

# Cognitive-Based Concept Mapping for Designing IRE Materials: Enhancing Meaningful Learning through Structured Knowledge

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## ABSTRACT

This study investigates the effectiveness of concept maps, grounded in Cognitive Load Theory (CLT) and Dual Coding Theory (DCT), in promoting meaningful understanding within Islamic Religious Education (PAI) as an alternative to rote-based pedagogy that hinders deeper conceptual and reflective learning. Using a quasi-experimental pretest–posttest control-group design with two intact eleventh-grade classes at a public senior high school, the experimental group was taught with cognitively informed concept maps while the control group received traditional lectures; cognitive gains in conceptual understanding were measured via pretest and posttest assessments. Results show that the experimental group achieved significantly higher posttest scores and greater improvement, with concept maps reducing extraneous cognitive load, enhancing dual-channel information processing, and integrating abstract Islamic values into coherent conceptual structures; students also exhibited increased engagement, participation, and reflective thinking. Although limited to two classes and a single instructional topic—and without assessing long-term retention or affective outcomes—the findings indicate that cognitively grounded visual strategies can enhance conceptual learning and warrant consideration in IRE instructional and curricular design. The study contributes to the underexplored domain of cognitive theory–driven visual strategies in religious education by combining CLT and DCT with concept mapping to propose a novel pedagogical model that supports both cognitive efficiency and meaningful understanding in faith-based learning contexts.

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## INTRODUCTION

Islamic Religious Education (IRE) plays a fundamental role in shaping students' character and noble morals [1], [2], [3]. However, in practice, IRE instruction at various educational levels remains dominated by traditional approaches that emphasize rote memorization of doctrines and verbal mastery of content, without contextualizing it with real-life situations [4], [5], [6]. Data from the Ministry of Education and Culture show that approximately 74% of IRE teachers still rely on lecture and memorization methods, while only 18% utilize visual media or active learning strategies [3], [7], [8]. This has resulted in students' low absorption of Islamic values that are meaningful and applicable to everyday life.

The 21st-century learning paradigm demands a transformation from rote-based learning to meaningful learning, particularly in religious education [9], [10], [11]. According to Ausubel, meaningful learning occurs when new information is substantively linked to the learner's existing cognitive structure [12]. In the context of IRE, this means that students should not merely memorize verses or hadiths but also understand their conceptual meanings and relate them to relevant moral and social values [13], [14]. Failure to foster meaningful learning in IRE may lead to weak internalization of religious values and a high potential for religious formalism among students [15].

Several recent studies support the effectiveness of visual learning strategies such as concept maps in enhancing learning quality. A meta-analysis by Anastasiou et al. (2024) reported that the use of concept maps in science education led to moderate to large improvements in student learning outcomes ( $g = 0.776$ ). Meanwhile, research by Yarmohammadi et al. (2023) in the context of midwifery education showed that concept map methods yielded significantly higher learning scores and student satisfaction compared to lecture-based methods ( $p < 0.05$ ). These findings suggest that this approach can be transferred to other fields, including religious education, provided it is designed with appropriate pedagogical principles.

Nevertheless, research on the use of concept maps in IRE instruction remains very limited, especially studies that integrate this approach with cognitive theoretical frameworks such as Cognitive Load Theory (CLT) and Dual Coding Theory (DCT) [18], [19], [20]. CLT emphasizes the importance of reducing cognitive load by presenting information in a clear and concise structure, whereas DCT asserts that learning becomes more effective when information is presented both verbally and visually [21], [22], [23]. In this regard, concept maps serve a dual function: simplifying information and integrating visual and verbal elements, thereby potentially enhancing retention and conceptual understanding [24].

The issue of verbalistic tendencies in IRE learning, coupled with the absence of focused studies examining the application of concept maps grounded in cognitive theories within this context, presents a significant research gap. Therefore, an in-depth empirical study is needed to address this gap. This research aims to examine the effectiveness of using concept maps based on cognitive theories (CLT and DCT) in enhancing meaningful learning in Islamic Religious Education.

The urgency of this research lies in the need to develop a model of religious education that is not only informative but also transformative. If this issue is not addressed through research and appropriate solutions, IRE instruction risks remaining doctrinal and socially irrelevant, ultimately hindering the achievement of national education goals in nurturing individuals of faith and noble character.

## METHODOLOGY

This study adopted a quasi-experimental research design with a pretest-posttest control group structure [25], [26], [27]. This design was selected to examine the effectiveness of a learning intervention—namely, the integration of concept maps with Cognitive Load Theory (CLT) and Dual Coding Theory (DCT)—on students' meaningful learning outcomes in the context of Islamic Religious Education (IRE). The use of a quasi-experimental design allowed for a comparative analysis between an experimental group and a control group, even though random assignment was not feasible due to institutional constraints [28], [29], [30]. The primary focus was to assess whether students who were taught using cognitive theory-based concept maps demonstrated significantly greater improvement in understanding compared to those taught using traditional methods.

The participants of this study were two intact classes of eleventh-grade students enrolled at SMA IT Nur Hidayah Sukoharjo during the 2025/2026 academic year. A purposive sampling technique was used to select the participants based on administrative class scheduling and similarity in academic characteristics. One class (XI-A) was designated as the experimental group, receiving IRE instruction using concept maps supported by cognitive learning principles, while the other class (XI-B) served as the control group, taught using conventional lecture-based strategies. Each group consisted of approximately 30 students, and both received instruction on the same IRE topic during a four-week period.

Three main instruments were utilized in this study. First, a learning outcome test was developed to assess students' understanding before and after the intervention. This test consisted of multiple-choice and short-

answer items that measured meaningful learning indicators such as conceptual comprehension, application, and the ability to relate ideas. The test items were reviewed and validated by experts in IRE content and educational assessment. Second, a concept map rubric was used exclusively for the experimental group to evaluate student-created maps. The rubric measured four components: hierarchical organization, conceptual accuracy, clarity of linking words, and completeness of content. Third, an observation sheet was employed during classroom sessions to record student engagement, interactions, and behavioral responses to the teaching strategies used in both groups.

Data collection was conducted over two consecutive weeks. The procedure began with a pretest administered to both experimental and control groups to establish baseline data on students' prior knowledge. The treatment phase followed, during which the experimental group received lessons using concept maps designed according to CLT (to reduce extraneous cognitive load) and DCT (to combine verbal and visual inputs), while the control group continued with conventional lecture-based instruction. After the treatment, a posttest identical to the pretest was administered to measure any improvement in learning outcomes. Additionally, the concept maps created by students in the experimental group were collected and assessed. Throughout the instructional sessions, the researcher observed classroom activities to supplement quantitative findings with qualitative insights on engagement and participation.

The collected data were analyzed using both descriptive and inferential statistical techniques. Descriptive statistics such as mean and standard deviation were used to summarize students' test scores and observation findings. Prior to inferential analysis, the normality of score distributions was tested using the Shapiro-Wilk test [31], and the homogeneity of variance between groups was tested using Levene's test [32]. To examine the effect of the intervention, a paired sample t-test was employed to compare pretest and posttest results within each group, while an independent sample t-test was used to compare the posttest results between the experimental and control groups. All statistical analyses were performed using SPSS software, and significance was set at the 0.05 level.

## RESULTS AND DISCUSSION

### Main Findings

#### *Description of Preliminary Data*

This study was conducted at SMA IT Nur Hidayah Sukoharjo during the first semester of the 2025/2026 academic year. The research subjects consisted of two eleventh-grade classes (*Kelas XI*) with relatively comparable academic characteristics, based on their previous Islamic Religious Education (IRE) report card scores. Class XI-A, comprising 28 students, was designated as the experimental group, which received instruction using concept maps integrated with cognitive theory—specifically, Cognitive Load Theory (CLT) and Dual Coding Theory (DCT). Meanwhile, Class XI-B, consisting of 29 students, was designated as the control group, which received instruction through conventional lecture-based methods.

To assess students' initial competencies, both classes were administered a pretest consisting of 10 multiple-choice questions designed to measure aspects of meaningful understanding in the IRE subject. These aspects included conceptual knowledge, understanding of inter-concept relationships, and the application of concepts in daily life. The pretest results are summarized in the following table:

**Table 1.** Descriptive Statistics of Pretest Scores

| Class                  | Number of Students | Minimum Score | Maximum Score | Mean Score | Standard Deviation |
|------------------------|--------------------|---------------|---------------|------------|--------------------|
| XI-A<br>(Experimental) | 28                 | 45            | 80            | 63.2       | 9.13               |

|                |    |    |    |      |      |
|----------------|----|----|----|------|------|
| XI-B (Control) | 29 | 43 | 78 | 62.5 | 8.76 |
|----------------|----|----|----|------|------|

The pretest results showed that the average scores of the two classes were within a nearly equivalent range, with a mean difference of only 0.7 points. This indicates that, academically, both classes possessed a homogeneous baseline ability, making them suitable for comparative analysis in this study. The distribution of student scores on the pretest is presented in the following table to illustrate the spread of scores across various ranges:

**Table 2.** Frequency Distribution of Pretest Scores

| Score Range  | XI-A (Experimental) | XI-B (Control) |
|--------------|---------------------|----------------|
| 40–49        | 3 students          | 4 students     |
| 50–59        | 6 students          | 7 students     |
| 60–69        | 11 students         | 10 students    |
| 70–79        | 6 students          | 6 students     |
| 80 and above | 2 students          | 2 students     |

The majority of students in both classes fell within the 60–69 score range, which is categorized as moderate. The number of students achieving high scores ( $\geq 80$ ) remained relatively low. This suggests that there is considerable room for improvement in learning outcomes through the intervention applied in this study.

### Posttest Results

Following two instructional sessions with different treatments, students in both classes were administered an identical posttest to assess their meaningful learning outcomes after the intervention. The posttest results were analyzed descriptively to observe score development within each class and to compare the effectiveness of the respective instructional methods.

The results indicated an improvement in learning outcomes in both classes; however, the increase was more substantial and evenly distributed in the experimental class (XI-A), which employed concept maps based on cognitive theory, compared to the control class (XI-B), which used the conventional lecture method.

**Table 3.** Descriptive Statistics of Posttest Scores

| Class               | Number of Students | Minimum Score | Maximum Score | Mean Score | Standard Deviation |
|---------------------|--------------------|---------------|---------------|------------|--------------------|
| XI-A (Experimental) | 28                 | 60            | 92            | 78.9       | 8.32               |
| XI-B (Control)      | 29                 | 55            | 85            | 70.3       | 7.84               |

The average posttest score of the experimental class (78.9) was higher than that of the control class (70.3). Additionally, the experimental class showed an improvement in the minimum score, rising from 45 to 60, along with an increase in the number of students achieving high scores ( $\geq 80$ ). To illustrate the progression of learning outcomes from pretest to posttest, the following table presents the changes in average scores for each class:

**Table 4.** Change in Mean Scores from Pretest to Posttest

| Class               | Pretest Mean | Posttest Mean | Mean Increase |
|---------------------|--------------|---------------|---------------|
| XI-A (Experimental) | 63.2         | 78.9          | +15.7         |
| XI-B (Control)      | 62.5         | 70.3          | +7.8          |

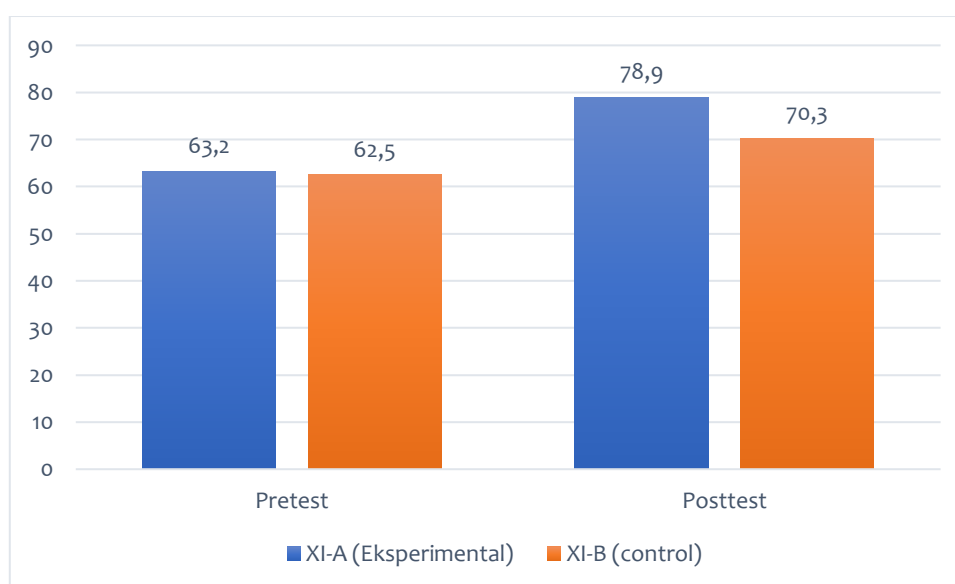
This significant improvement indicates that concept map-based instruction, integrated with cognitive theory, is more effective in enhancing students' meaningful learning outcomes, particularly in understanding

the interrelationships among complex Islamic concepts. The posttest score distribution in both classes also reflects a more even improvement in the experimental class, as illustrated in the following table:

**Table 5.** Frequency Distribution of Posttest Scores

| Score Range  | XI-A (Experimental) | XI-B (Control) |
|--------------|---------------------|----------------|
| 50–59        | 0 students          | 3 students     |
| 60–69        | 5 students          | 10 students    |
| 70–79        | 10 students         | 11 students    |
| 80–89        | 10 students         | 5 students     |
| 90 and above | 3 students          | 0 students     |

A total of 13 students (46%) in the experimental class achieved scores of  $\geq 80$ , compared to only 5 students (17%) in the control class. Furthermore, no students in the experimental class scored below 60, indicating more stable and comprehensive learning outcomes. A comparison of the average pretest and posttest scores is also presented in the following graph:



**Figure 1.** Comparison Chart of Pretest and Posttest Mean Scores

Based on the data presented in the graph above, it can be concluded that the concept map-based instructional approach, supported by cognitive theory, has proven to be more effective in enhancing meaningful learning outcomes in Islamic Religious Education (IRE) compared to conventional lecture-based methods.

### **Inferential Statistical Analysis**

Inferential statistical analysis was conducted to determine whether there was a statistically significant difference in the improvement of learning outcomes between the experimental class and the control class. This analysis included tests for normality, homogeneity, a paired sample t-test, and an independent sample t-test. Prior to conducting the t-tests, the pretest and posttest data were subjected to a normality test using the Kolmogorov-Smirnov test, in order to ensure that the data distributions conformed to the assumptions of normal distribution.

**Table 6.** Normality Test (Kolmogorov–Smirnov)

| Class               | Pretest (Sig.) | Posttest (Sig.) | Conclusion |
|---------------------|----------------|-----------------|------------|
| XI-A (Experimental) | 0.176          | 0.200           | Normal     |
| XI-B (Control)      | 0.128          | 0.167           | Normal     |

Based on Table 6, the significance values for both the pretest and posttest in each class were greater than 0.05. This indicates that the students' learning outcome data from both groups were normally distributed, thus meeting the assumptions required for conducting parametric tests. The next step was the Test of Homogeneity of Variances, which was conducted to ensure that the variances between the two groups were equal. This test employed Levene's Test for Equality of Variances.

**Table 7.** Homogeneity of Variance Test (Levene's Test)

| Variabel | Sig. Levene | Conclusion  |
|----------|-------------|-------------|
| Posttest | 0,292       | Homogeneous |

The results of the test, as shown in Table 7, indicate a significance value of 0.292, which is greater than 0.05. This suggests that the variances between the experimental and control classes are homogeneous. Therefore, the posttest scores between the two groups can be validly compared using the independent sample t-test. Subsequently, a paired sample t-test was conducted within each class to determine whether there were significant differences in students' scores before and after the intervention.

**Table 8.** Paired t-Test – Experimental Class (XI-A)

| Statistic               | Value  |
|-------------------------|--------|
| t-value                 | -9.874 |
| df (degrees of freedom) | 27     |
| Sig. (2-tailed)         | 0.000  |

Based on Table 8, the significance value was 0.000, which is less than 0.05, indicating a statistically significant difference between the pretest and posttest scores in the experimental class. This significant improvement suggests that the implementation of concept maps based on cognitive theory effectively and substantially enhanced students' learning outcomes.

**Table 9.** Paired t-Test – Control Class (XI-B)

| Statistic               | Value  |
|-------------------------|--------|
| t-value                 | -6.425 |
| df (degrees of freedom) | 28     |
| Sig. (2-tailed)         | 0.000  |

Table 9 above shows that the control class experienced a significant improvement from pretest to posttest ( $p = 0.000$ ). However, the lower t-value compared to the experimental class indicates that the magnitude of improvement was smaller, which is consistent with the earlier descriptive findings. The analysis then proceeded with an Independent Sample t-Test (Between Groups). This test was used to determine whether there was a statistically significant difference in learning outcomes between the experimental and control classes following the intervention, with a focus on the posttest scores.

**Table 10.** Independent Sample t-Test (Posttest: Experimental vs. Control Class)

| Statistic               | Value |
|-------------------------|-------|
| t-value                 | 4.127 |
| df (degrees of freedom) | 55    |
| Sig. (2-tailed)         | 0.000 |
| Mean Difference         | 8.57  |

Based on Table 10, a significance value of 0.000 ( $p < 0.05$ ) and a mean difference of 8.57 points were obtained. This indicates a highly significant difference between the posttest results of the experimental class and the control class. In other words, students who were taught using concept maps grounded in cognitive

theory achieved statistically higher learning outcomes compared to those taught using conventional lecture methods.

The results of the statistical analysis demonstrate that instruction using cognitive theory-based concept maps is significantly more effective than the traditional lecture method. The data satisfied the assumptions of normality and homogeneity, and the paired sample t-test revealed improvement in both classes, with a notably greater increase in the experimental group. The independent sample t-test yielded a significance value of 0.000 and a mean difference of 8.57 points, confirming the presence of a significant difference between the two groups. Thus, this approach has been empirically proven to enhance students' meaningful understanding in Islamic Religious Education (IRE) more optimally.

## Discussion

### *The Effectiveness of Concept Maps in Fostering Meaningful Learning*

The research findings indicate that the experimental group, which utilized concept maps based on cognitive theory, experienced a significantly greater improvement in learning outcomes compared to the control group, which employed traditional lecture-based methods. The average post-test score in the experimental class reached 78.9, whereas the control group achieved only 70.3. This higher gain demonstrates the effectiveness of using concept maps in promoting meaningful learning within the context of Islamic Religious Education (IRE).

Concept maps operate on Ausubel's theory of meaningful learning, which posits that learning becomes more effective when new information is meaningfully linked to learners' existing cognitive structures [33], [34]. By using concept maps, students do not merely receive information passively; rather, they actively organize and relate complex IRE concepts—such as faith (iman), worship ('ibadah), and moral character (akhlak)—into a coherent and logical framework.

This aligns with the findings of Fonseca et al. (2024), who assert that concept maps enhance critical thinking and reinforce the hierarchical interconnections among concepts. In the context of IRE, where the integration of faith, worship, and character is central to the development of Islamic values, concept maps are highly beneficial in elaborating both causal and conceptual relationships among these values [36], [37]. For instance, students can connect the concept of *faith in God* with *sincerity in worship* and *self-restraint in moral conduct*, leading to a deeper and more integrated understanding.

Concept maps also draw upon the principles of Dual Coding Theory, which emphasizes the simultaneous use of verbal and visual information in the learning process [38], [39], [40]. In IRE instruction, which frequently involves abstract values, the visualization of concepts helps students to grasp meanings more concretely while reducing cognitive load. With concept maps, students can more readily understand the relationships among Islamic legal rulings (fiqh), their theological foundations, and their moral implications in everyday life.

Students in the experimental class were actively engaged in constructing and revising their own concept maps [41], [42]. This activity not only enhanced cognitive engagement but also fostered metacognitive awareness—the ability to reflect on and regulate one's own learning processes [43]. Such involvement contributed to improved learning outcomes, as students became active agents rather than passive recipients in the educational process [44]. This concept is also emphasized in the study by Freedman et al. (2024), which showed that active participation in building collective concept networks significantly predicts students' depth of understanding.

In IRE instruction, concepts such as *tawhid* (monotheism), *sharia* (Islamic law), and *akhlak* (morality) are often taught in isolation [45], [46]. However, in real life, these three pillars are deeply interconnected. Concept

maps offer a powerful method to unify this fragmentation by visualizing how faith informs worship, and how both give rise to noble character. This fosters meaningful learning in which students not only know the “what” but also understand the “why” and “how” within the Islamic worldview [47].

The effective implementation of concept maps in IRE instruction reveals significant potential for transforming pedagogical approaches from rote memorization to conceptual understanding. These findings suggest the need for teacher training in designing and facilitating the use of concept maps, as well as in integrating cognitive theories into instructional planning.

### ***The Role of Cognitive Theory in the Learning Process***

The findings of this study indicate that the improvement in students' meaningful learning outcomes when using concept maps is not solely influenced by differences in material presentation formats but is also closely related to the implementation of principles from modern cognitive theories—particularly Cognitive Load Theory (CLT) and Dual Coding Theory (DCT) [17], [48], [49]. These two theories play a pivotal role in explaining why concept maps serve as effective instructional tools in Islamic Religious Education (IRE), which frequently requires comprehension of abstract, complex, and interrelated concepts [50].

According to CLT, human working memory has a very limited capacity [51]. When students are confronted with large amounts of unstructured and abstract information—as is often the case in IRE content—they are at risk of experiencing cognitive overload, which can hinder the learning process [52]. In this context, concept maps function as scaffolding tools that significantly reduce extraneous cognitive load—that is, the load caused by inefficient presentation of information [24], [53]. By visualizing information into nodes (concepts) and connecting lines (relationships between concepts), students are able to perceive hierarchical and systematic relationships among ideas [34]. For example, in learning about the *pillars of faith* (*rukun iman*), students are not merely memorizing six separate tenets but can instead see how belief in Allah underpins belief in angels and messengers, which in turn informs consistent worship practices [54]. This illustrates a concrete application of CLT through visual structures that help students filter and organize information efficiently.

In addition, the strength of concept maps also lies in their ability to integrate the dual channels of information processing as described by Dual Coding Theory [55]. This theory posits that information processed simultaneously through both verbal and visual pathways is more easily remembered and understood [33], [56]. In concept maps, each concept is represented in brief verbal form (verbal code), interconnected through lines and spatial relationships (visual code) [57], [58]. When students read and observe how concepts like *faith in God*, *worship of God*, and *moral conduct toward others* are interconnected, they do not receive information in a linear fashion alone; rather, they build complex and integrated mental representations [59]. Prior research by Anastasiou et al. (2024) supports this finding, showing that the use of concept maps combining text and visuals enhances memory retention, accelerates comprehension, and improves knowledge transfer across various educational levels.

In practice, the application of cognitive theory through concept maps not only facilitates information processing but also increases student engagement in the learning process [51]. The activity of constructing concept maps requires students to think critically, identify main ideas, and establish relationships among concepts—all of which are active processes essential for constructing meaning [60], [61]. Through this activity, students not only grasp the content of IRE but also develop metacognitive awareness, i.e., an understanding of how they learn. In ideal IRE instruction, students are expected not just to recall doctrinal content but to comprehend its interrelations and apply it in real-life contexts. Hence, a concept-mapping strategy grounded in cognitive theory fosters deeper and more applicable meaningful learning [35], [62].

Therefore, the integration of CLT and DCT through the use of concept maps provides a robust framework for enhancing the effectiveness of IRE instruction. The findings of this study demonstrate that students learning with this approach exhibit higher achievement and a more equitable distribution of scores compared to those in conventional learning settings. The practical implication is the need for teacher training in the design and facilitation of concept maps, as well as alignment with students' cognitive load capacities and the specific characteristics of Islamic educational content [63]. Overall, concept maps should not be viewed merely as learning aids, but as cognitive theory-based instructional strategies capable of transforming pedagogical approaches in religious education.

### ***Implications of the Findings for Islamic Religious Education (IRE)***

The findings of this study underscore the urgent need for a fundamental shift in the pedagogical approach to Islamic Religious Education (IRE)—from a traditional paradigm that emphasizes the memorization of normative texts to a more contemporary paradigm focused on conceptual and reflective understanding [64]. The prevailing tendency in IRE to prioritize rote cognitive mastery has created a disjunction between content acquisition and the application of Islamic values in real life [65]. This is not merely a methodological issue but reflects a deeper structural problem in pedagogical design. Within this context, the concept map-based approach emerges as a strategic learning method that can systemically foster higher-order thinking skills, develop integrated understanding, and bridge the gap between text and context [66].

As demonstrated in this research, concept maps function not merely as visual aids but as epistemological instruments that support students in constructing meaning [67], [68]. IRE contains numerous interrelated concepts that are often taught in a fragmented manner: faith is separated from worship, worship from morality, and history from ethical values [46], [54]. Yet within the Islamic tradition, these three pillars form a cohesive value system that cannot be understood in isolation. Functionally, concept maps are capable of dismantling such fragmentation by visually presenting the structure of meaning and illustrating causal and hierarchical relationships among concepts [60], [69], [70]. For instance, in studying *tawhid* (the oneness of God), students can trace how belief in divine unity informs a sense of worship, social responsibility, and moral accountability as stewards (*khalifah*) of the Earth [71]. This process goes beyond content mastery—it facilitates the internalization of an Islamic cognitive framework.

The potential of concept maps extends to a wide array of themes within IRE. In *fiqh* (Islamic jurisprudence), concept maps can support understanding the logic of legal reasoning (*istinbat*), linking textual evidence (*dalil*), legal maxims (*qawa'id*), and practical application. In *akhlak* (ethics), they can be used to distinguish between virtuous (*mahmudah*) and blameworthy (*madzmumah*) traits while exploring the spiritual, social, and psychological dimensions of ethical behavior [72]. In Islamic history, this approach allows for thematic and critical interpretation, enabling students not only to recall chronology but also to grasp the evolution of thought, civilizational interactions, and the dynamic trajectory of the Muslim ummah across time [45], [50]. These examples illustrate that concept mapping transcends cognitive understanding alone; it fosters the development of a holistic, reflective, and contextually grounded Islamic worldview.

Furthermore, this approach significantly influences students' affective domain [19], [73]. In traditional instruction, the teacher's dominance as the sole authoritative source often marginalizes students' active roles, leading to learning motivation that is contingent on external factors such as grades or punishment [74], [75]. In contrast, concept mapping gives students the opportunity to construct their own knowledge, engage in discussion, revise their understanding, and express it both visually and verbally. This process not only enhances self-confidence and learner autonomy but also fosters authentic learning experiences [53], [76]. In this study, students in the experimental group displayed more active participation, livelier discussions, and a greater

tendency for reflection on the subject matter. These findings align with previous research indicating that visual strategies such as concept maps enhance engagement, stimulate curiosity, and promote deeper meaning-making [18], [35].

From a critical perspective, it is also necessary to reevaluate how current curriculum policies accommodate such approaches. The *Merdeka Curriculum*, for instance, offers more flexible and project-based pedagogical opportunities, yet many IRE teachers are not adequately equipped to design conceptual learning models that go beyond content delivery [65], [77]. Therefore, a major implication of this research is the need to strengthen teacher capacity in curriculum design, conceptual mapping, and visual pedagogy, ensuring that this approach is not merely treated as an alternative method but embraced as a new paradigm for IRE instruction [46], [59], [64].

In conclusion, the use of concept maps offers more than a solution to the overemphasis on rote memorization in IRE; it provides a systematic approach that reinforces the integration of cognitive, affective, and spiritual dimensions. If implemented consistently and supported by progressive curriculum policy, this approach holds transformative potential in cultivating a generation that not only knows what Islam is, but also thinks and acts meaningfully and contextually in accordance with Islamic principles.

### **Limitations of the Study**

Although this study presents significant findings regarding the effectiveness of concept maps in Islamic Religious Education (IRE), several limitations must be critically acknowledged as a basis for future research development. First, the study was conducted with only two classes in a single public senior high school in Central Java. This limited scope impacts the generalizability of the findings. Cognitive, social, and cultural conditions in other schools—both urban and rural—may yield different outcomes. Consequently, the external validity of this research remains relatively narrow and warrants further examination through studies with broader geographical and demographic coverage.

Second, the study focused exclusively on a single topic within the IRE curriculum: the concepts of *faith* (*iman*). In reality, IRE encompasses a wide range of complex domains, including *fiqh* (Islamic jurisprudence), *akhlak* (ethics), the history of Islamic civilization, and contemporary issues. While the concept mapping approach has proven effective in promoting meaningful understanding in this particular topic, its effectiveness across other content areas—such as procedural normative materials (e.g., the steps of ablution) or historical narratives (e.g., the prophetic biography or *sirah nabawiyah*)—remains uncertain. Therefore, cross-topic studies are needed to strengthen the construct validity of this approach within the broader context of IRE instruction.

Third, the study did not measure long-term retention or affective outcomes, such as students' religious attitudes and value internalization. All measurements were conducted quantitatively within a short-term framework, utilizing pretest and posttest assessments spaced only two weeks apart. Yet the ultimate goal of IRE is not solely cognitive academic achievement, but also the formation of character and sustained religious attitudes. Without measuring long-term retention and changes in disposition, the enduring effectiveness of concept mapping in cultivating religious and morally grounded individuals remains an open question that should be addressed by future research. Accordingly, these limitations should be viewed not as detracting from the study's value, but as opportunities for expansion. A critical evaluation of these constraints provides a vital foundation for constructing a more robust, integrative, and impactful research agenda in Islamic religious education.

## CONCLUSION

Cognitive Theory-Based Concept Mapping has been proven effective in enhancing meaningful learning outcomes in Islamic Religious Education (IRE). By visualizing the relationships among concepts within a logical and hierarchical structure, students are better able to comprehend the interconnections between *faith (iman)*, *worship ('ibadah)*, and *moral conduct (akhlak)* as an integrated value system. In addition to strengthening conceptual understanding, this approach reduces cognitive load and accelerates the internalization of knowledge in a more efficient and structured manner. The implementation of such visual strategies holds strong relevance in the context of IRE instruction, which has traditionally relied heavily on rote memorization. Teachers must adopt approaches grounded in modern learning theories to promote both cognitive and affective student engagement. Concept maps play a critical role in fostering comprehensive conceptual understanding, while also encouraging active participation, critical thinking, and reflective awareness of Islamic values. The expanded use of concept maps is recommended across various IRE content areas such as *fiqh*, *akhlak*, and the history of Islamic civilization. Integration with digital technology—for instance, through interactive mapping applications—can enrich the student learning experience and enhance flexibility across diverse instructional contexts. Moreover, longitudinal evaluations are necessary to examine their impact on knowledge retention and the development of deeper, sustained religious attitudes.

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## Author Contribution

All authors contributed equally to this paper. Lutfi Zaki Al Manfaluthi was the lead author responsible for conceptualization, methodology, and initial drafting. Zaim Hilmi Musyaffa contributed significantly to data collection, analysis, and reviewing the manuscript. Azzam Mabrury provided valuable feedback and insights during the revision process. The roles of each author involved conceptualizing the study, conducting research, translating, editing, and finalizing the article. All authors read and approved the final manuscript.

## Conflicts of Interest

All authors declare no conflict of interest.

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