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Variation of Cognitive Beliefs and Hemisphericity Dominance in Undergraduate Science Students

Science

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ABSTRACT

Abstract: In this survey and co relation type of research the cognitive beliefs and Hemisphericity dominance of undergraduate students was measured using MPEX and Hemisphericity dominance test (HDT test). Co relations were observed amongst Hemisphericity and also amongst the cognitive beliefs as students from First year to Third year were analyzed.

Introduction:
Learning of basic sciences involves development of cognitive beliefs and brain Hemisphericity. These measurable quantities showed some relationships amongst each other and forms more subtler picture of learning of undergraduate students.

Cognitive beliefs in learning of Physics are divided in to six domains in the MPEX test and students development is scaled between Novice to Expert. While brain dominancy is categorized in three categories Right brain, left brain and Integrated brain dominancy. There are some clear relationships observed amongst these parameters which were discussed here.

Tools and methodology:
For analyzing learner's response for measuring cognitive beliefs and Brain Hemisphericity dominance in them following standard tests were used.

1) MPES test:
MPEX test tool: http://www.physics.umd.edu/rgroups/ripe/perg/experts/mpex.htm The development of student's cognitive domains like, Independence, Coherence, Reality link, Mathematics link, ability and interest in taking efforts, can be quantified.

The student's attempted these tests of 34 questions with five responses varying from strongly disagree to strongly agree scale, and students required to select any one appropriate response. The responses were arranged as Lickert scale. The questions were then clustered in to six interdependent groups or domains or beliefs.

It was a set of 34 questions, testing following six cognitive beliefs in physics:

D1: Independence. (Beliefs about learning physics- Whether it means receiving information or involves an active process of reconstructing one's own understanding).

D2: Coherence. (Beliefs about the structure of physics knowledge- As a collection of isolated pieces, or as a single coherent system)

D3: Concepts. (Beliefs about the content of physics knowledge- As formulas or as concepts that underlie the formulas)

D4: Reality link. (Beliefs about the connection between physics and reality- Whether physics is related to experiences outside the classroom or whether it is useful to think them together)

D5: Mathematics link. (Beliefs about the role of mathematics in learning physics- Whether the mathematical formulation is just to calculate numbers or is used as a way of representing information about physical phenomena)

D6: Effort. (Beliefs about the kind of activities and type of work necessary to make sense out of physics- Whether they expects to think carefully and evaluate what they are doing based on available materials and feedback or not.)

From clusters or domains, one can extract whether their answers were favorable or unfavorable for particular domain that is for a particular cognitive belief, in reference to responses given by experts. One can gauge whether current status of students are more towards experts or towards novice like. It can be clearly seen that which particular domain was unfavorable and how much. Accordingly it is possible to suggest particular remedy in the novice like belief.

2) Brain Hemisphericity dominance test (HDT):
Hemisphere dominancy test: this is established test comprised of 50 questions with two options. A option indicates right hemisphere dominancy, B option indicates left hemisphere dominancy while selecting both options indicates the integrated hemisphere that is a person is using both hemisphere with equal intensity.

Right brain dominancy: (A): Learner is more institutive and spontaneous, and likes to communicate through visual aids. Inclined more towards simplifying the complex structures.

Left brain dominancy: (B): learners are more rational and theoretical, and like to communicate through verbal aids. Inclined more towards analyzing sequential steps and expects concrete answers.

It is very important to know the overall distribution of hemisphere dominancy amongst students for designing task of teaching and learning. But one should note that both the hemispheres are involved in thinking, logic and reasoning and in creation and appreciation of art.

Observations: Following are the observations. Note that all values are given in percentage.

Terminology:
HDT: Hemisphericity Dominance Test: A: Right Hemisphere B: Right Hemisphere I: Integrated Hemisphere

F: favorable response, U: Unfavorable response, (With reference to Expert table given in MPEX test).

D: There are in all six cognitive beliefs or domains mentioned in the MPEX test developed by Maryland Group.

Number of First year students: 41.

Number of Second year students: 41.

Number of Third or final year students: 35.

Standard	HDT			Cognitive Domains					
	A	B	I	D1 F/U	D2 F/U	D3 F/U	D4 F/U	D5 F/U	D6 F/U
F Y BSc	63	27	10	15/61	17/68	7/76	27/42	17/68	61/27
S Y BSc	70	22	7	29/51	12/81	27/68	29/27	24/61	81/10
T Y BSc	83	11	5	29/62	9/80	26/63	34/31	31/57	86/11

Analysis and Result:

1) As the students are moving from first year to final year the dominance of Right hemisphere was observed to be increasing while that of left and integrated hemisphere was observed to be decreasing amongst the students.
2) All the cognitive beliefs or domains are observed to be Novice like that is undeveloped except D6 that is domain of effort.
3) However there was marginal increase in favorable response with years in all domains except D2 domain.
4) Consider domain of Coherence, in the absence of rational and analytical thinking learners could not make one picture of nature and they continued to treat science as isolated pieces of information. As it was seen that left dominancy was decreasing with years and was affecting this belief.
5) Right brain dominancy was observed to be increasing amongst students and due to its intrinsic nature of forming holistic idea spontaneity and tendency of taking efforts in simplifying the complex structure the effort domain D6 showed excellent development that is the response was Expert like that is above 80% favorable.
6) Due to poor left brain development the other cognitive beliefs are novice like but are showing marginal improvement.
7) It should be recommended here that there should sincere effort to be taken by teacher fraternity in developing syllabus and evaluation system so that we can cultivate left brain dominancy which is very essential in learning pure science at undergraduate level.

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