the students. There is definitely a need for newer teaching methods to be developed so that the students develop both the skills simultaneously. Also, emphasis must be laid in the minds of the students that performing tests in practical classes is not only to pass examination. Comprehension and understanding of the underlying principles is mandatory in grooming our future medical fraternity.

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