Scholarly Research Journal for Interdisciplinary Studies,
Online ISSN 2278-8808, SJIF 2016 = 6.17, www.srjis.com
UGC Approved Sr. No.49366, NOV-DEC 2017, VOL- 4/37
https://doi.org/10.21922/srjis.v4i37.10557

RELATIONSHIP BETWEEN TREATMENT, INTELLIGENCE AND THEIR INTERACTION ON ACHIEVEMENT IN DIAGNOSTIC TEST OF CELL BIOLOGY

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Abstract

Misconceptions are considered as a big obstacle in the path of the students' life. If misconceptions were not removed in the early stages of a student life it can cause various learning difficulties in future. To promote an effective and meaningful learning there is an urgent need to identify such misconceptions from students' mind and to rectify them or to prevent them from occurring in future. From the various investigations and review studies it is found that students' of different ages possess misconceptions in cell biology. The present study was undertaken to study the effect of treatment, intelligence and their interaction on achievement in cell biology by considering pre - achievement in cell biology as a covariate. To study all these necessary factors first the students' misconceptions was identified through a Two – Tier Diagnostic test (DTCB). The sample comprised of 191 students' of IX class selected from the secondary schools of Phagwara city. On the basis of pre-achievement test a relation between the above mentioned factors were carried out to find out the correlation between them.

Keywords: *Cell biology, Diagnostic test in cell biology (DTCB), Misconceptions, Intelligence, Raven's Standard progressive matrices (RSPM), Group Embedded Figure Test (GEFT)*

INTRODUCTION

Cell biology is one of the most important areas in biology and understanding the structure and functioning of cells is basic to all molecular and genome level biology studies. Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. Knowing the components of cells and how cells work is

fundamental to all biological sciences. To completely figure out these developments basics of cell biology must be clear to the students and our future citizens. Misconceptions can come from a variety of factors and unfortunately, these interpretations have been shown to impede learning of fundamental scientific concepts. Misconceptions if not detected immediately, adversely affect the students' subsequent learning. Students hold misconceptions that were developed before and during their early school years. These misconceptions may be compounded by the teacher or the textbook (Bahar, 2003 & Wandersee et al, 1994). Fisher (1985) contends that misconceptions serve the needs of the persons who hold them and that erroneous ideas may come from strong word association, confusion, conflict, or lack of knowledge. Some of the most widely studied misconceptions in cell biology relate to the concepts of cell division and diffusion & osmosis (Odom, 1995; Zuckerman, 1998). While studying conceptual difficulties, Friedler, Amir, & Tamir (1987) found that use of textbook definitions, technical language, and other issues related to use of language and textbooks may contribute to misconceptions. Indeed, some textbooks in the past were found to contain errors and misconceptions (Storey, 1992a, 1992b) relating to cell physiology and energetics. Driver, et al. (1994), a leader in misconception research, had discovered that students often confuse the concepts of molecules and cells. Prior studies have shown that students experience difficulties in learning concepts related to the cell division process (Kindfield, 1994). Reasons for these misconceptions include students' inability to differentiate between doubling (replication), pairing (synapsis), and separating (disjunction), as well as determining whether or not these processes occur in mitosis, meiosis, or both (Smith, 1991). Atilboz (2004) studied the level of understanding and misconceptions of 9th grade students related to mitosis and meiosis. Many students learn science topics as isolated facts and do not construct links between old and new knowledge. As a consequence they find it difficult to understand subsequent topics (Novak 1988). Because new knowledge is constructed on the base of existing cognitive structure, misconceptions have to be removed to prevent new ones developing. Identification of misconceptions is needed to develop strategies that provide students with accurate conceptual knowledge required for scientific problem solving. The instruction should be designed in such a way that it accounts for students' initial conceptions and especially their misconceptions.

AIMS AND OBJECTIVES

The aim and objective of the study was to check the effect of treatment, intelligence and their interaction on achievement in cell biology test by considering pre – achievement in cell biology test as a covariate.

HYPOTHESIS

The hypothesis of the study was that there is no significant effect of treatment, intelligence and their interaction on achievement in cell biology by considering pre – achievement in cell biology as covariate.

SAMPLING

The study was conducted on class IX students studying in senior secondary school of Phagwara. Sample was selected by using Cluster Sampling Technique from private senior secondary school. It comprises of about 118 students.

TOOLS USED

To collect the requisite data for the present study the investigators had administered the following tests:

1) Construction of the diagnostic test (DTCB) to identify the misconceptions of students.

2) Raven's standard progressive matrices is used to assess the intelligence and of students.

3) Group Embedded Figure Test (GEFT) developed by Herman A. Witkin, Philip K. Oltman, Evelyn Raskin and Stephen A. Kalp is used to assess the cognitive style of students.

STATISTICS APPLIED

The techniques used for analyzing the collected Data in the study are statistical techniques like means, percentages, t-test, and analysis of co-variance (ANCOVA) etc. The data was presented in tabular form.

DELIMITATIONS OF STUDY

The study was delimited in the following aspects:

a) The study was delimited to class IX students only.

b) The sample of the study was confined to 118 students of class IX.

c) This research was aimed to study the students' misconceptions in cell biology in only limited concepts, which are included in the syllabus of class IX.

ANALYSIS AND INTERPRETATIONS

The first objective of this study was to identify the common misconceptions in the concept of cell biology of class IX students'. To identify these misconceptions a two – tier diagnostic

test in cell biology was constructed by the investigators. In this approach two-tiers of multiple choice items with distracters to diagnose students' conceptual understanding of specified content areas in science. The first tier involves a content response and the second tier a reasoning response. The distracters in the items were based on student conceptions that were identified from the research literature as well as from students' responses. Students' overall performance in this diagnostic instrument was obtained by comparing the percentage of students who scored both parts correctly in each two tier item with the percentage who scored only the first part correctly. The data are summarized in Table below:

Table: Analysis of Students' Responses on DTCB

Item number	***Percentage of students who correctly answered***		***Item Number***	***Percentage of students who correctly answered***	
	First Tier	***Both Tiers***		***First Tier***	***Both Tiers***
1	*32.02*	*8.47*	*15*	*38.98*	*10.17*
2	*54.24*	*37.29*	*16*	*31.35*	*9.32*
3	*40.69*	*17.08*	*17*	*21.18*	*5.93*
4	*39.82*	*5.08*	*18*	*31.77*	*7.63*
5	*34.74*	*25.42*	*19*	*26.57*	*4.39*
6	*41.52*	*33.09*	*20*	*16.01*	*3.39*
7	*24.57*	*16.95*	*21*	*22.89*	*7.63*
8	*24.57*	*14.41*	*22*	*14.40*	*3.39*
9	*47.45*	*25.42*	*23*	*27.96*	*5.93*
10	*26.27*	*7.63*	*24*	*34.75*	*18.64*
11	*52.99*	*41.03*	*25*	*19.48*	*6.78*
12	*26.27*	*11.86*	*26*	*32.20*	*2.54*
13	*22.88*	*4.24*	*27*	*32.20*	*18.64*
14	*22.87*	*5.08*			

The range of correct answers for the first tier of the test was 14.40% to 54.24% while for both tiers combined, the number of correct responses was reduced to a range of 2.54% to 41.03%. This means that, on average, 34.32% of the students answered the first-tier questions correctly. However, the mean percentage dropped to 21.78% when both tiers 57 are considered. This means that students may be able to sense‟ right" or "wrong" in a given situation but unable to give the exact reason. This trend is an indication that students may have memorized certain facts without sufficient understanding of the concepts involved.

The second objective of this study is to assess the Intelligence of the students. It was assessed by administering to them Raven's standard progressive matrices scale. RSPM represents an attempt to measure intellectual functioning within the context of Spearman's concept of 'g'. Numerous reliability coefficients quoted by Raven vary from 0.80 to 0.90. The third objective of this study is the cognitive level. The cognitive level of the students was assessed by using the Group Embedded Figure Test. The test was developed by Herman A. Witkin. The total 18 figures were provided to 118 students along with the figure to be embedded on the last page. Each test was associated 2 minutes for comparison. The test retest reliability for different aspects was .82 and validity was -.71 to .55. To study the effect of intelligence and their interaction on achievement two levels of treatment was made, one was teaching with Remedial Approach (RA) and other was Traditional Method (TM). The students were categorized into three levels of intelligence namely high, average and low. Thus there were two levels of treatment and three level of intelligence Therefore the data was analyzed with the help of 2x3 factorial design analysis of covariance. The results are given in the table below:

Table: Summary Of 2x3 Factorial Design Ancova For Achievement In Cell Biology Test By Considering Pre-Achievement In Cell Biology Test As A Covariate

Sources of variance	Df	Sum of square	Mean square	F-value
TREATMENT	1	220.922	220.922	57.873**
ING	2	3.181	1.591	.417
TREATMENT * ING	2	6.567	3.283	.860
Error	111	423.727	3.817	
Total	118	37791.000		

**significant at 0.01 level

From the table above it can be seen that the adjusted F-value of treatment is 57.873 which is significant at 0.01 level. It indicates that mean scores of achievement in cell biology test of students taught through RA and TM differ significantly, when pre-achievement in cell biology test was taken as a covariate. In this context, the null hypothesis that "There is significant effect of treatment on achievement in cell biology test of class IX students when pre-achievement in cell biology test is considered as a covariate" is rejected.

Further, the adjusted mean scores of achievement in cell biology test of RA group was 19.542 which is significantly higher than that of those taught through TM whose adjusted mean score was 14.298. It may therefore be concluded that RA group is found to be significantly superior in comparison to TM group when pre-achievement in cell biology test is taken as a covariate.

The adjusted F-value for intelligence is 0.417, which is not significant. It indicates that adjusted mean scores of achievement in cell biology test of students belonging to high intelligence group, average intelligence group and low intelligence group don't differ significantly when pre-achievement in cell biology test was taken as a covariate. Thus the null hypothesis that "There is no significant effect of intelligence on achievement in cell biology test of class IX students when pre-achievement in cell biology test is taken as a covariate" is not rejected. It may therefore be concluded that achievement in cell biology test was not correlate with intelligence of students.

The adjusted F-value for interaction between treatment and intelligence is 0.860, which is not significant. It indicates that there was no significant influence of the resultant of interaction of treatment and intelligence on achievement in chemical bonding when pre-achievement in cell biology test was taken as a covariate. In this context, null hypothesis that "There is no significant effect of the interaction between treatment and intelligence on achievement in cell biology test of class IX students when pre-achievement in cell biology test was taken as a covariate" is not rejected. It may therefore be said that achievement in cell biology test was found to be independent upon the interaction of treatment and intelligence when pre-achievement in cell biology was taken as a covariate.

CONCLUSION OF THE STUDY

The present study deals with the effect of treatment, intelligence and their interaction on achievement in cell biology test which shows that treatment and intelligence is independent of DTCB test. Hence it can be said that the adjusted mean score of achievement in cell biology of control and experimental group differs significantly from each other. Moreover the achievement in cell biology was found to be independent of intelligence when pre – achievement was taken as a covariate.

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