INCREASING LONG-TERM RETENTION AND PERFORMANCE USING BRAIN-BASED LEARNING

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Abstract

This study explores the craze for brain-based learning founded on the neurophysiological underpinnings and claims about value-laden knowledge. It makes the case that brain research can foster adequate understanding. It also analyses whether there is any scientific backing for the concept that learning is affected by brain research. The main goal of the essay is to demonstrate how knowledge of the brain can improve understanding. The study also looks at how individual learning problems might be revealed through brain research. A pretest, posttest, and quasi-experimental design were used in this investigation. In a higher education setting, students from the researcher's institution in India were divided into two groups: those who employed brain-based learning and the control group, which used traditional knowledge. Both groups received a quasi-experimental procedure 6-week intervention programme. BBL students achieve superior learning results.

Key words: *Applied Psychology, Cognition, Instructional Design, Learning outcomes.*
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Introduction

It is a simple fact that knowledge retention will enhance if brain-based learning is implemented. Additionally, academic performance will increase. We know that brain-based learning techniques impact more than just the skills our learners acquire. Further, they can influence social and emotional growth and boost attitude and motivation. The study aims to find the answer to the following research question.

How should educators be more intentional in implementing brain-based learning strategies?

Brain-Based Teaching Approaches

Brain-based learning produces curricula and lesson plans that are informed by neuroscience. The BBL results inrapid and practicalknowledge. According to Education Reform, the research that underpins this approach focuses on the brain's capacity to alter, remap, and reorganise itself as a person learns new information. "BBL aims to develop an atmosphere in the classroom where each student can succeed. It has been demonstrated that using brain-based learning strategies improves students' retention of information, desire, and mindset. Students who comprehend how connecting ideas expand their mental capacity are frequently more eager to study and more adept at remembering. The ability of the brain to adapt and change, or versatility, is developed through brain-based learning."

(Kohar, 2022). The researcher created the following brain-based exercises depicted in figure 1.

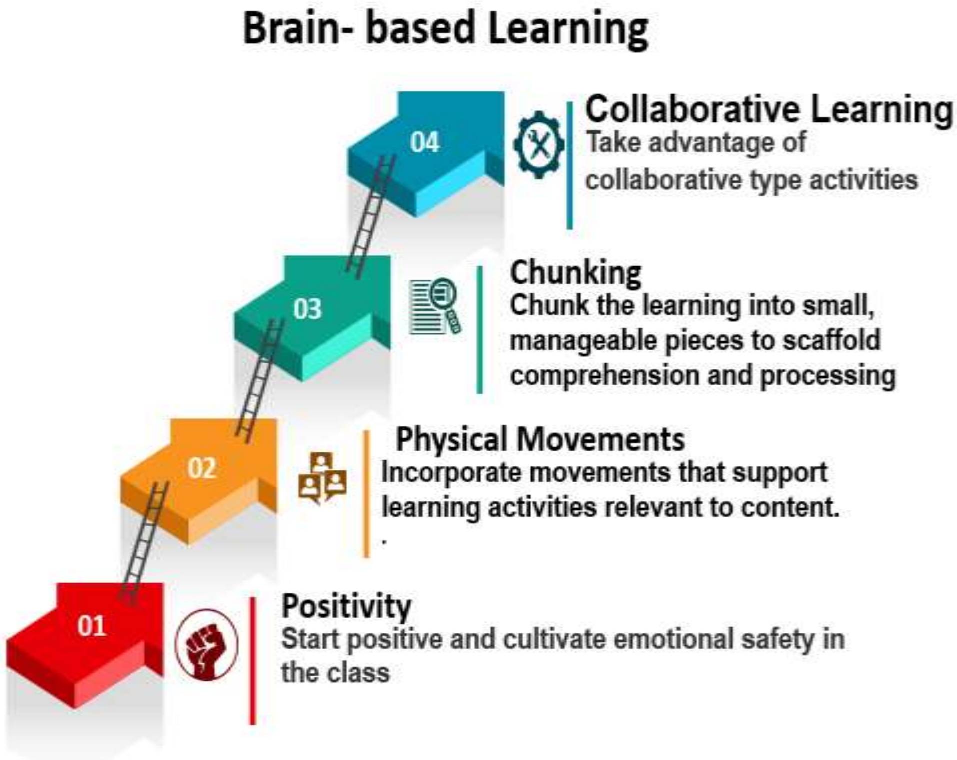

Figure-1
BBL stages designed by the researcher

The underlying premise of brain-based learning and assessment is that education and evaluation should be informed by neuroscience research. "The critical components of ideal teaching were stated as being inseparable. The perfect emotional and social context for learning is relaxed alertness, which fosters complex social interactions in a challenging but safe environment. It provides learners with rich, complicated, and realistic experiences giving them time and space to reflect on, find, and construct meaningful relationships in how things relate. Presenting practical tutorials are examples of incited immersion in the complex experience throughout the process. Some of the fundamental premises of BBL are it fosters active processing,constructing, elaborating, and consolidating learning through dynamic, continuing processing of events and changes. Some people think that examining brain activity might better understand how people know" (Arnekrans et al., 2018).

The necessary skills have dramatically developed with the introduction of technology-based teaching methods. They are highly specialised and technical. "It has recently been fashionable to discuss "brain-based learning" and to make educational proposals seem more persuasive by citing purportedly relevant studies about how the brain works. Given this, it is critical to consider how much brain science can advance our perception of learning" (Boals & Banks, 2020).Therefore, an empirical finding would be necessary for a complete response. Consequently, this investigation was conducted.

The researchers address some philosophical concerns that are brought up when using brain phenomena to support assertions about effective or efficient learning strategies. The study's findings demonstrate the theoretically constrained breadth of brain science's investigation of knowledge. According to (Cozolino & Sprokay, 2006),"brain experts advise particular learning strategies. Professor of neuroanatomy and neuroscientist Marian Diamond encourages us to "teach children to think for themselves." Nothing further is implied on how young children should indeed be taught to consider scientific research on the human brain. This idea requires a little more explanation. How we approach learning could be negatively affected by discoveries about how the brain functions. Human autonomy is a core value in the long-standing liberal tradition. However, the idea that liberalism's cherished form of autonomy is necessary for human well-being is hotly debatedin academia. Neurophysiology cannot advance the lengthy and intricate argument between liberals and traditional societies. According to Caine, R. N., & Caine, G. (1995), "BBL applies neuroscience to produce knowledgeable learners. It is capable of managing multiple tasks at once. The brain simultaneously perceives complete information and portions. The brain has several storage locations, and information can be accessed through various neurological and memory routes. Learning involves the entire body, the curriculum, and the lesson plan. A logical outcome of brain-based education is critical thinking, which requires the capacity to think critically in order to answer persuasively. Critical thinking develops as a self-regulatory judgement through perception, analysis, assessment, and inference. The researcher included the following language-learning exercises in the classroom based on the BBL principles, as shown in figure-2

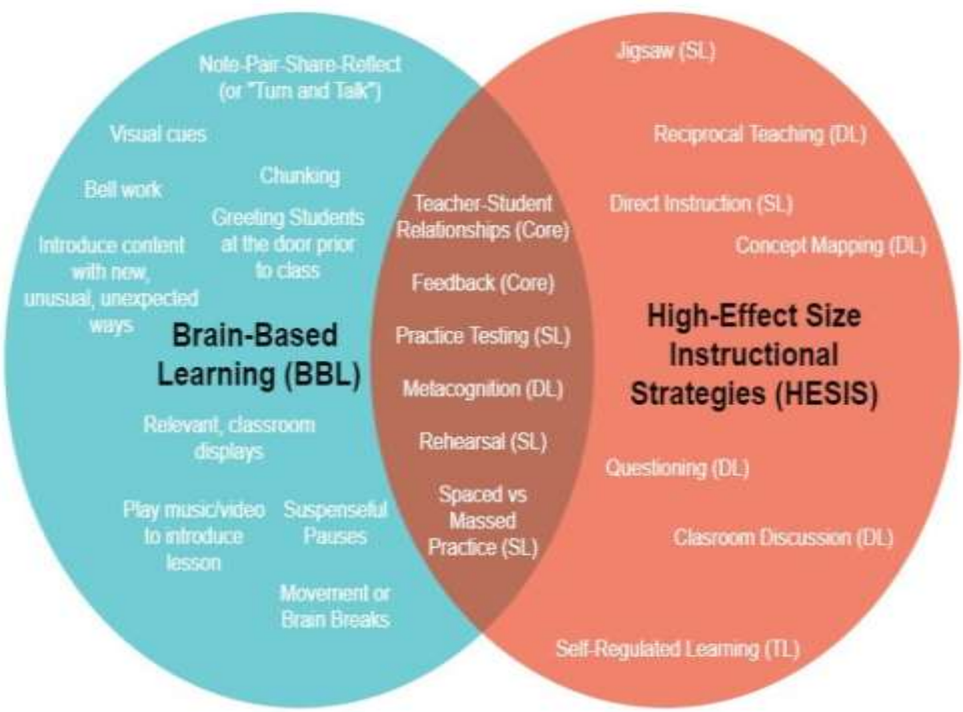

Figure-2
BBL Activities as an instructional strategy

Some scientists do not acknowledge the complexity of the components that go into their studies and conclusions. For them, the facts about the brain serve as adequate reasons for particular learning strategies. For learning to be effective, we must reflect on these activities. By doing this, we'll also start laying the groundwork for the fundamental argument against brain science's potential to provide light on the nature of learning. Memory, comprehension, beliefand attitude are all learning components. "These concepts are essential components of a discussion and a group of related ideas referred to as " psychology." We all use educational psychology to analyze and discuss our ideas, deeds, and those of others. We use information, belief, intention, emotion, feeling, and reason to explain why people do the things they do" (Felitti et al., 1998, p.11).

Parallel to this ideal learning environment, a more sophisticated and comprehensive evaluation method has also been adopted. According to Gozuyesil E., & Dikici, A. (2014), "Brain-based assessments have been designed as an achievement, authentic assessment to evaluate how well students performed while learning, exploring the concept, creating mental models or patterns, combining the essential information and abilities to solve complicated issues, planning and directing their learning experience, reflecting on their work, and modifying and integrating learning. The twelve concepts listed in table 1 served as the foundation for the teaching and assessment activities" (p.44)

Table-1

Principles of Brain-Based Learning BBL (Adapted from Caine Institute, 2005)

1	The brain is social
2	The search for meaning is innate
3	Emotions are critical to learning
4	The brain processes parts and wholes simultaneously
5	Learning involves both focused attention and peripheral attention
6	The brain accepts all forms of learning, namely rote learning, spatial, contextual and dynamic
7	Learning is developmental
8	Learning is inhibited by threat
9	Each brain is uniquely organised
10	Learning happens through patterning

"According to these principles of brain-based learning, constructivist learning models like experiential learning, problem-based learning, and cooperative learning can be assessed as brain-compatible to the extent that they respect learners as unique individuals within their sociocultural context; establish trust; provide meaningful, realistic experiences; and create a complex, enriched learning environment. (Karatekin, 2018)

Review of Literature

Learning environments and situations can be optimised if educators know current research on the brain's mechanisms for learning. They understood the anatomical details of how the brain works are not the most significant difficulty for educators facing brain research. Fundamental beliefs about traditional education are being called into question by what we are starting to learn about the effects of emotions, stress, and risk on memory and motivation. This information necessitates a fundamental change in how we define testing, grading, and learning outcomes.(Miller et al., 2007) "The teacher's job is to assist students in revisiting their concept misconceptions and developing more accurate knowledge by offering experiences and support.Simply keeping a gaze, walking all around the classroom, connecting with learners, and ensuring that students are engaged before instruction are effective ways for teachers to increase student attention (p.29)

Principles for Brain-Based Learning

We offer the following brain principles to provide a general theoretical framework for brain-based learning. These guidelines are clear and compatible with the human brain. However, when used in education, they assist us in redefining teaching by removing us from conventional frameworks of reference and identifying and picking the most suitable programmes and techniques. The brain continuously carries out numerous tasks in parallel. They integrate with other mental functions like maintaining health and gaining more general cultural and social information. (Pascoe et al., 2019) states,"Like the brain, effective instruction should "orchestrate" all parallel dimensions.

Theories and procedures that enable such orchestration must be the foundation of processing. Teachers require a frame of reference to help. Learning Engages the Entire Physiology.Learning is as natural as breathing, and it is possible to inhibit or facilitate it.Neuron growth, nourishment, and synaptic interactions are integrally related to the perception and interpretation of experiences. Stress and threat affect the brain and are influenced differently by peace, challenge, boredom, happiness, and contentment. The actual "wiring" of the brain is affected by learning experiences. Anything that affects our physiological functioning affects our capacity to learn and has Implications for education.

Brain-based teaching must fully incorporate stress management, nutrition, exercise, and other facets of health into the learning process. (p.185) Learning is influenced by the natural development of the body and the brain. According to brain research, for example, there can be a five-year difference in maturation between any two average learners. Gauging achievement based on chronological age is, therefore,inappropriate. Brain-based education must furnish a learning environment that provides stability and familiarity. At the same time, it should be able to satisfy the brain's enormous curiosity and hunger for novelty, discovery, and challenge. Programs for gifted children already combine a rich environment with complex and meaningful challenges. Most creative methods for teaching talented students should be applied not only to gifted but to all students.(Salem, 2017) states, "Designed to perceive and generate patterns, the brain resists having meaningless patterns imposed on it. By empty, we mean isolated pieces of information unrelated to what makes sense to a particular student.

When the brain's natural capacity to integrate data is acknowledged and invoked in teaching, Vast amounts of initially unrelated or seemingly random information and activities can be presented.The brain chooses to assimilate from the wide variety of available approaches and ways because no technique or method can effectively encompass the variances of the human brain on its own. Holistic learning is patterning,which includes problem-solving, critical thinking, and daydreaming. (p.184). We should present the material to enable brains to extract patterns, even though we determine most of what pupils will learn rather than attempting to enforce conventions. Time spent on a task does not guarantee proper patterning because the learner can be doing "busywork" while their thoughts are elsewhere. A student must be able to develop patterns that are personally relevant and meaningful for education to be effective. The proponents of whole language reading instruction, theme classroom instruction, and life-appropriate learning strategies are the ones who most clearly recognise this sort of teaching. According to (Winter, 2019), Emotions Play a Key Role in Patterning. As a result, emotions and cognition are interdependent. Additionally, emotions are essential to memory since they make storing and retrieving information easier. Any life lesson or experience can have an emotional influence that lingers long beyond the original incident that caused it. (p.87)Teachers must be aware that students' attitudes and moods will influence learning and shape their course of study in the future.

They must ensure a positive emotional atmosphere characterised by acceptance and respect for one another. Cooperative learning strategies provide credence to this idea. Metacognition and reflection among students and teachers. Approaches ought to be supported. "Although there is proof of brain laterality, the left and right portions of the brain differ, which only tells part of the tale. Whether a person is working with words, mathematics, music, or art, the two hemispheres interact intimately in a healthy person. The "two-brain" doctrine's value demands educators to recognise the brain's various but concurrent organisational tendencies. One option is to break down such knowledge into smaller pieces; the alternative is to see and use it as a complete set of wholes.

Learning is challenging for people when either portions or wholes are overlooked. Because it acknowledges that education is incremental and progressive, effective teaching helps students gain understanding and skills through time. Domains and wholes, however, interact conceptually. They derive significance from one another. The most significant way to comprehend and understand vocabulary and grammar is to use them in real-world, whole-language contexts. The most important way to approach mathematics and scientific concepts is within the framework of living science.(Weiss, 2000).Educators and students lose a lot of time and energy because learners do not correctly absorb their experiences. Active processing enables students to reflect on what and how they have learnt to start taking control of their education and creating meaning. It alludes to introspection and metacognitive exercises, where a student could identify their favourite method of learning. Teachers can support active learning by imaginatively "elaborating" theories and procedures through metaphorical and analogies to assist students with rearranging the material in personally relevant and beneficial ways.

Brain-based language learning

Through a variety of engaging vocabulary and grammar experiences, we learn our mother tongue. Internal mechanisms and social contact influence it (Vygotsky 1978). That illustrates how particular things acquire significance when included in regular experiences. When this embedding method is used, education is improved. Duman (2010) states,"The most crucial aspect all new brain-based learning models share is embedding.The most effective way to activate spatial memory is through experiential learning, which is valued differently in different cultures. Teachers should incorporate many real-life activities into their lessons, such as projects, field excursions, and visual depictions of certain events/ Success depends on engaging the student in several complex and dynamic experiences that engage all of their senses. Instead of excluding lectures and analyses, teachers could include them in a more comprehensive learning experience. (p.2073).Threatinhibits learning, whereas challenge fosters it. When given the right kind of challenge, the brain learns best, but it "downshifts" when threatened. When threatened, we constrict our perceptual fields to use phenomenological terminology.

Clemons, S. A. (2005) states,"We lose access to certain brain parts when we feel a threat, likely due to the hippocampus's extraordinary sensitivity. Students' relaxed alertness should be encouraged by teachers and authorities. Therefore, they must create a set high on the challenge and low on the threat. Both the teacher and the lessons must be in this constant state. The relaxed alertness state is influenced by every instructor's strategy to plan the learning environment. Every brain is different. Even though our senses and fundamental emotions are universal to all humans, each brain uniquely integrates them' (p.26). Additionally, learning modifies the way that the brain is organised. We grow more distinctive as we gain knowledge. Instruction should be multimodal to allow all pupils to articulate visual-tactile, emotional, or aural preferences. Additionally, options should be diverse enough to appeal to different interests. This might necessitate restructuring learning organisations to reflect the complexity present in life. In conclusion, education must promote optimal brain function.

Methodology

Implementation of BBL Language Laboratory

The BBL programme helps students develop their skills and knowledge as they learn English. It makes acquiring fluency and other language skills easier. It dramatically enhances learning enjoyment and effectiveness. BBL aids in the improvement of communication abilities, linguistic proficiency, confidence building, and obstacle readiness. The researcher's university developed the BBL strategies and incorporated them into the ESL classrooms. Before using any language lab programme, one must understand why it is necessary. The research team posed the following querybefore the software's development. How will brain-based learning improve learning outcomes?Locating a digital literacy lab solution will be simpler if you consider the factors listed previously. With the aid of these design principles, the researcher used two different approaches to enhance learning outcomes in the language lab. These approaches were then contrasted through an intervention study.

The nature of the intervention in the research study

Interventional studies involve changing a scenario or interfering with it to see how the changed circumstance affects the outcomes. Immediately following the baseline period, an intervention was started using BBL. The main objective of the intervention is to foster effective learning. The fundamental aim of intervention programmes is to inspire people to increase their activity levels. The researchers assign people to interventions (or "exposure") to create subject groups that are actively involved in the investigation. The researcher used these principles to create two groups: an experimental group and a control group. The control group was instructed to utilisecollaborative learning, whereas the experimental group was trained using brain-based exercises.BBL integrates several theories and methods, as mentioned earlier. English teaching content and BBL can be combined to suit each student's unique language learning needs in higher education. BBL is a cutting-edge pedagogy for language acquisition. It improves verbal and written communication skills, self-assurance, and language mastery. The teacher didn't use any brain-based principles with the control group.

Design

Pretest, Posttest, and a Quasi-Experimental Design were used in this study, as was already mentioned. At a higher-education institution, learners from the researcher's Indian institution were divided into two groups: those who employed BBL and the control subjects whowere exposed to traditional learning. Both groups received a quasi-experimental 6-week intervention programme based on a procedure, as seen in figure 3.

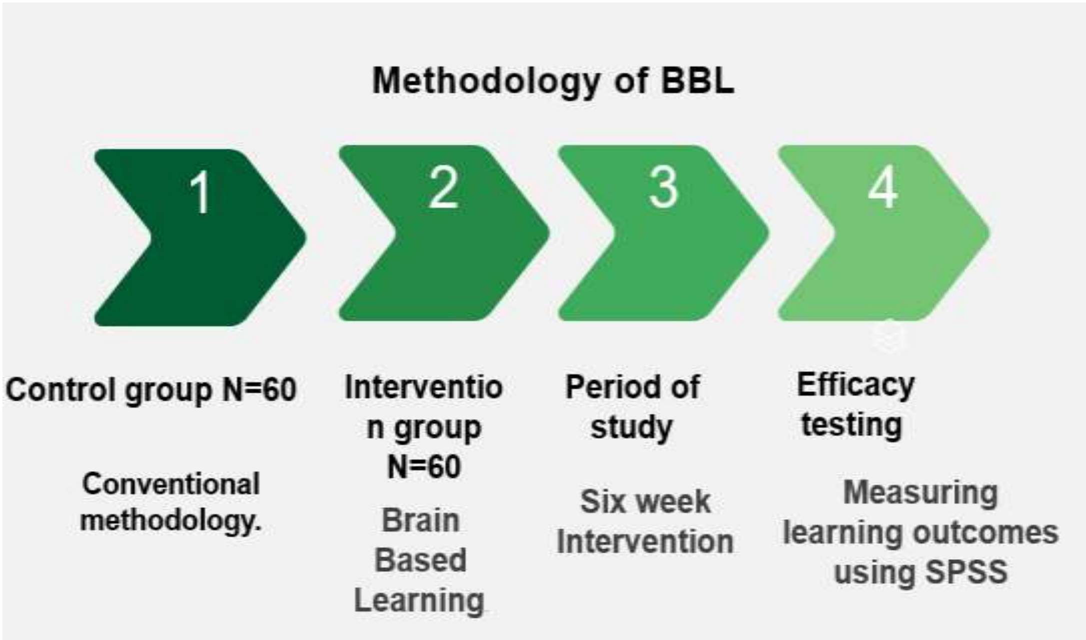

Figure-3
BBL Methodology

After the 6-week programme, the same variables assessed on the pretest were again reviewed. With an alpha value of.05 and a power of.80, a sample size of 120 students overall and 60 students per category were chosen to ensure the statistical significance of the two groups. As previously noted, several types of training were offered to both participants in the experimental group and a control group. The sample was chosen using random sampling. The participants were split into experimental and control groups by the researcher. To avoid any interactions between setup and selection, the learning was unbiased. Just the delivery method was different. Participants for the random sample came from the Rajalakshmi Engineering College in India. Those who met the requirements gave their written, informed permission. The institutional review board has given the study clearance.

Gersten et al. (2005) "Quasi-experimental research strategies are frequently used to assess interventions that positively impact learning outcomes. However, past studies that used these designs usually used subpar statistical methods, which caused researchers to draw false conclusions" (p.159).One method for analysing data from quasi-experiments is the two-group test, which has assumptions, data requirements, benefits, and drawbacks. This study looks at the reactions of two different groups of learners to brain-based learning. It also looks to discover if these two organisations have distinct gains in language learning due to classroom interventions.

Do ESL learners improve differently in BBL and conventional language classes?

The research question was answered based on the output of the Dependent T-Test in SPSS Statistics.

We only need to pay attention to the output among the three tables SPSS Statistics presents in the Output Viewer under the heading "T-Test." The T-Test table and the reliability Statistic. Our intervention study explains this. The two essential tables you need to check if your data has conformed with all pertinent assumptions are the subject of this section:

Paired Sample Statistics Table

The results of the two kinds of pedagogies are indicated in table-1

Table-1 Paired Sample Statistics

	Mean	N	Std.Deviation	Std.Error Mean
Pair1 Conventional Learning	14.11	60	.17835	.04717
Brain-based learning	21.89	60	.39978	.87961

The Paired Samples Experiment table shows the dependent t-test findings. It is essential to remember that this study uses inferential statistics and details the variations across the language lab's instructional approaches. ("Paired Differences," the subtitle states). As a result, the table's "Mean", "Std. Deviation", "Std. Error Mean," and "95 Percent Confidence Range of the Difference" columns refer to the mean difference between the two leaps and the related standard deviation, standard error, and 95 Percent Confidence Interval. The last three columns of the table include the dependent t-test results, which are displayed as the t-value ("t"), degrees of freedom ("df"), and significant level ("Sig. (2-tailed)"). According to the descriptive data, the moodle-based course helped the students outperform the control group regarding academic performance.

Since descriptive statistics are not sufficient for conclusive results, a paired t-test was conducted, which is shown in table-2

Table-2
Paired samples statistics

	Mean	Std.Deviation	Std.Error Mean	95% confidence interval		t	df	sig.2 tailed
				Lower	Upper	- 4.891	62	.000
BBL and conventional	15.51	2.978	.01843	-03789	-01708			

Reporting the Output of the Dependent T-Test

The significance level for table 2's p-value and t(degrees of freedom) is the t-value. In our case, this would be: t(19) = -4.891, p 0.0005. We can conclude that performance in brain-based training increased in a statistically significant way. Considering the t-direction values and the means of the two instruction modalities, it is crucial to note that the impact sizes were substantial in proportion to their importance.

Conclusion and Recommendations

The BBL method makes learning more interesting for students. It enhances communication and listening skills. The engaging digital platform boosts language proficiency while making studying more effective and fun. In contrast to traditional classroom settings, language labs allow all students to speak and practice simultaneously without interfering with one another, regardless of class size. You can work on specific requirements in a language lab faster than in a classroom. Regular written and spoken communication in a language will improve your language skills. Language laboratories promote increased class involvement.

Conclusion

Ozden & Gultekin (2008) state, "Brain-based learning aims to transition from the memorisation of information to meaningful learning. This necessitates the presence of three interactive components: relaxed alertness, immersion, and active processing. The brain prefers the challenge and finds significance in a flexible mindset. Teachers should create an environment that combines a feeling of minimal threat with a significant challenge and the level of relaxation typical of self-assured people and at ease. Because all knowledge is subjective and the extent to which students learn from their experiences depends on how they interpret them, teachers should plan for their pupils to be fully immersed in practicalaffairs" (p.40). Learners can control the internalisation and consolidation of personally meaningful learning through active processing activities, including questioning and sincere contemplation. A personal journal is permitted for students. In the lower grades, these highly developed metacognitive and reflective strategies take on a more tangible form. Instructional design is affected by our understanding of how the brain learns: administration and assessment. Community-based learning, teacher preparation, and other crucial educational reform concerns are essential. According to the research, we gain knowledge through experience, and this process involves far more than we previously realised. Understanding how the brain processes events will enable us to comprehend meaningful learning to its fullest. In that regard, BBL instruction is not a distinct educational trend or movement. In the end, all forms of education will gain from this strategy. This research concludes that the concept of "brain-based learning" is strange. If we are to ever advance in our learning comprehension, we need the knowledge of many other disciplines.

We might picture an excellent research team that included cognitive psychologists and social scientists collaborating on theoretical learning studies. Real progress might be accomplished if the ensuing inquiries were genuinely interdisciplinary and the team members listened to and comprehended each specialist's contribution. Such a body might, at some point, decide to consider suggesting teaching methods, whether for use in classrooms or elsewhere. Though this limited position implies more than it does, it is essential for philosophy. All of this would be very dissimilar from thescientific' trend for brain-based learning that is currently not practised effectively. So there is a lot of scope for future research on BBL.

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