A Systematic Literature Review on Enhancing the Success of Independent Curriculum through Brain-Based Learning Innovation Implementation

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A Systematic Literature Review on Enhancing the Success of Independent Curriculum through Brain-Based Learning Innovation Implementation

Dimas Febriansyah Krisna Dwiputra[1]✉, Waliyyatu Azzahra[2], Fahmi Nugraha Heryanto[3]

[1]Faculty of Social Science Education, Universitas Pendidikan Indonesia, Indonesia
[2]Faculty of Mathematics and Natural Science Education, Universitas Pendidikan Indonesia, Indonesia
[3]Faculty of Education, Monash University, Australia

Abstract

Brain-based Learning has been recognized for its potential to foster creative and innovative pedagogical approaches. Despite this, the relevance and potential impact of this model with the independent curriculum remains relatively unexplored by previous research. This study seeks to address this gap by investigating and analyzing the relevance and benefits of integrating Brain-based Learning within the independent curriculum framework in Indonesia. Employing a Systematic Literature Review referred to the 2020 PRISMA guidelines, we obtained 2013 articles from Scopus and Google Scholar databases but only 48 articles met the eligibility criteria for further analysis using the meta-synthetic analysis method. Results indicate the relevance between Brain-based Learning and the principles of differentiated learning inherent to the independent curriculum. By focusing on the natural system of the brain, Brain-based Learning enhances the efficacy of the curriculum, yielding enjoyable, meaningful, and beneficial learning experiences for students. This underscores the potential of Brain-based Learning as a driving force for the success of the independent curriculum in overcoming educational challenges in Indonesia.

Keywords: brain-based learning, differentiated learning, independent curriculum, learning innovation, natural system of the brain, student learning style

Corresponding Author:
Dimas Febriansyah Krisna Dwiputra, Faculty of Social Science Education, Universitas Pendidikan Indonesia, Indonesia
Email: dimasfkd18@upi.edu

1. Introduction

At the very least, the 'Merdeka Belajar' [Freedom of Learning] concept proposed by the Ministry of Education, Culture, Research, and Technology (Kemdikbudristek), Republic of Indonesia, has made Indonesian education more innovative (Arung et al., 2023). The Government of Indonesia has initiated the Freedom to Learn (Merdeka Belajar) Policy to support Indonesia's educational vision and learning recovery. One of the main focuses of the policy is the launch of an independent curriculum (Kurikulum Merdeka) to address multifarious issues within the realm of education, particularly after the Covid-19 pandemic. Notably, these challenges encompass phenomena like learning loss, based on previous research shows that during Covid-19 as many as ±45 million students in Indonesia could not participate in learning and only about 50% of students met competency standards (Batubara, 2021; Kurniawan & Budiyono, 2021; Awaludin et al., 2023). Moreover,

UNICEF & UNESCO (2021) states that 12.3 years of schooling in Indonesia is only equivalent to 7.9 years of learning. In response to this challenge, the independent curriculum was formulated with enhanced flexibility, expressly considering the heterogeneous characteristics of students and the conditions of the school objectively.

Indonesia is developing two curricula based on the 2013 curriculum (Rajiani et al., 2023). One of them is the independent curriculum. Indonesia is developing two curricula based on the 2013 curriculum. Independent curriculum aims to give freedom to schools, teachers, and students to develop their potential, talents, and uniqueness in order to create a conducive and meaningful learning environment according to needs so that students do not feel burdened (Abidah et al., 2020; Rahayu et al., 2022; Sihombing et al., 2021). This policy is considered a positive strategy as it allowed flexibility for teachers and schools to develop their creativity and provides freedom for students to determine their potential and interests (Istaryaningtyas et al., 2021; Prastowo et al., 2020; Sakdiah & Maryam Jamilah, 2022). This is certainly positive for learning because as we know that in schools there are students with different characters, interests, potentials, and learning styles. Consequently, this policy is considered relevant to address various learning problems in Indonesia

Nonetheless, it cannot be denied that there is empirical evidence that the implementation of the independent curriculum still faces obstacles and difficulties, especially in regard to the preparedness of schools and teachers to carry it out. The implementation of the independent curriculum ultimately requires schools and teachers to be creative and innovative in preparing and implementing learning (Istaryaningtyas et al., 2021). In other words,

the success or failure of the implementation of the independent curriculum greatly depends on the competence of the teacher.

Pedagogically, competent teachers are not only capable of designing, implementing, and evaluating learning but also can understand and develop children's natural potential (Lillvist et al., 2014; Nousiainen et al., 2018). Besides, Kaur (2019) states that the teacher has the most important and the most difficult role lies in designing learning to accommodate children's natural potential. Therefore, a teacher's knowledge and skills regarding various kinds of learning processes are vital, including in the context of an independent curriculum as a good understanding will help the teacher to design learning processes that suit the characteristics of students.

In the context of the independent curriculum, learning is directed to stimulate students to learn without feeling forced or pressured (Purba et al., 2021). Thus, understanding the working system of the brain needs to be considered in designing and implementing learning. Without considering the working system of the brain, the natural learning process will not be possible (Duman, 2010). The natural system of the brain in learning is related to social, emotional, cognitive, kinesthetic, and reflective aspects that are interrelated (Belkacem & Lakas, 2021; Bonomo Ed. D., 2017; Given, 2002). Jensen (2008) argued that brain-based learning is the right learning to realize natural learning as its application emphasizes understanding the working principles of the brain.

Based on the explanation above, it can be concluded that the implementation of brain-based learning emphasizes understanding the natural characteristics of students with a multidisciplinary approach. This actually has relevance to the principle of focusing on the

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implementation of learning in Indonesia today, namely differentiated learning (Anggraena et al., 2021). Consequently, brain-based learning can serve as an alternative educational strategy to enhance the success of independent curricula

Studies concerning the application of Brain-based Learning in Indonesia are not something new. However, no studies comprehensively evaluate the relevance of implementing Brain-based learning with the independent curriculum in Indonesia. Hence, this research holds paramount importance due to its potential as an alternative solution for addressing the obstacles and difficulties encountered in the implementation of the independent curriculum. Ultimately, it is anticipated that this endeavor will yield a favorable impact on enhancing the quality of education in Indonesia, aligning with the envisioned objectives of the independent curriculum policy.

Therefore, this systematic literature review involved previous studies concerning the application of Brain-based Learning in Indonesia and analyzed its relevance to the context of the independent curriculum. The review aims to gather a comprehensive understanding of the potential of Brain-based Learning to enhance the effective implementation of the independent curriculum in Indonesia. This study proposes two research questions, namely (1) What is the relevance of Brain-based learning to the independent curriculum; (2) What is the potential for implementing Brain-Based Learning in supporting the independent curriculum.

2. Method

The research employed a Systematic Literature Review based on PRISMA 2020 guidelines (Page et al., 2021) to review previous studies and identify information related to the application of brain-based learning in Indonesia. The search was conducted on October 23, 2022, using Harzing's Publish or Perish application, which utilizes the Scopus and Google Scholar databases. These databases were selected due to their provision of credible and high-quality information, ease of data extraction, and relevance to the study topic.

There are several keywords in Indonesian and English that are used for searches, namely (1) Brain-based Learning in Indonesia; (2) pembelajaran berbasis otak; (3) neuro-pedagogy; and (4) neuroscience. From the search results, there were 2013 articles (Scopus = 96 and Google Scholar = 1917). Furthermore, articles were selected through examination of titles, abstracts, to full-text concerning the criteria presented in Table 1 below.

Tabel 1. Eligibility Criteria

Inclusion Criteria	Exclusion criteria
1. Article published between 2013 and 2022.	1. The title is not in Indonesian or English.
2. Text in the form of journal articles or proceedings	2. The research location is not in Indonesia or it is not clear.
3. Journal indexed by Scopus (Q1-Q4) or Sinta (S1-S2)	3. The article or proceeding is not empirical research.

To ensure a structured selection process, the researcher employed the EndNote X9 application throughout their process, following these steps: (1) the data that has been collected is stored in Research Information Systems (RIS) format and imported into the EndNote X9 application; (2) the creation of EndNote Groups for each of

the databases (Scholar, Scopus, and their combination); (3) the creation of a Group Set for the systematic review process, referring to the eligibility criteria in Table 1; (4) sorting to identify data duplications; and (5) the selection process in accordance with the eligibility criteria and placing the outcomes into the previously created Group Set. This process was undertaken to precisely determine the number of selected and non-selected articles in each stage of the screening process. Moreover, the Microsoft Excel application was utilized to ease the process of data coding, sorting, and analysis. Out of the 2013 articles, 1965 were eliminated as they did not fulfill the predetermined criteria. The detailed procedure of the selection process is illustrated in Figure 1.
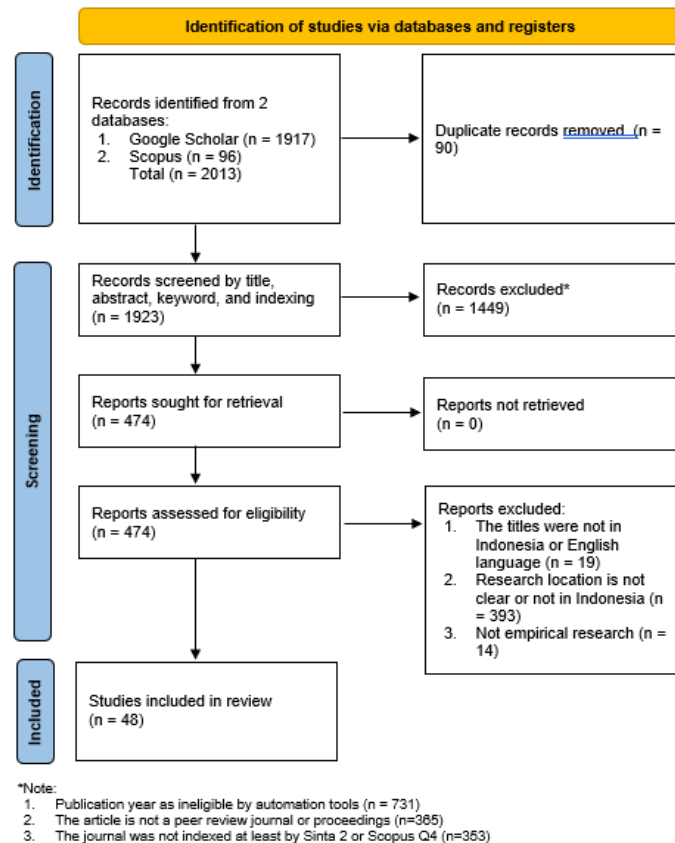

Figure 1. Article Selection Flow

Based on the selection results, there were 48 articles that met the criteria. The analysis of these articles involved a meta-synthetic approach which included several stages: (1) identification of the research focus; (2) identification of relevant research; (3) selection of research that meets the review criteria; (4) assessment of the selected research; (5) extraction of data from the research; and (6) synthesis of data. This approach is in accordance with the methodology proposed by Evans & Pearson (2001). The selection of this method is not only because it provides a structured guide in conducting this research, but also because it is relevant to the main purpose of the study, which is to analyze and synthesize various previous studies related to brain-based learning in Indonesia. This will result in comprehensive information on how the relevance of brain-based learning in optimizing the implementation of the independent curriculum in Indonesia.

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3. Result and Discussion

a. The Relevance of the Application of Brain-Based Learning to the Independent Curriculum

The application of Brain-based Learning between one study and another may be different but at least there are three main patterns of the application of Brain-based Learning which are summarized in Table 2 below:

Table 2. Application of Brain-based Learning in Indonesia

Author	Result
(Aulia et al., 2021; Badriyah et al., 2020; Damayanti & Sukestiyarno, 2014; K. N. sania Effendi & Marlina, 2021; Herliandry et al., 2018; Husna et al., 2018; Jailani, 2021; Jazuli et al., 2019; Juniarti et al., 2022; Mekarina & Ningsih, 2017; Meri & Wulan, 2019; Permana & Kartika, 2021; Putri et al., 2019; Riskiningtyas & Wangid, 2019; Sani et al., 2019; Sari Rahmatin & Suyanto, 2019; Setyaningtyas & Harun, 2020; Suarsana et al., 2017; Sukoco & Mahmudi, 2016; Wijayanti et al., 2021; Winarti & Haq, 2013; Wulansari & Suarni, 2020; Yudha et al., 2020; Yulian & Hayati, 2019; Zaqiah et al., 2022)	Using syntax which generally consists of 7 stages, namely (1) pre-exposure; (2) preparation; (3) initiation and acquisition; (4) elaboration; (5) memory incubation and coding; (6) verification and checking; and (7) celebration and integration
(Badriyah et al., 2020; Handayani & Purwati, 2022; Kartikaningtyas et al., 2017, 2018; Kusumaningrum et al., 2021; A. E. Lidiastuti et al., 2020; A. L. Lidiastuti et al., 2019; Priatna, 2017; Susanti et al., 2019; Wiantara et al., 2020)	Combine/integrate it with other learning models or make it a learning medium.
(Dewi & Masrukan, 2018; Dewi & Zahid, 2020; Rukminingsih et al., 2021)	Applied in online or hybrid learning while still referring to the 7 main syntaxes.

Based on Table 2, most of the implementation of Brain-based Learning is carried out following the syntax with 7 stages proposed by Jensen (2008). There are interesting findings in the application of the seven stages, namely, the use of mind maps, playing music, and implementing brain exercises (Husna et al., 2018; Riskiningtyas & Wangid, 2019; Sani et al., 2019; Suarsana et al., 2017; Yulian & Hayati, 2019; Zaqiah et al., 2022). Besides, there are learning modifications by utilizing animated videos (Winarti & Haq, 2013; Wulansari & Suarni, 2020; Yulian & Hayati, 2019), puzzle media (Mastoni et al., 2019), outdoor activities (Wahyudi & Widodo, 2020), and mini-games (Yudha et al., 2020). This suggests that Brain-based Learning seeks to create a learning environment that has a variety of alternatives. Whereas this aligns with the statement by Pusat Asesmen dan Pembelajaran/Center for Assessment and Learning (2021) that the principle of instruction required in the independent curriculum, which encompasses various contemporary and relevant teaching methods or approaches considered to students' characteristics, thus avoiding a monotonous reliance on the same conventional methods or approaches.
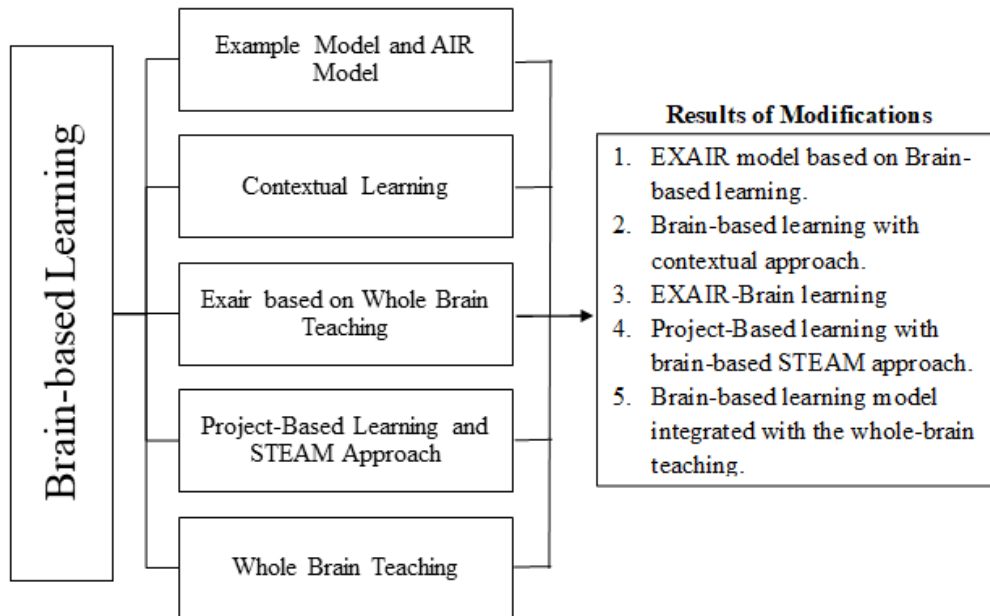
Figure 2. Modification of Brain-Based Learning with Other Models/Methods

Figure 2 shows that Brain-based learning can not only be applied independently but also be integrated with other learning models or methods. This modification is positive as it can increase the success of the learning process (Badriyah et al., 2020; Handayani & Purwati, 2022; Kartikaningtyas et al., 2017; A. L. Lidiastuti et al., 2019). These findings indicate that Brain-based Learning has flexibility in its application. Indeed, brain-based learning can also be implemented through online means with the assistance of websites, as demonstrated by Rukminingsih et al. (2021), or in a hybrid manner, as carried out by Dewi & Masrukan (2018) and Dewi & Zahid (2020) using the flipped classroom approach. However, it cannot be denied that research on the application of online or hybrid brain-based learning is still limited. These limitations make the relevance and potential impact of online or hybrid brain-based learning in enhancing the success of the independent curriculum still in doubt Nevertheless, these limitations present the potential for novelty and innovation for future researchers.

Referring to its implementation, it can be said that brain-based learning not only accommodates one learning style, but also the diversity of characteristics and uniqueness of student learning styles through the use of various models, methods, strategies, techniques, and learning media. In terms of the diversity of learning styles, individual characteristics in receiving information during the learning process cover at least three characteristics, namely visual, audio, and kinesthetic (Dunn & Dunn, 1978). Even though individuals still use these three ways of processing information, there is one characteristic that dominates (Abella et al., 2022). Through proper understanding of this aspect, it will certainly make learning more effective as learning styles are related to the characteristics of how individual brains process information (Abella et al., 2022; Huang, 2019). Moreover, not all students learn in the same way, so the use of a strategy can have different effects on students with different learning styles (Alwishah, 2016; Pashler et al., 2008). Thus, if the teacher can present learning according to student learning styles, it can maximize student learning

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performance. In this case, the application of Brain-based Learning is relevant for realizing optimal learning because it considers the natural characteristics of students' brains which are not always the same in processing information.

Furthermore, brain-based learning conducted in online or hybrid settings is inherently intertwined with the utilization of digital technology, which is familiar to contemporary students. Citing the terminologies proposed by Prensky (2001) concerning Digital Natives and Digital Immigrants generations, present-day students can be classified as Digital Natives who have grown up and become accustomed to the digital environment since early childhood. In other words, when brain-based learning is implemented in online or hybrid formats, it aligns with the characteristics of students and the ongoing developments in the digital era.

In the context of an independent curriculum, Brain-based Learning, with its implementation emphasizing students' characteristics, is in accordance with the principles of differentiated learning which is used as one of the principles for the focus of implementing learning in Indonesia (Anggraena et al., 2021). Differentiated learning was introduced by Tomlinson (2001) in his book entitled 'How to Differentiate Instruction in Mixed Ability Classrooms'. Differentiated learning is a learning process that pays attention to student differences so teachers need to pay attention to the level of readiness, interest, and student learning styles. Even though teachers need to pay attention to the characteristics of each student, it does not mean that the teacher has to deal with students one by one, but the teacher can do this by making modifications in aspects of content, process, product, and learning environment to facilitate the diversity (Tomlinson, 2014). In other words, differentiated learning can be interpreted as learning that focuses on understanding individual differences and adapting learning to accommodate the diversity of students in the class.

Based on the description above, it can be concluded that there is relevance between Brain-based Learning and the principles of differentiated learning in the independent curriculum. Brain-based learning allows teachers to organize learning by considering the learning needs of students such as visual, auditory, and kinesthetic learning styles, without having to handle each student individually. This is in line with the purpose of differentiated learning whose main orientation is to create learning that can accommodate different characteristics of the learning process. Thus, the application of Brain-based Learning that is relevant to the principles of differentiated learning can be an effective strategy to increase the success of the independent curriculum set by the government.

b. The Benefits of Implementing Brain-based Learning in the Independent Curriculum

Comprehending the mechanisms of the brain as the foundation of the learning process can lead to the transformation of educational strategies and designs that can optimize learning (Blakemore & Frith, 2005). It is thus unsurprising that brain-based learning offers several advantages for the learning process. In this particular investigation, Table 3 showcases eight primary benefits of integrating brain-based learning into the learning practices of Indonesia.

Table 3. Benefits of implementing Brain-based learning in Indonesia

Author	Result
(Aulia et al., 2021; Jazuli et al., 2019; Juniarti et al., 2022; Kartikaningtyas et al., 2017; Kusumaningrum et al., 2021; Mastoni et al., 2019; Mekarina & Ningsih, 2017; Sari Rahmatin & Suyanto, 2019; Wahyudi & Widodo, 2020; Widiana et al., 2017; Winarti & Haq, 2013; Wulansari & Suarni, 2020)	Improving student learning outcomes.
(Herliandry et al., 2018; Karolina, 2018; Susanti et al., 2019; Wiantara et al., 2020; Zaqiah et al., 2022)	Improve critical thinking skills.
(W. R. Effendi, 2018; Permana & Kartika, 2021; Rukminingsih et al., 2021; Sani et al., 2019)	Increase student motivation.
(Adiansha et al., 2018; Damayanti & Sukestiyarno, 2014; A. L. Lidiastuti et al., 2019; Setyaningtyas & Harun, 2020)	Improve problem-solving abilities.
(Handayani & Purwati, 2022; Jailani, 2021)	Improve student retention ability.
(Adiansha et al., 2018; Syahrir & Prayogi, 2022; Triana & Zubainur, 2019)	Improving students' mathematical communication skills.
(Riskiningtyas & Wangid, 2019; Sukoco & Mahmudi, 2016)	Increase student self-efficacy.
(Badriyah et al., 2020; Meri & Wulan, 2019)	Improve students' science skills.

Based on the findings in Table 3, it can be concluded that the advantages of implementing Brain-based learning in Indonesia are not restricted to one aspect of learning. Improving student learning outcomes stands as a prominent advantage resulting from the implementation of brain-based learning. This holds particular significance in fortifying the achievements of the independent curriculum. As emphasized by Anggraena et al. (2021), the independent curriculum is a strategic governmental initiative aimed at tackling the persistent learning crisis marked by suboptimal student learning outcomes.

Undoubtedly, there is a rationale behind these benefits of brain-based learning in support of an Independent curriculum as Salem (2017) reveals that Brain-based Learning is a natural and effective way to increase student learning motivation so that it can support and maximize the teaching and learning process. This statement is supported by the results of an analysis of various previous studies which show that the application of Brain-based Learning aims to create favorable learning conditions, encourage active student participation, and challenge students' abilities so that they can stimulate the learning process naturally (Effendi & Marlina, 2021; Husna et al., 2018; Mastoni et al., 2019; Mujiyanto et al., 2021; Riskiningtyas & Wangid, 2019). In other words, the application of Brain-based Learning focuses on student-centered learning which is designed to take into account the needs and natural characteristics of students' brains in learning.

The analysis reveals that the objective of Brain-based Learning is to establish a learning environment that enables students to acquire knowledge autonomously, without any form of compulsion or pressure. This has important advantages in fostering the success of an independent curriculum, as the achievement of an independent curriculum is partially contingent on the learning environment, the self-directedness of students, and institutional assistance (Purnomo et al., 2022). These findings are consistent with research by Yulianto et al. (2022) which emphasizes that the concept of "Merdeka or Independent" aims to create independence, creatively, critically, and

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collaboratively. Therefore, the application of brain-based learning can help achieve these goals and increase the effectiveness of learning following the independent curriculum.

Brain-based learning has various advantages because of its principles which pay attention to the natural characteristics of the brain in the learning process. That's because in the brain there are several networks that are connected to process information that affects how and what a person learns (Weiss, 2000). Barbara Given's book, "Teaching to The Brain's Natural Learning System," outlines five primary interconnected components of the brain's natural learning system: emotional, social, cognitive, kinesthetic, and reflective (Given, 2002). This multidisciplinary approach is highly beneficial as it allows individuals to comprehend complex concepts more effectively by incorporating a diverse range of sensory inputs.

Furthermore, the application of Brain-Based Learning is in line with one of the principles of learning a new paradigm in an independent curriculum, which emphasizes the importance of considering the diverse learning needs and developmental attributes of each student to create an engaging and meaningful learning experience (Pusat Asesmen dan Pembelajaran, 2021). Thus, the implementation of Brain-based Learning has advantages that are not only limited to increasing the effectiveness of student skill development learning but also played a vital role in supporting the successful implementation of the independent curriculum in Indonesia. This is because Brain-based Learning can help create a conducive learning environment for students to develop independent, creative, critical, and collaborative abilities, which are the main objectives of the independent curriculum.

4. Conclusion

Brain-based learning has relevance to the principle of differentiated learning, which stands as a new paradigm within the independent curriculum. Its application is student-oriented through a multidisciplinary approach that combines the teacher's understanding of the elements contained in the aspects of neurobiology, pedagogy, and psychology. Through this holistic framework, educators can craft a learning process that reflects the unique characteristics and needs of students, thereby fostering a natural proclivity for learning within the students' brains, devoid of any compulsion or undue pressure. The implementation of the brain-based learning approach in the independent curriculum yields the advantage of enhancing its effectiveness, resulting in enjoyable, meaningful, and beneficial learning experiences.

The implications of this research indicate that brain-based learning can serve as an alternative educational model applicable across all academic levels to contribute to the success of the Independent curriculum. Nevertheless, it remains imperative for educators and researchers to continue engaging in further research. Currently, there is a lack of quantitative studies that explore the precise impact of brain-based learning on enhancing learning outcomes and processes within the context of the independent curriculum. Such research endeavors will fortify comprehension and substantiate the sustained utility of brain-based learning in educational realms, particularly within independent curricula.

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