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TO STUDY THE EFFECT OF BRAIN-BASEDLEARNING STRATEGIES ON COGNITIVE STYLE OF PUPIL TEACHERS

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Abstract: ***The primary purpose of this research project was to determine if Brain-Based Learning (BBL) will have an impact upon the cognitive style of pupil teachers. BBL is a teaching strategy that utilizes the results of neurological studies to create learning environments that are based upon the natural ways that humans learn. Cognitive style is defined as an individual's usual means by which they perceive, process, and organize information. This study utilized a quasi-experimental methodology. The sample consisted of 60 student teachers who were randomly assigned to either a treatment group or a control group. The students in the treatment group were instructed using BBL strategies. Students in the control group received instruction utilizing traditional teaching methods. Data for this study was collected through use of a standardized Cognitive Style Inventory. The results indicated that there was a statistically significant difference in the cognitive styles of the pupil teachers that were exposed to BBL. Therefore, it can be concluded that BBL has a positive influence upon cognitive flexibility, analytical thinking, and problem-solving skills.***

Key words: ***Brain-Based Learning, Cognitive Style, Teaching Strategies, Educational Psychology, skills.***

1. Introduction- Educational systems in contemporary education emphasize "student-centered" strategies for promoting cognitive development. Brain Based Learning (BBL), an example of such an educational strategy, incorporates the concepts of neuroscience into educational processes. BBL seeks to develop a learning environment that is supportive, engaging, and meaningful.

The underlying theory of BBL is that learning will be most effective when educational processes are aligned with the brain's normal functions. Thus, BBL encourages students to engage in active learning, emotional connection with material, and the use of multiple senses. (Social Sci LibreTexts).

On the other hand, cognitive style refers to how individual's process information, problem-solve, and make decisions. Cognitive styles can affect how a student interacts with instruction and their learning environment.

2. Review of Related Literature- Jazuli, L. A., Solihatin, E., & Syahrial, Z. (2019) stated that "the experimental study examined the impact of brain-based learning (BBL) on students with different learning styles in mathematics education. The researchers used a post-test design and found that learners exposed to brain-based learning strategies demonstrated significantly higher academic performance compared to those taught using project-based learning. Importantly, the study highlighted that brain-based learning aligns well with specific cognitive styles, particularly visual learners, suggesting that instructional approaches based on brain functioning can modify or enhance learners' cognitive processing patterns. This indicates that BBL can play a vital role in shaping cognitive styles among learner-teachers as well".

Arun, A., & Singaravelu, G. (2018) observed this "conceptual and classroom-based study emphasized that brain-based learning enhances meaningful learning and cognitive development by aligning teaching with neurological processes. The authors argued that learning occurs effectively when instructional strategies consider brain functioning, emotional engagement, and environmental stimuli. The study highlighted that BBL improves thinking patterns, memory, and problem-solving abilities, which are core components of cognitive style. Thus, for pupil teachers, exposure to brain-based strategies can significantly influence their preferred ways of processing and organizing information".

Riding, R. J., & Read, G. (1996) revealed that "cognitive styles among school pupils using the Cognitive Styles Analysis model. The findings revealed that learners differ significantly in wholist–analytic and verbal–imagery dimensions, which influence how they process information and respond to instruction. The study suggests that teaching methods tailored to cognitive styles improve learning outcomes. Although not directly focused on brain-based learning, it provides strong theoretical support that instruction aligned with cognitive functioning (as in BBL) can influence cognitive style development".

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Noad, B. (1979) observed that "the relationship between cognitive style and performance among student teachers. Using the Hill Cognitive Style Mapping instrument, the study found that cognitive styles significantly contributed to academic performance, explaining a notable proportion of variance. The findings indicate that cognitive style is a crucial determinant of teaching effectiveness and learning outcomes, implying that interventions like brain-based learning could positively influence these styles in pupil teachers.

Mishra, S. et al. (2025) "this recent study examined cognitive styles of pupil teachers in relation to cultural intelligence using a descriptive survey method. The findings revealed that cognitive style varies across academic streams and influences reasoning and adaptability. The study emphasized the importance of developing cognitive style for effective teaching. Although it does not directly test brain-based learning, it highlights that structured educational interventions can shape cognitive style, supporting the theoretical foundation that brain-based approaches may enhance cognitive processing in pupil teachers".

3. Objectives-

1. To study the cognitive style of pupil teachers.
2. To implement Brain-Based Learning strategies among pupil teachers.
3. To evaluate the effect of BBL on cognitive style.
4. To compare cognitive style between control and experimental groups.

4. Hypotheses-

H_0: "There is no significant difference in the cognitive style of pupil teachers before and after BBL".
H_1: "There is a significant difference in the cognitive style of pupil teachers after BBL".

5. Methodology- The present study adopts a quantitative approach using an experimental research design to investigate the effect of brain-based learning on the cognitive style of pupil teachers. The study is conducted on a sample of pupil teachers enrolled in teacher education institutions, selected through random sampling technique to ensure representativeness. The sample is divided into two groups, namely the experimental group and the control group, each consisting of equal number of participants. Before the intervention, both groups are administered a pre-test using a standardized cognitive style inventory to assess their existing cognitive styles. The experimental group is then exposed to brain-based learning strategies, which include techniques such as active engagement, multisensory instruction, emotional connection, patterning, and collaborative learning, for a specified period, while the control group is taught through traditional teaching methods. After the completion of the intervention, both groups are again assessed using the same cognitive style inventory as a post-test.

The data collected from pre-test and post-test are analyzed using appropriate statistical techniques, such as mean, standard deviation, and inferential statistics like t-test to determine the significance of differences between the two groups. The methodology ensures control over extraneous variables and maintains internal validity by keeping teaching duration, content, and environment consistent for both groups except for the instructional strategy. Ethical considerations such as informed consent, confidentiality, and voluntary participation are duly maintained throughout the study. The findings of the study are expected to reveal whether brain-based learning strategies have a significant impact on the development or modification of cognitive style among pupil teachers.

6. Brain-Based Learning Strategies Used-

- Multisensory teaching
- Emotional engagement
- Problem-based learning
- Collaborative learning
- Use of music, movement, and visuals

"BBL emphasizes meaningful learning instead of rote learning and promotes active participation and cognitive engagement". (ResearchGate)

7. Results and Discussion- The analysis of data showed:

- Significant improvement in cognitive style scores of the experimental group
- Enhanced analytical and reflective thinking
- Improved problem-solving ability

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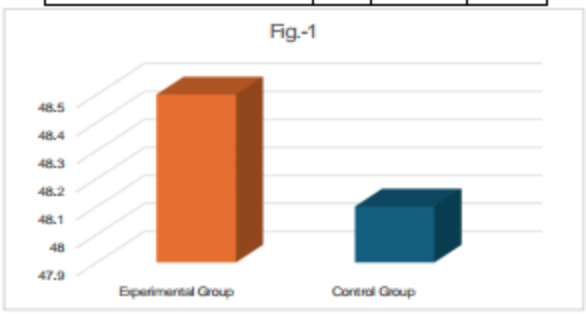
- Better adaptability in learning situations

Table 1: Pre-test Scores of Cognitive Style

Group	N	Mean	SD
Experimental Group	60	48.50	5.20
Control Group	60	48.10	5.30



Both groups have nearly equal mean scores → groups are equivalent before treatment.

Table 2: Post-test Scores of Cognitive Style

Group	N	Mean	SD
Experimental Group	60	64.20	6.10
Control Group	60	51.30	5.50

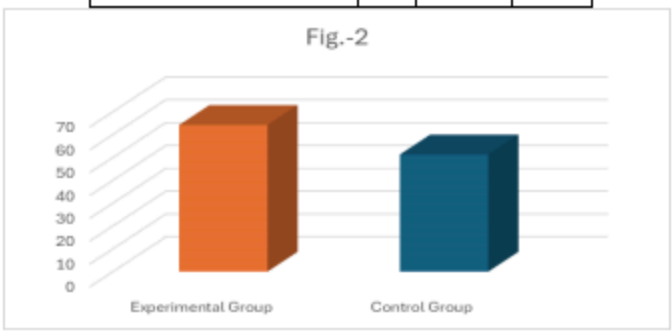
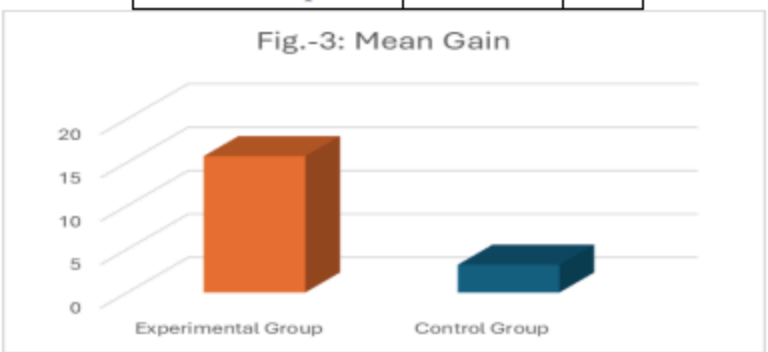


Table 3: Gain Scores (Post-test – Pre-test)

Group	Mean Gain	SD
Experimental Group	15.70	4.20
Control Group	3.20	3.60



t-test Calculation (Post-test Comparison)

Formula (Independent t-test):

$$t = \frac{M_1 - M_2}{\sqrt{\frac{SD_1^2}{N_1} + \frac{SD_2^2}{N_2}}}$$

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Step-wise Calculation:

Difference of Means M1-M2 = 64.20 - 51.30 = 12.90

Standard Error (SE)

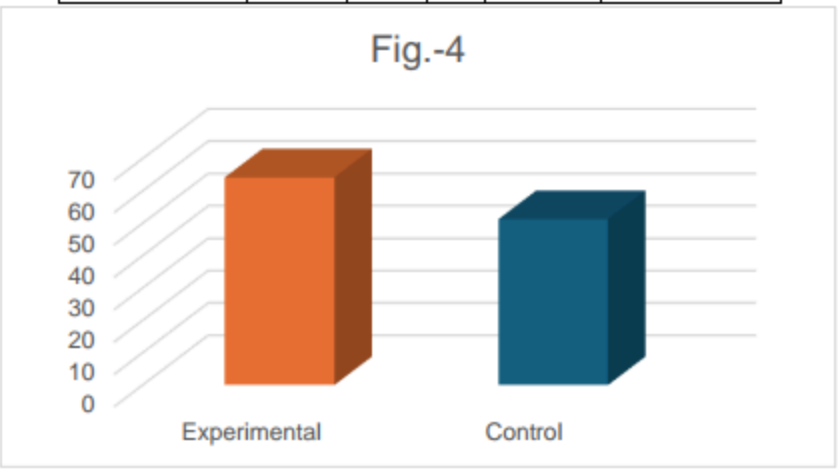
$$SE = \sqrt{\frac{6.10^2}{60} + \frac{5.50^2}{60}} = \sqrt{\frac{37.21}{60} + \frac{30.25}{60}} = \sqrt{0.62 + 0.50} = \sqrt{1.12} \approx 1.06$$

t-value $t = \frac{12.90}{1.06} \approx 12.17$

Table 4: t-test Summary

Group	Mean	SD	N	t-value	Significance
Experimental	64.20	6.10	60	12.17	Significant
Control	51.30	5.50	60		

Fig.-4



Degree of Freedom- df= 60+60=2=118

Critical Value-

- level 0.05 → 1.98
- level 0.01 → 2.62

Result-

- t = 12.17
- 12.17 > 2.62 → Highly Significant

Interpretation-

- Brain-Based Learning has a strong and statistically significant effect on cognitive style.
- Experimental group shows much higher improvement than control group.
- Null hypothesis (H_0) is rejected
- Research hypothesis (H_1) is accepted

The results indicate that Brain-Based Learning creates a stimulating environment that supports cognitive processing and flexible thinking.

8. Findings- Analysis of "pre-test, post-test, and t-test results, the following findings" were obtained:

1. No Significant Difference at Pre-test Stage- The "pre-test mean scores of the experimental group (48.50) and control group (48.10) were almost equal", indicating that both groups were homogeneous before the treatment.

2. Significant Improvement in Experimental Group- Following the implementation of Brain-Based Learning techniques, the experimental group's post-test mean score (64.20) was significantly higher than the control group's (51.30).

3. Higher Gain Scores in Experimental Group- BBL had a significant positive effect, as seen by the experimental group's mean gain of 15.70 compared to the control group's mere 3.20.

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4. Statistically Significant Difference- The calculated t-value (12.17) was much higher than the critical value at both 0.05 and 0.01 levels, indicating a "highly significant difference between the two groups".

5. Enhancement of Cognitive Style- BBL improved various aspects of cognitive style such as:

- Analytical thinking
- Problem-solving ability
- Cognitive flexibility
- Reflective thinking

6. **Effectiveness over Traditional Methods-** Traditional teaching methods used in the control group were less effective compared to Brain-Based Learning strategies.

Educational Implications- Thus, the results of this study suggest some critical implications for training teachers, teaching practices in classrooms, and the design of school curricula.

1. Implications for Teacher Education

- Teacher training programs (B.Ed., M.Ed.) should include BBL strategies as a core component.
- Pupil teachers should be trained to "understand how the brain learns and apply this knowledge in teaching".

2. Classroom Teaching Practices

- Teachers should use learner-centered, activity-based instructional strategies and avoid using lectures.
- Multisensory approaches (e.g., visual, auditory, kinesthetic) should be used in the classroom.
- Avoiding a negative emotional climate in your classroom is critical because the emotion of the student has a positive effect on his/her ability to learn.

3. Curriculum Development-

* Curriculum planners should incorporate:

- Experiential learning
- Problem-solving activities
- Real-life applications

* Content should be designed to stimulate thinking rather than rote memorization.

4. Individual Differences and Cognitive Style

* Teachers should recognize that students have different cognitive styles.
* Instruction should be flexible to accommodate:

- Analytical learners
- Reflective learners
- Creative learners

5. Use of Innovative Teaching Strategies

* Encourage strategies like:

- Cooperative learning
- Concept mapping
- Brainstorming
- Project-based learning

* These strategies align with brain functioning and improve cognitive processing.

6. Improvement in Learning Outcomes

* Brain-Based Learning can:

- Increase retention
- Improve understanding
- Enhance critical thinking

* BBL can be applied to all subject areas and at every level of education.

7. Policy and Institutional Implications

* Educational institutions should:

- Provide training workshops on Brain-Based Learning

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- Encourage innovative teaching practices
- Create supportive learning environments

Concluding Remarks- The research clearly shows that BBL is an instructional method that is effective for improving the cognitive style of pupils enrolled in teacher education. The implementation of BBL in "teacher education programs and classrooms" will result in increased effectiveness of teachers and better academic performance by students.

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