

**A STUDY TO INTERPRET COMMON FACTORS FOUND IN LEARNING
CHEMISTRY AT SENIOR SECONDARY LEVEL.**

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Abstract

In the era of science and technology, we need students who can cope with the challenging situation of the world. To accept these challenges, need of students having some inherent potential to accept these challenges is essential. Eighteen achievement tests covering different field of Chemistry was constructed. Item analysis of these tests was done. Chi-square tests of normality of distribution were applied after computing the mean and S.D. Transformation of test scores into T- scales in test no 1 where the distribution of score was abnormal. All these achievement tests had more than .85 reliability. Product moment correlation was used to get correlation matrix between eighteen tests. Factorization was stopped after five factors. Difference between obtained and guessed communalities became less than 0.10 after first reiteration. Result indicates that there are five factors responsible for learning basic concept of Chemistry.



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SRJIS 2014

INTRODUCTION: Due to explosion of knowledge in every sphere of life. We need such type of curriculum which can satisfy the aspiration of the people, but it becomes difficult to find out such type of students who have such type of abilities hidden in them. These hidden abilities can be explored by providing series of items related to these fundamental cognitive abilities.

No extensive research work has been done in India and abroad so far to identify common factors and to interpret these fundamental cognitive abilities for chemistry which is equally important for science students. When some intellect abilities had been found related with Physics (Ignatz 1982, Sphero 1974), Mathematics (Peterson 1965, Chauhan 1984), and Biology (Chhikara 1984). Pritch, Paul R (1990) found that self efficacy and intrinsic value were positively related to cognitive engagement and performance.

Kember, David (2003) found that a student adopting a surface approach does not seek understanding and, therefore, relies upon memorization. GWO- Hshiang Tzen (2007) carried out

a research on evaluating Intertwine effect in e-learning programmes. A naval hybrid MCDM Model based on factor analysis. Hilde brand H.P. (2011) conducted a research on a factorial study of introversion-extraversion and it is found that previous research suggested that Jung's theory of psychological types could be best examined by factorial method. A review of studies carried out in the field of factor analysis reveals that no systematic attempt has been made to assess the cognitive abilities in chemistry. Since there is paucity of such studies, it is appropriate to investigate common factors and to interpret the same in learning chemistry.

OBJECTIVE OF THE STUDY

1. To construct 18 objective type achievement tests for assessing the achievement in different aspects of chemistry at senior secondary level.
2. To find out the correlations between the achievement in different aspects and to apply factor analysis in order to extract common factor.
3. To interpret the factors.

Method of Study and procedure

The study was undertaken to extract common factors found in learning different aspects of chemistry. Correlation among different tests was carried out, thereafter, factors were found out by Centric Method for psychological interpretation of factors.

SAMPLE: Sampling was done on two occasions. Try out test was administered to about 75 students out of these 69 were selected out at random to get data about each individual item. Sample was of 250 students.

Instrumentation: The researcher constructed 18 achievements for assessing achievements in different aspects of chemistry. The purpose was to find out the inter correlations of the score in different aspects for the factor analysis.

Analysis of Data: Investigator decided to use the Centric method for factor analysis of the correlation matrix. Factor analysis was stopped after fifth factor after first reiteration as the loadings of the sixth factor fell short of Guilford and Lacey's criterion.

Table 01: **After Reiteration:** (For this reiteration the communalities obtained from first factorization were used after correct up to the decimal places).

Table 01 : After Reiteration

Tests	I	II	III	IV	V	h ² obtained	h ² guessed	Diff.
1.	.667	-.247	.183	-.420	.104	.728	.628	.092
2.	.619	-.129	-.163	.463	.075	.644	.582	-.062
3.	.776	-.466	-.092	-.268	-.197	.836	.82	.016
4.	.627	-.403	.252	-.329	-.133	.747	.659	.088
5.	.662	-.182	.224	.132	.082	.571	.669	.098
6.	.755	.583	.203	-.187	.067	.917	.943	.025
7.	.425	.134	.187	-.139	.171	.28	.248	.032
8.	.550	.327	-.144	-.303	-.312	.616	.715	.099
9.	.674	.392	-.230	-.178	-.332	.794	.697	.097
10.	.627	.461	.226	-.102	.270	.604	.614	.010
11.	.471	.279	-.056	-.049	-.232	.358	.358	.000
12.	.919	-.134	-.186	.185	-.235	.984	.992	.008
13.	.543	-.191	-.187	.048	.017	.367	.399	.032
14.	.458	-.097	.133	.099	.148	.267	.245	.022
15.	.582	-.160	-.282	-.195	-.453	.685	.661	.024
16.	.723	-.131	-.352	.294	-.258	.812	.713	.099
17.	.490	.179	.324	.328	-.278	.560	.580	.020
18.	.383	-.108	.090	.086	-.117	.185	.217	.032

INTERPRETATION OF COMMON FACTORS

Common Factor I: Factor one constitutes the major bulk of achievement in chemistry. This factor shows more than .383 loading in each test. It reflects the importance of this factor in each test. Loading in each test shows that such type of achievement is mandatory to learn chemistry. After giving a look to loading of factor I, test nos. 1,2,3,4,5,6,9,10,12 and 16, i.e. 10 tests out 18 show substantial loading more than 0.6. These loadings in these tests reflect the requirement of achievement in chemistry. The achievement depends on the knowledge in the chemistry. Test no. 12 i.e. chemical property has the highest loading of 0.91 in this factor. This shows that knowledge of chemical properties of an element / compound is fundamental to know chemistry. Similarly it is fundamental to know symbol, chemical equations, numerical ability, electronic configuration, and nomenclature, discriminate various chemical principals / laws / facts, composition of various compounds, mechanism of a reaction. It may be called as a **conceptual factor** of achievement in chemistry. It constitutes greater than half the total achievement in chemistry.

Common factor II: From reiteration table 01, it is clear that test no. 6 has the highest loading in this factor. A student, who has the conceptual knowledge of chemistry, can discriminate minutely by inductive and deductive method. Analysis and synthesis is required at every step in

chemistry. This factor constitute only 1/8 part of total achievement. It also lays emphasis on chemical units, constitution of various compounds, fundamental laws and principles of chemistry. It may be called as **discriminating factor** as it analyses composition of compound, principles and various measurement units used in chemistry.

Common Factor III: This factor constitutes 1/10th part of total achievement in the chemistry. This factor has the highest loading .324 in test no. 17. Test no. 17 relates with mechanism of a reaction. Some reaction takes place slowly while others are very fast. Some reaction completes in a single step while other completes in number of steps. So the knowledge of path of reaction is compulsory. Reactivity of an element depends upon the electronic configuration. By knowing outer electronic configuration, one is able to judge its reactivity. This factor has 2nd highest loading .252 in test no. 4 i.e. electronic configuration. This factor has also small loading for laws and principle, nomenclatural, discriminating and figural aspect. This factor may be named as **mechanism factor** as it depends on electronic configuration of element etc.

Common Factor IV: This factor has loading on test no. 2 (.463); test no. 17 (.328) and test no. 16 (.294). Test No. 2 is numerical aspect. No practical and theoretical work can be done without mathematical calculation. Similarly test no. 17 is mechanism aspect. This test determines the mechanism of the reaction. Slow and fast reaction also depends upon the mathematical calculations. Hence, this factor depends upon calculation, so it may be called **inference factor** as one has to draw inference from general observations based on analytic method

Common Factor V: This factor constitutes 1/20th part of total achievement in the chemistry. This is a minor factor. Test no. 7 (figural aspect) has .171 loading which is the highest in the factor V. Graphs are used in chemistry to show relative positions of melting/ boiling point of various compounds. Diagrams are used to show shape of ions, molecules, extent of bonding, and shape of orbital existing in them. Similarly test no. 14 (application aspect) has .148 loading. So with the help of diagrams, application of various compounds can be easily explained. Keeping in view of above fact, it is reasonable to call it a **figural factor**.

CONCLUSIONS

1. Factor I constitute more than half of the total achievement test and it is called conceptual factor.
2. Factor II is called discriminating factor as it analyses the composition, principles and laws, measurement units used in chemistry.

3. Mechanism factor was named for factor III as it tells about the path of reaction to be followed. Factor IV is called as inference factor as one has to draw inferences from general observations based on analytic method.
4. Figural factor is named for factor V as structure of orbital, bonding relative position in graph and diagrams tells a lot in brief.

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