

Effect of Neurocognitive Intervention Strategies on Enhancing Teaching Competency among Graduate Teacher Trainees

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Abstract This research examined the effect of neurocognitive intervention strategies on enhancing teaching competency in pre-service graduate teacher trainees. The most important task of education for the future is to improve the professional competence of the teachers. Only competent teachers will be able to relate theoretical insight to practice and to improve teacher preparation (B.Ed. course) programme. They will be effective practitioners in their profession also. Teacher education seeks to develop such competencies in the prospective teachers, It intends to increase the ability of the teachers to deal with a range of individual differences. Teachers' can facilitate a life time of successful learning by equipping students with a repertoire of strategies and tools for learning. Effective teaching depends upon the evolution of innovative strategies and also the methodology of teaching. As we gain a more scientifically based understanding about today's novel brain and how it learns, we must rethink about what we do in the classroom and school. Neuro scientists are mapping the pathways between body and brain, providing tangible evidence of the benefits of hands-on, experimental learning. Neurocognitive process includes a number of human functions through neuronal networks. The present study is undertaken to enhance core teaching competencies through neurocognitive intervention strategies.

Keywords: neurocognition, competencies, neuronal network and innovative strategies

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1. Introduction

Teacher plays a vital role in moulding the minds of the students in classroom activities. In order to bring about desirable changes in students, there has been demand for adequate number of competent and committed teachers. Therefore preparation of highly competent teachers become the priority and concern of all teacher training institutions. Teaching is a demanding profession, requiring multi-dimensional skills, patience, commitment and continuous growth to face the challenges of the present era. The term "teaching competency" as defined by Flanders and Simon includes more than mere teacher effectiveness and pupil outcomes [10]. According to Hewkew and Wilson, it includes knowledge, attitude, skill and other teacher characteristics [11,19]. Medley and Mit and Biddle perceive "teacher competence" as teacher behaviour that produces intended effects [13]. Rama gives a comprehensive definition of the term teaching - competency as the ability of a teacher manifested through a set of overt teacher classroom behavior [17]. In other words it is a set of observable teacher behaviours that bring about pupil learning. Hence for the purpose of this

study "teaching competency" would mean "effective performance of all observable teacher behaviours that bring about desired pupil outcomes".

Teaching Competency is the competency of the teachers and their planning and preparation of lessons for teaching, class room management, knowledge of subject, interpersonal relationship, attitude towards the children, usage of teaching aids and time management during their teaching - learning.

Neurocognitive process includes a number of human functions through neuronal networks. Brain cells communicate with each other through electrochemical process. Neurocognition includes perceiving, recognizing, conceiving, judging and reasoning processes. The neurocognitive approach is based upon certain irrefutable facts concerning brain function, which are applied to the intervention strategies of student teacher's developmental difficulties. The teachers must develop the competencies like content competency, contextual competency, communication competency, classroom management and evaluation competency.

Neurocognitive functions are cognitive functions closely linked to the function of particular areas, neural pathways, or cortical networks in the brain substrate layers of neurological matrix at the cellular molecular level.

Therefore, their understanding is closely linked to the practice of neuropsychology and cognitive neuroscience, two disciplines that broadly seek to understand how the structure and function of the brain relates to perception defragmentation of concepts, memory embed, association and recall both in the thought process and behaviour [8]. Naturally, the learning process depends on the effective

functioning of the brain. Clearly, teaching will be more effective if it uses methods which are aligned with how the brain best attends to understand and retain information [12]. Teaching learning process is concerned with the functioning of the brain that facilitates information processing, restoration and retrieval.

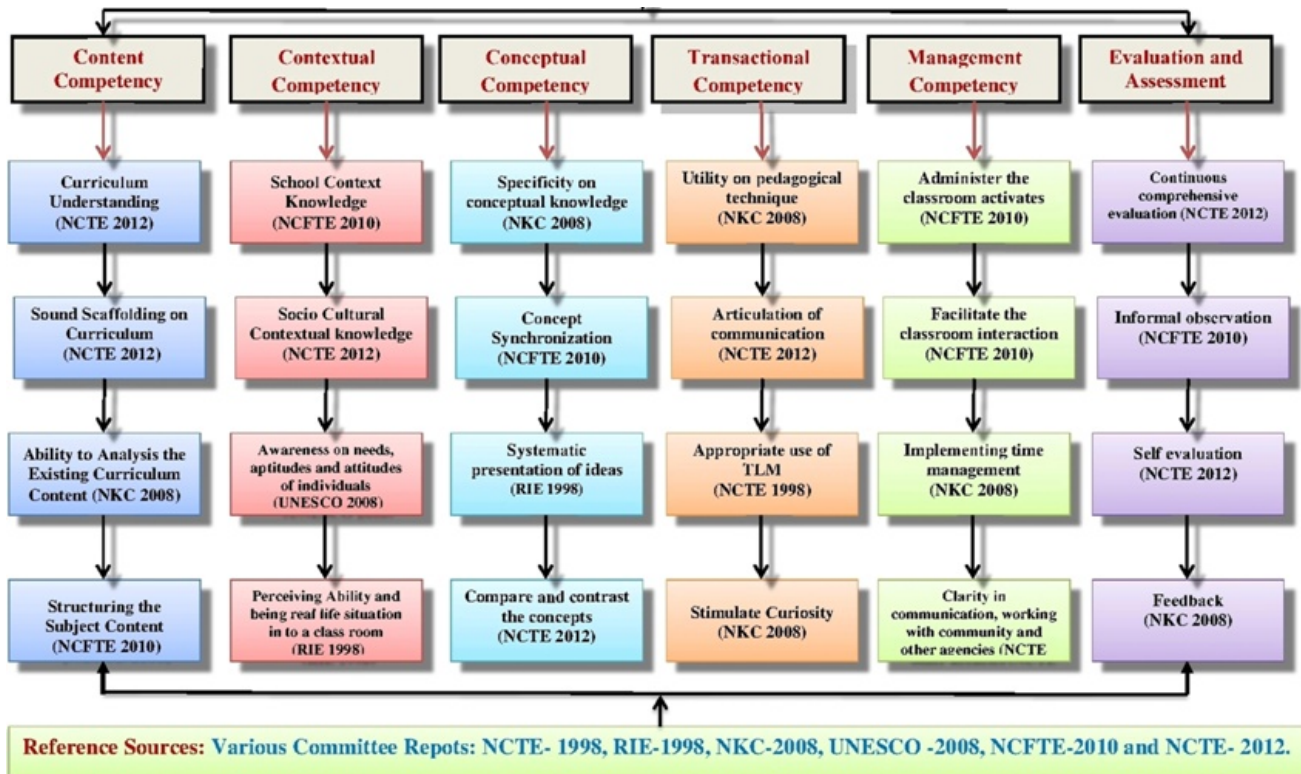


Figure 1. Teaching competency frame work

The appeal of Competency- Based Teacher Education is in its emphasis on pragmatism in determining the content of Teacher Education Programmes, its potential for improvement through preparing teacher [1]. The basic Concepts are simple and straight forward. Programme requirements are derived from and based on the practice of effective teacher. This contrasts sharply with approaches where the content of the behavioural sciences such as Psychology and the structure of academic disciplines such as mathematics are used to determine content and organization of teacher education [2].

Teachers must take the initiative to strengthen and improve the teaching profession on a daily basis and support its high standards. The professionally dynamic teacher alone can keep pace with the latest developments in education in general and in his/her own subject in particular. Only such teachers can fulfil the demands of the ever changing society and an ever-growing nation. On the caliber of the teacher depends the success with which new methods are employed and adopted. The term "Teacher education" is more comprehensive and has deeper implications. Teacher education is concerned with equipping the future teachers.

2. Review of Related Literature

Carl Pacifico (2004), Gerard E. Hogarty, (2004), David E. Gard et.al., (2009), Raymond CK Chan et.al., (2011),

Dolors Girbau (2007), Martin and David (1997), Brenda Milner et al., (1998), Kalondr and Cynthia (1997), Hains and Anthony (1997), Marie T. Banich (2009) Elizabeth A Phelps (2004), David W. Green (2002), Ananthi.A And Mohan.S (2011) Investigated on neurocognitive domain process, thinking process, sensory association process, auditory monitoring, visual recognition, cognitive association, cognitive articulation, emotional regulation and memory retention and on the Neurocognitive strategies to facilitate the ability to promote the successful listeners.

Safdar Rehman (2013), Michael M. Patte (2011). Lucdeman, John K. et al.(2003) Natarajan (1984) Rajameenakshi (1988), Hairul Nizam Ismail et al.,(2009), Gulcan Mihladiz et al., (2011), Dilshad Akber Ali and Dilshat Bano (2013), Paramasivam (1997), Ebrahim Ali (2004), Abdulghani Mutahar Alnoor and Ma Hongyu (2011), Isil Kabakci Yurdakul (2011) investigated skill based training on independent teaching skills, language and arithmetic skills, self guidance approach by using motivational strategies to promote the efficacy of intervention towards developing the content, contextual, conceptual, transactional, management and evaluation competency among pre-service teacher competence and teacher effectiveness.

From the literature survey, the researcher observes that adequate research focus has not been give to the impact of Neurocognitive strategies developing teaching competency. The effect of Neurocognitive intervention

strategies in relation to teaching competency especially for B.Ed. students remains an unexplored area. This research gap was identified by the investigator and an attempt was made in these lines for the present investigation. The researcher has framed the topic for research thus “Effect of Neurocognitive Intervention Strategies in Enhancing Teaching Competency among graduate teacher trainees”. Having chosen the topic, he has prepared a conceptual framework which spells out the arena of research.

3. Neurocognitive Intervention Strategies

In this present study the investigator selected eight strategies based on the literature survey and on the concept of neuro education, such as sensory association, information sequencing, visual recognition, auditory monitoring, scaffolding and decoding, emotional regulation, cognitive association and cognitive verbal articulation.

As far as teaching learning process is concerned, the functioning of the brain facilitates information processing, restoration and retrieval. The teachers should be fully aware of all the brain functions to make their teaching effective. Also they should be aware of the factors like Instructional procedure, model using the strategy, think aloud, start with simplified materiel, complete part of the task for the students, present material in small steps, anticipate student errors and difficult areas, provide models of expert work, suggest fix up strategies, increase students responsibility influencing in teaching competency. If the teacher follows some of the neurocognitive practices such as affective education, relaxation training, cognitive restructuring, attribution retraining, problem solving, contingent reinforcement, neural modeling, neural plasticity, neural rewiring, neural firing, neural tuning and emotional integration to improve their efficiency, it will

definitely help them to take their roles confidently in enhancing their teaching competency in the classroom situation.

From the ideas presented in the review literature and conceptual framework, it would be clear that the application of neurocognitive intervention strategies particularly sensory association, visual recognition and emotional regulation strategies would enhance the management competency, transactional competency and conceptual competency.

4. Research Architecture

The objectives set by the investigator were based on the research questions and assumption of the research study. It was also aimed to identify the Neurocognitive strategies that enhance the competency in teaching science and there by to apply the NCIS model to the Graduate Teacher Trainees. Further, the intention of the investigator was to find out the effect of application of the Neurocognitive intervention strategies on teaching competency among the Biological and physical science optionals student teachers. Following were the objectives of the research.

1. To assess the level of teaching competency in science among the Graduate Teacher Trainees.
2. To identify the Neurocognitive Intervention strategies that would enhance the competency in teaching in science among Graduate Teacher Trainees.
3. To develop and implement the Neurocognitive intervention strategies to the Graduate Teacher Trainees to enhance the teaching competency in science.
4. To find out the effect of Neurocognitive intervention strategies on teaching competency in science among Graduate Teacher Trainees.

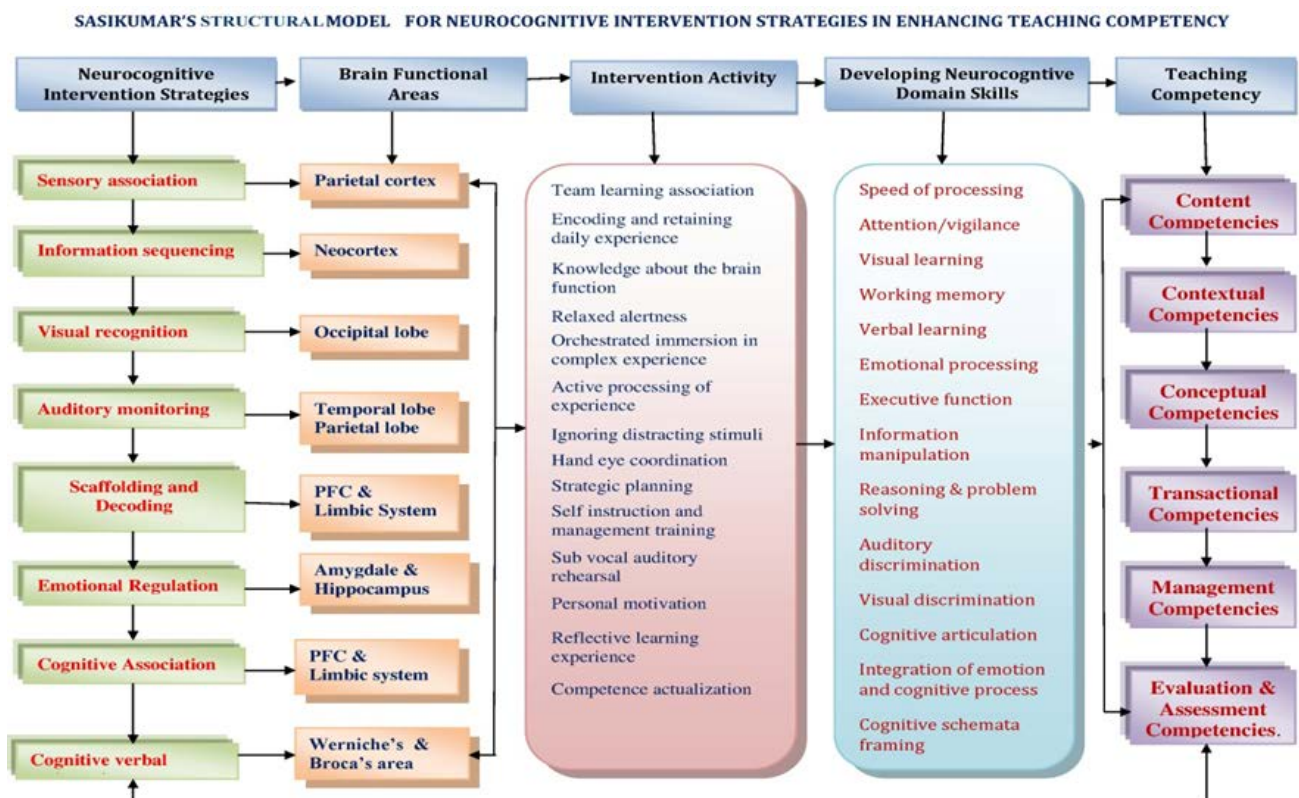


Figure 2.

Sasikumar's Functional Model for Neurocognitive Intervention Strategies in Enhancing Teaching Competency

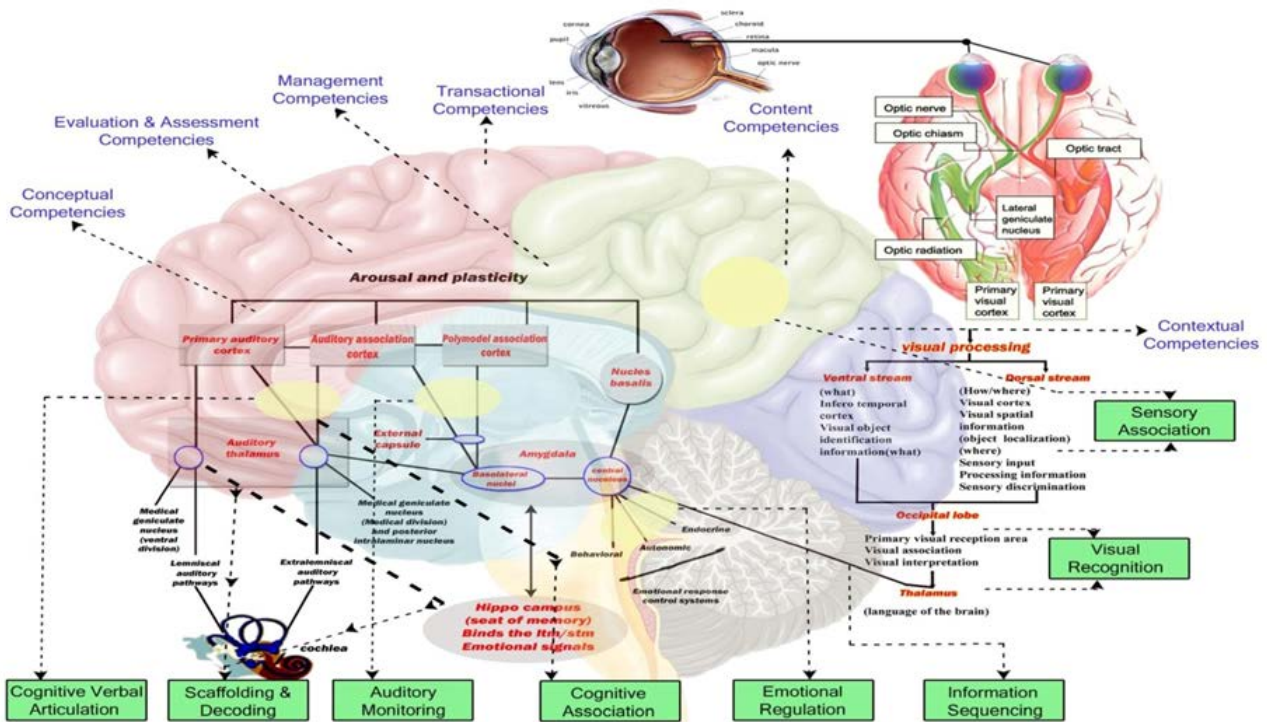


Figure:3.5

Reference: Tanaka (1991), Moshe Bar (2003), Gross and Thompson (2007), Diamond (2002), Ochsner & Gross (2007), Harris (2005), Buzsaki (2004), Antony Wright (1997).

Figure 3.

Following hypotheses were formulated in this research work.

1. There will be significant mean difference between the pre assessment and progressive assessment scores on teaching competency in science among the Graduate Teacher Trainees.
2. There will be significant mean difference between the progressive assessment and post assessment scores on teaching competency in science among the Graduate Teacher Trainees.
3. There will be significant mean difference between the pre and post assessment scores on teaching competency in science among the Graduate Teacher Trainees.
4. There will be significant mean difference between the pre assessment and post assessment level of the Neurocognitive Intervention Strategies among the Graduate Teacher Trainees.

Experimental method was adopted. The present investigation was conducted in Bharath college of Education, Thanjavur, Tamil Nadu, South India. All the 21 B.Ed. (06 Biological science & 15 Physical science) Trainees of Biological science & Physical science optional formed the sample of the study. Single-group pre-assessment – treatment- post-assessment design was followed in this study. In a single-group experiment, a pre-test and a post-test are given to one group to measure the effect of an intervention, without involving a control group. A single case is observed at two time points, one before the treatment and one after the treatment. Changes in the outcome of interest are presumed to be the result of the intervention or treatment.

The researcher constructed the tool for independent variable Neurocognitive intervention strategies (NCIS) and dependent variable Teaching competency (TC). NCIS scale contains 30 statements in eight categories of four point scale with minimum 0 and maximum score 3. Teaching competency scale contains 55 statements in six dimensions of four point scale with minimum 0 and maximum score 3. The researcher validated the tool by used Cronbach's Alpha method for reliability. The value of reliability in Neurocognitive Intervention Strategies scale was 0.83 and Teaching Competency scale was 0.96. NCIS and TC tools were validated by content validity and face validity based on review literature.

These two variables were assessed before the treatment. During the treatment the progressive assessment in teaching competencies assessed by self and investigator were also carried out. After the treatment was over, post assessment was completed by the investigator.

The data was collected from Pre, progressive and post assessment and analyzed in two phases namely, parametric analysis and non-parametric analysis. In the present study, parametric analysis was applied to find out the effect of neurocognitive intervention strategies on enhancement of the teaching competency. As the sample was small in the study, the investigator also applied the non parametric analysis for further consolidation. The Non Parametric Analysis like Kruskal Wallis one way ANOVA, Mann Whitney 'U' test, Omega square ω^2 , Effect Size and Gain Ratio were also done to confirm the same. The delimitation in this research work. In the present study, only Graduate Teacher Trainees – who opted biological science and physical science as their

optional subjects were selected. The experiment was spread over for a period of three months. Neurocognitive Intervention Strategies were adopted to develop teaching competency in the form of programmes in the classroom.

This study is confined only to Bharath college of education, Thanjavur, Tamil Nadu, South India.

5. Results

Table 1. Mean and Standard Deviation scores on “Teaching Competency” (Max Mark: 165) (Percentage in parenthesis)

S.No	Teaching Competency	Self Assessment		Investigator Assessment	
		Mean	SD	Mean	SD
1.	Pre assessment	45.76 (27.73)	14.79	45.65 (27.63)	13.69
2.	Progressive assessment	72.28 (43.80)	19.42	72.90 (44.18)	18.27
3	Post assessment	128.29 (77.74)	17.05	128.81(75.64)	11.95

The mean scores on teaching competency in post assessment and progressive assessment are greater than the mean score on teaching competency in pre assessment of self and investigator assessment. The increase in the

mean score shows the effectiveness of Neurocognitive Intervention Strategies (NCIS) in improving teaching competency.

Table 2. Mean Scores of Pre, Progressive and Post Assessments on dimensions of Teaching Competency (Percentage in parenthesis)

S.No	Dimensions	Max Score	Self Assessment			Investigator Assessment		
			Pre Assessment	Progressive Assessment	Post Assessment	Pre Assessment	Progressive Assessment	Post Assessment
1.	Content Competency	27	6.95(25.74)	11.80(43.05)	20.85(76.04)	6.86(25.64)	11.80(43.73)	20.28(75.13)
2.	Contextual Competency	27	7.47(27.68)	11.47(42.48)	21.71(80.42)	7.47(27.68)	11.47(45.50)	21.52(79.71)
3.	Conceptual Competency	21	5.19(24.71)	9.57(45.57)	15.80(75.28)	5.19(24.69)	9.57(45.57)	15.71(74.82)
4.	Transactional Competency	30	8.33(27.77)	12.85(42.85)	23.71(79.04)	8.42(28.09)	12.85(42.85)	23.00(76.66)
5.	Management Competency	33	9.71(29.43)	14.76(44.73)	25.42(77.05)	9.47(28.71)	14.66(44.44)	24.19(73.30)
6	Evaluation and Assessment competency	27	8.09 (29.98)	11.80(43.73)	20.76(76.89)	8.23(30.51)	12.52(46.38)	20.09(74.42)

The pre assessment mean score in “Evaluation and Assessment competency” is comparatively greater than other dimension in self and investigator assessment. The progressive assessment mean scores in “Conceptual Competency” dimension is comparatively greater than other dimensions by self and investigator assessment. The post assessment mean score in “Contextual and Transactional competency” dimension is comparatively greater than other dimensions. It shows that the evidence

of reflection on Neurocognitive Intervention. There is a continuous increase in the mean score in all the dimensions of teaching competency it is evident that the Neurocognitive Intervention Strategies are effective for the continual development.

The mean scores on all the dimensions of teaching competency in post assessment are greater than the mean score on dimensions of teaching competency in pre and progressive assessment.

Table 3. Mean and Standard Deviation scores on “Neurocognitive Intervention Strategies” (Max Mark: 90) (Percentage in parenthesis)

S.No	Neurocognitive Intervention Strategies	Self Assessment		Investigator Assessment	
		Mean	SD	Mean	SD
1.	Pre assessment	23.23 (25.82)	7.78	24.09 (26.77)	7.38
2.	Progressive assessment	36.19 (40.21)	12.97	36.90 (41.05)	11.62
3	Post assessment	69.57 (77.30)	9.20	67.61 (75.13)	9.27

The mean scores on Neurocognitive Intervention Strategies in post assessment and progressive assessment are greater than the pre assessment mean scores. It reveals

that there is an enhancement in transformation of neurocognitive process.

Table 4. Mean Scores of Pre, Progressive and Post Assessment of “Neurocognitive Intervention Strategies” (Percentage in parenthesis)

S.No	Dimension	Max Score	Self Assessment			Investigator Assessment		
			Pre-Assessment	Progressive Assessment	Post-Assessment	Pre-Assessment	Progressive Assessment	Post-Assessment
1.	Sensory Association	09	2.76 (30.68)	4.28 (47.61)	6.95 (77.24)	2.76 (30.68)	4.14 (46.03)	6.90 (76.71)
2.	Information Sequencing	12	2.52 (21.03)	4.28 (35.71)	9.47 (78.96)	2.90 (24.20)	4.66 (38.88)	8.66 (72.22)
3.	Visual Recognition	12	2.33 (19.44)	4.71 (39.28)	9.61 (80.15)	2.61(21.82)	4.57 (38.09)	9.23 (76.92)
4.	Auditory Monitoring	09	2.38 (26.45)	3.71 (41.26)	7.52 (83.59)	2.42 (26.98)	4.00 (44.44)	7.33 (81.48)
5.	Scaffolding and Decoding	15	4.28 (28.57)	6.19 (41.26)	11.00 (73.33)	4.38 (29.20)	6.00 (40.00)	11.00 (73.33)
6	Emotional Regulation	15	3.95 (26.34)	6.00 (40.00)	11.66 (77.77)	4.04 (26.98)	6.28 (41.90)	11.32 (76.82)
7	Cognitive Association	09	2.47 (27.51)	3.85 (42.85)	6.76 (75.13)	2.42 (26.98)	3.85 (42.85)	6.61 (73.54)
8	Cognitive Verbal Articulation	09	2.52 (28.04)	3.14 (34.92)	6.57 (73.05)	2.52(28.04)	3.38 (37.56)	6.33(70.37)

The progressive assessment mean scores in “Cognitive Association” strategies is comparatively greater than other strategies in self and investigator assessment. The post assessment mean scores in “Auditory Monitoring” and “Visual Recognition” Strategies is comparatively greater than other strategies in self and investigator assessment. There is a continuous increase in the mean scores in all the Neurocognitive Intervention Strategies. It reveals that the improvement may be due to the application of Neurocognitive Intervention Strategies.

- There are significant mean differences between pre-progressive, progressive-post and pre-post assessment scores on teaching competency and neurocognitive intervention strategies in self and investigator assessment. It may be due to the percolation of neurocognitive intervention strategies from pre to post assessment on teaching competency.
- The relationship analysis indicates the significant relation between self and investigator assessment on teaching competency and neurocognitive intervention strategies.
- All kinds of non parametric analysis like Kruskal-Wallis ‘H’ test, Mann Whitney ‘U’ test, Omega Square, Effect Size and Gain Ratio reflect on considerable improvement from pre to post assessment scores on teaching competency and neurocognitive intervention strategies. This improvement reflects the role of neurocognitive intervention strategies on enhancing the teaching competency.

6. Educational Implication

The findings reveal that it is possible to facilitate the pedagogical components under teaching competency by making use of the corresponding elements of Neurocognitive intervention strategies such as clarifying the information, familiarizing the content, appropriate learning activities and giving guided practice etc. These are brought out by match setting and instruction, Mind Mapping, Visual perception, cognitive articulation and registering & retrieving process of neural networks. This was made possible by activation by matching embedded facts and beliefs under neurological perspective of retention and retrieval process.

The B.Ed. students should be given training in neurocognitive intervention strategies which are needed to be practiced in classroom. Thus, brain compatibility process may be activated to enhance teaching competency.

The investigator suggests that the following recommendation for NCTE, NCERT and other educational bodies may be implemented to improve the teaching competency of B.Ed. student teachers.

1. The influence of Neurocognitive intervention strategies is found to be effective in enhancing competence in teaching science. Hence, the student teachers of colleges of education could be asked to practice Neurocognitive intervention strategies to enhance their competence in teaching science.
2. Theoretical aspects of Neurocognitive intervention strategies can be introduced as a unit

of the core subject in the B.Ed. curriculum (core subject-teaching-learning process)

3. The practical inputs regarding Neurocognitive intervention strategies should be taken up through subject specific programmes such as lesson plan writing, observation classes and practice teaching.
4. The Neurocognitive intervention strategies can be tried at various levels and also at in-service teacher programmes and distance teacher education programme.

7. Suggestions for Further Research

To extend the scope of the research findings of this study, the following suggestions are given for further research.

1. The present study was confined only to the sample of Graduate Teacher Trainees, Bharath college of education, Thanjavur. It is suggested that the above study may be undertaken with other colleges of Education Graduate Teacher Trainees.
2. The present investigation was carried out to find out the effect of Neurocognitive intervention strategies on teaching competency in science as an optional subject (Physical Science and Biological Science). It could be replicated with other optional subjects such as teaching competency in social studies, mathematics etc. And also, it could be replicated with other variables namely personality, motivation and cognitive style of learning etc.,
3. Separate study for boys and girls may be carried out with different age group.
4. The present study was conducted for two months; a longitudinal study of the same type can be undertaken.
5. The applicability of Neurocognitive intervention strategies on improving teaching competencies of university and college teachers can be attempted.

8. Conclusion

The contextual competency could be developed by the stimulation of auditory monitoring strategies. This strategy activates the sensory receptors for long term memory.

The transactional competency could be developed by the activation of visual recognition strategies. This strategy focuses on retrospective visual monitoring and cognitive schemata formation.

The management competency could be developed by the articulation of scaffolding and decoding strategies. These strategies facilitate cognitive articulation, registering and retrieval from short term to long term memory.

The evaluation and assessment competency could be developed by the activation of sensory association and cognitive association strategies. These strategies enhance self evolution and open mindedness.

The content competency could be developed by the influence of information sequencing and scaffolding and

decoding strategies. These strategies facilitate the reception of stimulation and sensory information sequencing.

The conceptual competency could be developed by the facilitation of cognitive verbal articulation strategies. These strategies reflect the modulation of neural representation and reasoning.

This research identifies the influence of Neurocognitive intervention strategies on developing teaching competency profiles of Graduate Teacher Trainees. These neurocognitive intervention strategies will surely help the Graduate Teacher Trainees to develop the competency profiles though there is no specific earmark exclusive strategies for the particular specific competency on all occasions. Teacher educators should equip themselves to develop a “strategies framework template” for utilizing neurocognitive intervention strategies for developing competency at different situations. Brain based learning envisages the role of neurocognitive intervention strategies on developing different competencies on different occasions. The investigator suggests that, this experiment will definitely help the future teachers to take their roles confidently by enhancing their teaching competency in the classroom situation.

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