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Improving Islamic Religious Education Learning Outcomes Utilizing the Brain-based Learning Model Based on Students' School Origin and Cognitive Stage

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Abstract

This study aims to improve learning outcomes in Islamic religious education (IRE) utilizing the brain-based learning model based on students' school origin and cognitive stage. This study used a quantitative approach and was conducted in SMPN 1 Wanayasa Purwakarta Regency with a sample of 31 students, SMPN 2 Parongpong West Bandung Regency with a sample of 32 students, and SMPN 2 Ciampel Karawang Regency with a sample of 37 students. The research instrument was a test with data analysis requirements, consisting of a normality test and a homogeneity test, using Kolmogorov-Smirnov and Shapiro-Wilk, assisted by SPSS software version 26. It was found that there were significant differences and interactions in the IRE learning outcomes that utilized the brain-based learning model based on students' school origin in SMPN 1 Wanayasa, SMPN 2 Parongpong, and SMPN 2 Ciampel, and students' cognitive stages in the concrete, transitional, and formal categories. Therefore, further study can be carried out based on students' school origin at the Senior High School level and cognitive stage utilizing the brain-based learning model.

Keywords: Brain-Based Learning Model, Cognitive Stage, Islamic Religious Education, School Origin.

Abstrak

Penelitian ini bertujuan untuk meningkatkan hasil belajar pendidikan agama Islam (PAI) dengan menggunakan model pembelajaran berbasis otak (*brain-based learning*) berdasarkan asal sekolah dan tahap kognitif siswa. Penelitian ini menggunakan pendekatan kuantitatif dan dilakukan di SMPN 1 Wanayasa Kabupaten Purwakarta dengan sampel sebanyak 31 siswa, SMPN 2 Parongpong Kabupaten Bandung Barat dengan sampel sebanyak 32 siswa, dan SMPN 2 Ciampel Kabupaten Karawang dengan sampel sebanyak 37 siswa Instrumen penelitian berupa tes dengan syarat analisis data terdiri dari uji normalitas dan homogenitas menggunakan Kolmogorov-Smirnov dan Shapiro-Wilk berbantuan software SPSS versi 26. Ditemukan adanya perbedaan dan interaksi signifikan pada hasil belajar PAI yang menggunakan model pembelajaran *brain-based learning* berdasarkan asal sekolah siswa di SMPN 1 Wanayasa, SMPN 2 Parongpong, dan SMPN 2 Ciampel dan tahap kognitif siswa berada pada kategori konkret, transisi, dan formal. Oleh karena itu, dapat dilakukan kajian lebih lanjut berdasarkan asal sekolah siswa pada jenjang SMA dan tahap kognitif dengan menggunakan model pembelajaran berbasis otak.

Kata kunci: Brain-Based Learning Model, Cognitive Stage, School Origin.

Introduction

Many educational structures are designed to hone and expand students' memory capacity (Yusuf, 2023), which is fundamentally a rote-focused approach to learning (Silvira & Suyadi, 2023). However, the greatest advantage that humans have compared to other creatures is the ability to think (Husnaini et al., 2020), which is not just a mere capacity or strength of memory (Santosa, 2022). Adopting a conventional learning approach that emphasizes the excesses of memorization tends to make the learning process centralized with the teacher. It makes students objects of learning to be able to complete the tasks given (Putri, 2022). In addition, students also have the potential to receivevarious punishments if they make mistakes and lack appreciation for their performance inmemorization (Sabarudin et al., 2023).

In recent decades, Islamic religious education has come under criticism from various quarters due to its use of auditory-oriented learning methods focusing on drills, repetition, and most of the time spent on activities that encourage convergent thinking (Nofrianti & Arifmiboy, 2021; Suraijiah et al., 2023). This is due to the emphasis on daily practice and school tests that focus more on absorbing subject matter through memorization rather than the thought process of analyzing and synthesizing problems (Nusroh & Luthfi, 2020). If this kind of learning pattern is maintained, it will harm students in the long run. These impacts include remembering subject matter briefly, making students passive, discouraging social skills, causing repetitiveness that hinders students' creativity and thought exploration, leading to convergent thinking, and following instructions without the freedom to think independently (Nowak, 2022). Students will feel that what they are doing is not something they want. It contradicts efforts to create meaningful student learning experiences (Azzahra & Dwiputra, 2023; Windari et al., 2023).

Teachers have a central role in the classroom, and success in learning is highly dependent on the teacher's ability to create conducive conditions and encourage students to think critically and creatively (Keiler, 2018). It indicates the importance of teacher awareness to continue improving their competence and adapting to all changes (Habibah, 2022). Ten challenges lie in the way of the learning process: not knowing how different people learn, not communicating well, not keeping up with educational technology, not communicating with parents, pressure from school administrators, not having engaging lesson plans that align with the curriculum, managing behavior and the classroom, long administrative tasks, not having enough money and burnout (Hegwood, 2023). The main challenge in the learning

process of Islamic religious education is delivering religious material to attract students' attention and increase their understanding and acceptance of religious teachings (Triansyah et al., 2023). This is vital because students' interest in this subject varies significantly, so a monotonous approach can reduce the effectiveness of learning (Sirojuddin, 2023). Therefore, an innovative and exciting learning approach is needed to improve students' learning outcomes in Islamic religious education.

One of the practical learning models to improve these abilities is the brain-based learning model (Baroroh & Prastowo, 2023). Three strategies are used by the teachers when they apply BBL: establishing a classroom environment that can (1) encourage students to think critically, (2) welcome them into a sufficiently pleasant setting, and (3) foster an environment that is engaging and meaningful for them. This notion suggests that safe and threat-free learning environments should be provided for students. Additionally, students study the brain's functions and makeup, which equips them to process, store, and recall knowledge enjoyably (Handayani & Nurfadilah, 2021). Moreover, many previous studies have not involved the learning process of Islamic religious education with the brain-based learning model to provide meaningful learning to students based on their cognitive stage (Arizal et al., 2019; Nasution et al., 2020). It is because the studies that have been carried out focus on the implementation's effects based on student gender (Zuhra & Safarati, 2024), improving student learning outcomes and science literacy (Handayani & Nurfadilah, 2021; Windari et al., 2023), and integrating it with digital learning media (Yolanda et al., 2024).

In order to fill the gap, this study aims to improve learning outcomes in Islamic religious education using the brain-based learning model based on students' school origins and cognitive stages. Then, the novelty value of this study is in the geographical aspect of students and the student's stage of thinking in junior high schools, where the stages of concrete, transitional, and formal thinking are still found to be analyzed further. Islamic religious education shapes students' character and morality (Syafei, 2019). Learning Islamic religious education is not only about introducing religious aspects but also aims to develop positive attitudes, such as honesty (Habibah et al., 2023; Muttaqin, 2023), caring (Wulandari & Suyadi, 2019), tolerance (Helmawati et al., 2024; Mawadda et al., 2023; Mustakim et al., 2021; Nurhidin, 2023), curiosity to continue to develop, critical and creative thinking (Masturin, 2024; Yolanda et al., 2024), and maximizing reasoning in the context of abstraction, which is the basis for the formation of a good personality to be applied to everyday life.

Methods

This study used a quantitative approach conducted in SMPN 1 Wanayasa Purwakarta Regency, SMPN 2 Parongpong West Bandung Regency, and SMPN 2 Ciampel Karawang Regency. This research uses a survey method by reviewing student learning outcomes with the time spent during one meeting and Analysis of Variances test analysis to determine the relationship between students' learning outcomes of Islamic religious education, student's school of origin, and students' cognitive stage categorized as concrete, transitional, and formal. The sampling technique uses cluster area sampling with the Slovin formula to determine the number of samples used in this research.

$$n = \frac{N}{1 + Ne^2}$$

The population of this study was seventh-grade students in SMPN 1 Wanayasa with a sample of 31 students, SMPN 2 Parongpong with a sample of 32 students, and SMPN 2 Ciampel with a sample of 31 students in SMPN 1 Wanayasa with a sample of 37 students. The sample total is 100 students in the inferential statistical analysis. This research instrument was a test with data analysis requirements consisting of a normality and homogeneity test using Kolmogorov-Smirnov and Shapiro-Wilk assisted by SPSS software version 26.

Results and Discussion

The Alternative Hypothesis and Null Hypothesis

The alternative hypothesis is an answer to the research question. It claims that there is an effect on the population. In other words, it is a claim that is expected or hoped to be true. Then, the null hypothesis is another answer to the research question. It claims no effect on the population (Turney, 2022). The alternative and null hypotheses with the test criteria accept h_0 if the Sig. value ≥ 0.05 and reject h_0 if the sig. value < 0.05 are as follows.

H_0 : There is no difference in learning outcomes in Islamic religious education utilizing the brain-based learning model based on students' school origin.

H_1 : There are differences in learning outcomes in Islamic religious education utilizing the brain-based learning model based on students' school origin.

H_0 : There is no difference in learning outcomes in Islamic religious education utilizing the brain-based learning model based on the cognitive stages of concrete, transitional, and formal category students.

H_1 : There are differences in learning outcomes in Islamic religious education utilizing the brain-based learning model based on the cognitive stages of concrete, transitional, and formal category students.

H_0 : There is no interaction between students' school origin and the cognitive stage of concrete, transitional, and formal categories in determining learning outcomes in Islamic religious education, which utilizes a brain-based learning model.

H_1 : There is an interaction between students' school origin and the cognitive stage of concrete, transitional, and formal categories in determining learning outcomes in Islamic religious education, which utilizes a brain-based learning model.

Students' School Origin and Cognitive Stage

Several steps are discussed to explain students' school origin and cognitive stage. These steps include subject factors, descriptive statistics, a test of normality, Levene's test of equality of error variances, a test of between-subjects effects, multiple comparisons of school origin, and multiple comparisons of the cognitive stage. They complete each other.

Table 1. Between subjects factors

	Value Label	N
School Origin	SMPN 1 Wanayasa	31
	SMPN 2 Parongpong	32
	SMPN 2 Ciampel	37
Cognitive Stage	Formal	35
	Transition	40
	Concrete	25

Based on the output of Between Subject Factors, it can be known that the number of students in SMPN 1 Wanayasa, SMPN 2 Parongpong, and SMPN 2 Ciampel amounted to 31, 32, and 37 students with a total of 100 students. Then, based on the student's cognitive stages, they were classified into formal, transitional, and concrete, averaging 35, 40, and 25 students.

Table 2. Descriptive statistics

School Origin	KAM	Mean	Std. Deviation	N
SMPN 1 Wanayasa	Formal	88.75	5.225	12
	Transition	74.33	4.271	12
	Concrete	52.71	4.572	7
	Total	75.03	14.58	31
SMPN 2 Parongpong	Formal	85.64	3.296	14
	Transition	78.90	1.101	10
	Concrete	74.25	2.712	8
	Total	80.69	5.421	32

School Origin	KAM	Mean	Std. Deviation	N
SMPN 2 Ciampel	Formal	87.11	2.147	9
	Transition	78.22	1.592	18
	Concrete	69.60	4.169	10
	Total	78.05	6.851	37

Based on the Descriptive Statistics output, it can be known that students in SMPN 1 Wanayasa at the formal, transitional, and concrete thinking stages have an average value, with a total of 75.03. In contrast, the standard deviation has a total of 14.58. Then, in SMPN 2 Parongponng at the formal, transitional, and concrete thinking stages, students have an average value of 80.69, while the standard deviation values total 5.421. In addition, students in SMPN 2 Ciampel at the formal, transitional, and concrete thinking stages have average values of 78.05, while the standard deviation values have a total of 6.851. As shown in the output above, it is found that the average value and standard deviation based on the number of students in the formal, transitional, and concrete thinking stages in SMPN 1 Wanayasa amounted to 12,12, 7, with a total of 31, in SMPN 2 Parongpong amounted to 14, 10, 8 with a total of 32, and in SMPN 2 Ciampel amounted to 9, 18, 10 with a total of 37 students.

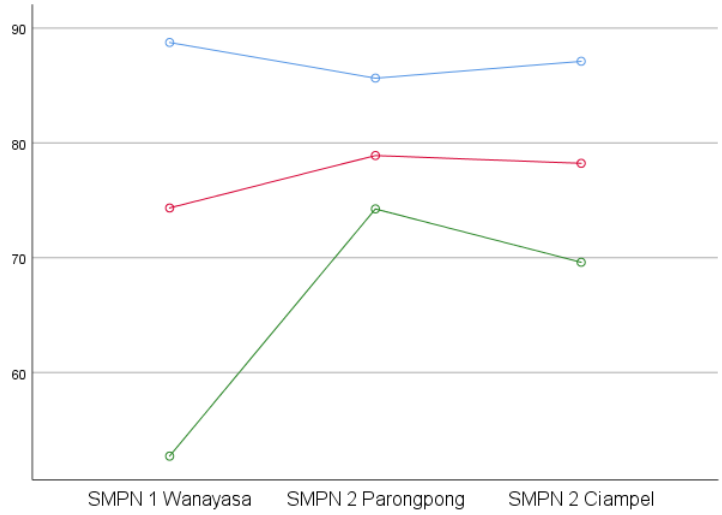


Figure 1. Estimated marginal means

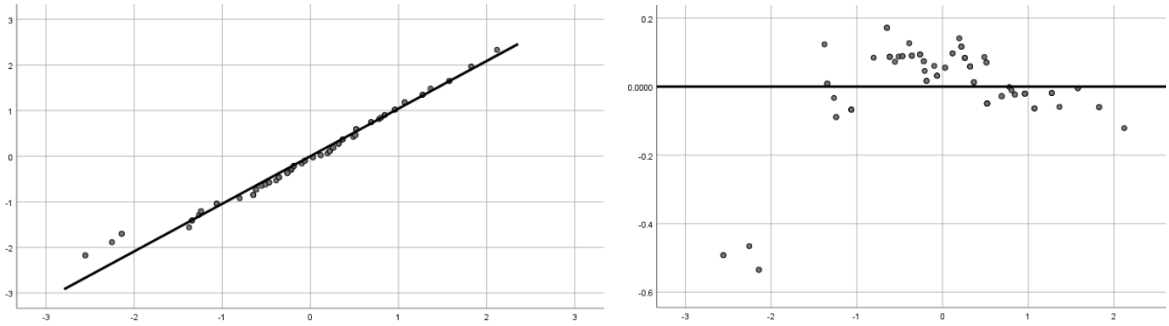
Based on Figure 1, it can be known that the Profile Plot on the students' school origin variable and the cognitive stage is in the formal, transitional, and concrete categories. The blue line shows the students' cognitive stage in a formal category, the red line in a transition category, and the green line in a concrete category. So, it can be said that students with a formal cognitive stage in SMPN 1 Wanayasa are better than those in SMPN Parongpong and

SMPN 2 Ciampel. In comparison, students in SMPN 2 Ciampel are better than those in SMPN 2 Parongpong. Then, at the cognitive stage of the transitional category, students in SMPN 2 Parongpong can be said that they are better than students in SMPN 1 Wanayasa and SMPN 2 Ciampel, while students in SMPN 2 Ciampel are better than students in SMPN 1 Wanayasa. Next, students with a concrete category cognitive stage in SMPN 2 Parongpong can be better than those in SMPN 1 Wanayasa and SMPN 2 Ciampel. In comparison, students in SMPN 2 Ciampel are better than those in SMPN 1 Wanayasa.

Table 3. Tests of normality

	Kolmogorov-Smirnov[a]		**Shapiro-Wilk**	
	Statistics	Sig.	Statistics	Sig.
Standardized Residual	.069	.200*	0.981	0.155

Based on the Test of Normality output, it can be known that the Standardized Residual value on Kolmogorov-Smirnov and Shapiro-Wilk is 0.200 and 0.155. From the data above, it is obtained that the significance value is more significant than 0.05, and it can be concluded that the data is normally distributed.



Picture 2. Detrended and normal Q-Q plot of standardized residual

Figure 2 shows that most of the Standardized Residual value data of learning outcomes in Islamic religious education whose learning uses the problem brain-based learning model is around the line. So, it shows that the data is normally distributed. Furthermore, it will be continued with the variance homogeneity test.

Table 4. Levene's Test of Equality of Error Variances[a,b]

	Levene Statistics	**Sig.**
Based on Mean	4.090	0.000
Based on Median	2.540	0.015
Based on the Median and with adjusted df	2.540	0.023
Based on trimmed mean	3.973	0.000

Based on Levene's Test output, it can be known that the Sig. based on the mean is 0.000. From the data above, it is obtained that the significance value is smaller than 0.05, and it can be concluded that the data has the same or homogeneous variance value.

Table 5. Tests of between-subjects effects

Source	Mean Square	F	Sig.
School Origin	501.628	42.807	.000
Cognitive Stage	3337.250	284.791	.000
School Origin*Cognitive Stage	385.383	32.887	.000

Based on the Tests of Between Subjects Effects output, it can be known that the Significance value of School Origin, Cognitive Stage, and School Origin * Cognitive Stage are all 0.000. From the data obtained, the significance value is smaller than 0.05. It can be concluded that there are differences in learning outcomes in Islamic religious education utilizing brain-based learning model based on students' school origin, there are differences in learning outcomes in Islamic religious education utilizing brain-based learning model based on students' cognitive stages in the concrete, transitional, and formal categories, and there is an interaction between school origin and students' cognitive stages in the concrete, transitional, and formal categories in determining learning outcomes in Islamic religious education whose learning utilizes brain-based learning model. Due to the differences between students' learning outcomes utilizing a brain-based learning model based on students' school origin and cognitive stages, the post hoc test continued to describe the results of the hypothesis obtained in more detail.

Table 6. Multiple comparisons of school origin

School Origin	School Origin	Mean Difference	Std. Error	Sig.
SMPN 1 Wanayasa	SMPN 2 Parongpong	-5.66*	.863	.000
	SMPN 2 Ciampel	-3.02*	.833	.001
SMPN 2 Parongpong	SMPN 1 Wanayasa	5.66*	.863	.000
	SMPN 2 Ciampel	2.63*	.826	.006
SMPN 2 Ciampel	SMPN 1 Wanayasa	3.02*	.833	.001
	SMPN 2 Parongpong	-2.63*	.826	.006

Based on Table 6 above, it can be known that the significance value between SMPN 1 Wanayasa and SMPN 2 Parongpong is 0.000, between SMPN 1 Wanayasa and SMPN 2 Ciampel is 0.001, and between SMPN 2 Parongpong and SMPN 2 Ciampel is 0.006. From the data obtained, the significance value is smaller than 0.05, and it can be concluded that there is a difference in learning outcomes in Islamic religious education utilizing the brain-

based learning model based on school origin in SMPN 1 Wanayasa, SMPN 2 Parongpong, and SMPN 2 Ciampel. It is also evidenced by the (*) sign on the Mean Difference value, which shows that the differences in students' learning outcomes in Islamic religious education based on school origin can be real.

Table 7. Multiple comparisons of the cognitive stage

Cognitive Stage	Cognitive Stage	Mean Difference	Std. Error	Sig.
Formal	Transition	9.86*	.792	.000
	Concrete	20.73*	.896	.000
Transition	Formal	-9.86*	.792	.000
	Concrete	10.86*	.873	.000
Concrete	Formal	-20.73*	.896	.000
	Transition	-10.86*	.873	.000

Based on Table 7 above, it can be known that the significance value between the students' cognitive stages categorized as formal with transitional, formal with concrete, and transitional with concrete is 0.000. From the data obtained, the significance value is smaller than 0.05. It can be concluded that there is a difference in learning outcomes in Islamic religious education utilizing brain-based learning models based on the student's cognitive stage in the formal, transitional, and concrete categories. It is also evidenced by the * sign on the Mean Difference value, which shows that the differences that occur in students' learning outcomes in Islamic religious education based on these cognitive stages can be said to be real.

Brain-based Learning Model

The brain-based learning Model is a learning approach based on understanding the human brain (Anggraini et al., 2020). This model assumes that the human brain has an important role in the learning process and is the cognitive control center (Wilson et al., 2023), which in this study is classified in secondary schools at the concrete, transitional, and formal thinking stages. The brain-based learning model prioritizes using learning strategies that optimally engage the brain, thus ensuring that the material taught can be understood and applied effectively and efficiently (Damayanti & Suryadi, 2024). The brain-based learning model is oriented towards expandingthe understanding of learning activities that can be classified based on students' cognitive stages (Nurasiah et al., 2022).

Based on the explanation above, it can be known that the use of the brain-based learning Model on the students' cognitive stage is classified by school origin, namely SMPN 1 Wanayasa, SMPN 2 Paronngpong, and SMPN 2 Ciampel. The treatment of Islamic

religious education learning outcomes utilizing the brain-based learning model affects students' learning outcomes in understanding concepts and optimizing the thinking skills that students already have in the concrete, transitional, and formal categories. Thus, this aligns with previous research, where learning Islamic religious education utilizing a brain-based learning model affects the aspect of differences and students' learning interactions (Arikarani, 2019; Handayani & Nurfadilah, 2021).

Conclusion

This study found a significant difference in the learning outcomes of Islamic religious education utilizing the brain-based learning model based on the student's school origin based on the student's cognitive stages in the concrete, transitional, and formal categories. In addition, there was a significant interaction between students' school origin and cognitive stage in the learning outcomes of Islamic religious education. Then, the differences are classified explicitly between the students' school origins.The difference in the student's thinking stage is also seen in the formal cognitive stage in SMPN 1 Wanayasa, which is better than students in SMPN Parongpong and SMPN 2 Ciampel. Next, the student's cognitive stage of transitional and concrete category in SMPN 2 Parongpong can be better than students in SMPN 1 Wanayasa and SMPN 2 Ciampel. Thus, for further study, it can be referenced to analyzing students' learning outcomes based on their school origin and cognitive stage at the Senior High School level to know the differences and interactions that occur utilizing brain-based learning models.

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