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Enhancing Islamic Astronomical Literacy and Religious Practice through Qibla Direction Training Using the Istiwa'aini Method and Google Earth at Patna Witya School, Thailand

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Abstract

Background: Strengthening Islamic astronomy literacy is essential to ensure that qibla direction education is grounded not only in religious principles but also in scientific and technological approaches. Patna Witya School in Thailand requires practical assistance in understanding geographical coordinates, visualizing the direction of the Kaaba, and performing basic qibla measurements. **Objective**: This program aimed to enhance students' Islamic astronomy literacy, understanding of qibla direction, and practical skills in using Google Earth and the Istiwa'aini method. **Methods**: The program was conducted over two days, comprising eight hours of instruction and involving 30 students. The activities included a pre-test, instructional sessions, a Google Earth demonstration, hands-on practice of the Istiwa'aini method through solar-shadow observations, guided discussion, and a post-test. **Results**: The program demonstrated a substantial improvement in participants' understanding of Islamic astronomy and qibla direction. The mean pre-test score increased from 43.87 to 92.83 on the post-test, representing an absolute increase of 48.96 points and a relative increase of 111.6%. These findings indicate that the training was effective in strengthening participants' conceptual understanding and practical skills in qibla direction determination. **Conclusion**: Integrating religious knowledge with science and technology through Google Earth and the Istiwa'aini method provides an effective approach to qibla direction education. This integrated approach can serve as a practical model for strengthening digital religious literacy in Muslim educational institutions.

Keywords: google earth, islamic astronomy, istiwa' aini, qibla direction, digital religious literacy

Abstrak

Latar belakang: Penguatan literasi astronomi Islam diperlukan agar pembelajaran arah kiblat tidak hanya bersifat normatif, tetapi juga berbasis sains dan teknologi. Patna Witya School Thailand membutuhkan pendampingan praktis dalam memahami koordinat geografis, visualisasi arah Ka'bah, dan pengukuran kiblat sederhana. **Tujuan**: Kegiatan ini bertujuan meningkatkan literasi astronomi Islam, pemahaman arah kiblat, serta keterampilan siswa dalam menggunakan *Google Earth* dan metode *Istiwa'aini*. **Metode**: Program dilaksanakan selama dua hari dengan total delapan jam dan melibatkan 30 siswa. Tahapan kegiatan meliputi *pre-test*, penyampaian materi, demonstrasi *Google Earth*, praktik metode *Istiwa'aini* melalui pengamatan bayangan matahari, diskusi, dan *post-test*. **Hasil**: Kegiatan menunjukkan peningkatan pemahaman yang signifikan. Nilai rata-rata *pre-test* sebesar 43,87 meningkat menjadi 92,83 pada *post-test*. Peningkatan sebesar 48,96 poin atau 111,6% menunjukkan keberhasilan pelatihan dalam memperkuat pemahaman konseptual dan keterampilan aplikatif peserta. **Kesimpulan**: Integrasi agama, sains, dan teknologi melalui *Google Earth* dan *Istiwa'aini* efektif diterapkan dalam pembelajaran arah kiblat dan direkomendasikan sebagai model penguatan literasi digital religius di sekolah Muslim.

Kata kunci: arah kiblat, astronomi Islam, google earth, istiwa'aini, literasi digital religius

INTRODUCTION

In the context of contemporary Islamic education, the integration of Islamic knowledge, science, and technology has become increasingly important [1,2]. Islamic religious education should extend beyond the acquisition of normative knowledge and incorporate scientific and practical approaches that enable students to understand and appropriately apply Islamic teachings in their daily lives [3]. One important aspect of religious practice that is closely associated with scientific knowledge is the determination of the Qibla direction. As facing the Qibla is an essential requirement for performing *salah*, accurate Qibla determination is an important aspect of ensuring the proper performance of Muslim worship [4].

Despite its importance, students' understanding of the scientific principles underlying Qibla determination remains relatively limited [5]. Many students identify the Qibla direction primarily on the basis of local customs, the orientation of mosque buildings, or the simple use of a compass, without understanding the scientific principles underlying these practices. Previous research has indicated that most students in Islamic schools determine the Qibla direction based on practices within their social environment, while lacking the ability to independently verify its accuracy using scientific methods [6]. This situation suggests that Islamic religious education, particularly topics related to *ilm al-falak* or Islamic astronomy, has not yet been optimally integrated into the learning process.

Limited Islamic astronomical literacy among students is therefore an important educational issue that warrants greater attention. Islamic astronomical literacy extends beyond understanding the concept of the Qibla direction; it also involves recognizing how religious practices can be explained, verified, and strengthened through scientific approaches. *Ilm al-falak* plays an important role in Muslim religious life, particularly in determining the Qibla direction and prayer times, establishing the Hijri calendar, and observing astronomical phenomena such as eclipses [7]. However, the limited availability of educators with expertise in Islamic astronomy, together with the lack of contextual and practical learning resources, has contributed to the limited integration of Islamic astronomy into school-based education [8,9].

At the same time, advances in digital technology offer substantial opportunities to enhance the quality of religious education. Digital applications and platforms such as Google Earth can be used as instructional media to help students understand and verify the Qibla direction through accessible, visual, and spatially oriented approaches [10–12]. The integration of digital technology into Qibla-direction learning is particularly relevant because it connects religious concepts with scientific reasoning and spatial visualization, thereby making abstract concepts more comprehensible to students [13]. Nevertheless, many students and teachers remain unfamiliar with the use of digital technology to support religious practices. The lack of systematic training and mentoring represents a significant barrier to strengthening digital religious literacy within school settings.

Alongside technological approaches, traditional methods such as Istiwa'aini are also valuable for introducing students to the scientific foundations of Qibla determination. The Istiwa'aini method determines the Qibla direction by utilizing the shadow cast by the sun as a reference for measurement. Its educational value lies in enabling students to explore the relationship between natural phenomena, the apparent position of the sun, and religious practices. Combining the Istiwa'aini method with Google Earth provides students with both conceptual understanding and hands-on experience in determining the Qibla direction through complementary traditional and digital approaches. Such an integrative approach is consistent with the broader need for Islamic education that connects religious values with science and technology in meaningful everyday contexts [14–17].

Preliminary observations at PATNA Witya School indicated that some students were unable to independently determine the Qibla direction using either traditional methods or digital technology. This situation highlights a gap between the religious knowledge acquired at school and students' practical ability to apply that knowledge in real-life contexts. Addressing this gap requires educational activities that are practical, participatory, and contextually relevant. Training can serve as a strategic approach by providing students with direct learning experiences that develop both their understanding of the importance of accurate Qibla determination and their ability to apply scientific methods in practice.

This activity is significant because it seeks not only to improve students' technical competence in determining the Qibla direction but also to strengthen Islamic astronomical literacy, digital religious literacy, and awareness of scientifically grounded religious practices. By integrating Islamic values, science, and technology, the activity is expected to encourage students to approach religious practices more accurately, critically, and responsibly.

Accordingly, the primary objective of this activity is to enhance students' Islamic astronomical literacy and the accuracy of their religious practices, particularly their ability to determine the Qibla direction scientifically and independently. By combining the traditional Istiwa'aini method with modern technology through Google Earth, the activity seeks to develop students' capacity to integrate Islamic knowledge and scientific understanding in practical contexts. It also aims to foster rational religious awareness and cultivate students' critical, creative, and responsible attitudes toward religious practices. Ultimately, this activity is expected to contribute to the development of a religious school environment supported by digital and scientific literacy.

METHODS

Program Design and Approach

This community service program employed an educational, participatory, and practice-oriented approach to address students' limited understanding and practical skills in determining the Qibla direction. The program was designed to integrate Islamic knowledge, scientific principles, and digital technology through hands-on learning activities. The approach emphasized active student participation, allowing participants to understand the conceptual basis of Qibla determination while directly applying both traditional and digital methods.

The program adopted a participatory action approach through a training-based learning model. Students were actively involved in identifying the direction of the Qibla, understanding the scientific principles underlying its determination, conducting practical measurements using the Istiwa'aini method, and verifying the results using Google Earth. This approach was intended to strengthen students' Islamic astronomical literacy, digital religious literacy, and practical competence in applying scientific knowledge to religious practices [18].

The implementation consisted of three main stages: (1) preparation, (2) training and practical implementation, and (3) evaluation and follow-up. Each stage was designed to ensure that the training addressed the identified needs of the partner institution and produced measurable learning outcomes.

Participants and Setting

The program was conducted at PATNA Witya School, Thailand, involving students as the primary participants. The school was selected based on preliminary observations indicating that some students had limited ability to independently determine the Qibla direction using either traditional measurement techniques or digital technology.

The participants were involved in both classroom-based and field-based activities. Classroom sessions focused on the conceptual foundations of Islamic astronomy and Qibla determination, whereas practical sessions provided opportunities for students to apply the principles through direct measurements and digital verification. The participatory nature of the activities encouraged students to ask questions, perform measurements, compare results, and discuss possible differences between the methods used.

Preparation Stage

The preparation stage included coordination with the partner school, identification of participants, preparation of instructional materials, and development of practical training procedures. Initial communication with the school was conducted to identify students' existing knowledge and practical experience related to Qibla determination.

Training materials were developed to cover three interconnected components: Islamic concepts, scientific principles, and technological applications. The Islamic component introduced the significance of facing the Qibla in performing *salah*. The scientific component explained the relationship between geographical location, the Earth, and the position of the sun in determining direction. The technological component introduced Google Earth as a spatial visualization and verification tool.

The practical equipment required for the Istiwa'aini method was also prepared and tested before implementation. The training team ensured that the procedures could be demonstrated in a manner appropriate to the students' level of understanding. Google Earth was prepared as a complementary digital tool for visualizing geographical locations and verifying the Qibla direction.

Training and Practical Implementation

The implementation stage consisted of interactive instruction, demonstration, guided practice, independent practice, and discussion. The sequence was designed to progressively transfer knowledge and skills from the instructors to the students.

Conceptual Learning

The activity began with an interactive explanation of the importance of accurate Qibla determination and its relationship with Islamic religious practice. Students were introduced to the basic principles of *ilm al-falak* (Islamic astronomy), particularly the relationship between astronomical phenomena and religious practices.

The conceptual session also introduced the scientific basis of Qibla determination, including the geographical relationship between the students' location and the Kaaba in Makkah. Rather than presenting Qibla direction merely as a predetermined compass bearing, the session emphasized that the direction can be scientifically determined and independently verified.

Istiwa'aini Method Training

Students were subsequently introduced to the Istiwa'aini method, a traditional method of Qibla determination that utilizes the sun's position and the resulting shadow as measurement references. The instructors demonstrated the sequential procedure for establishing the reference direction and determining the Qibla orientation.

The students then performed the procedure under instructor supervision. During this session, emphasis was placed on accurate positioning of the equipment, appropriate observation of the sun's shadow, identification of the reference line, and determination of the resulting Qibla direction.

The practical application of Istiwa'aini was intended not only to develop students' technical skills but also to strengthen their understanding of the relationship between astronomical phenomena and Islamic religious practice. Through direct observation, students were encouraged to recognize that the position and movement of the sun can be used as scientific references for solving practical problems related to worship.

Google Earth-Based Verification

Following the traditional measurement exercise, students were introduced to Google Earth as a digital tool for visualizing geographical positions and verifying the Qibla direction. Students were guided to identify their school location and the geographical position of the Kaaba, and subsequently examine the spatial relationship between the two locations.

The digital session was designed to complement rather than replace the Istiwa'aini method. Students compared the direction obtained through direct astronomical observation with the direction visualized through the digital platform. This comparison enabled students to recognize the complementary roles of traditional astronomical measurement and modern digital technology in religious practice.

Guided and Independent Practice

After receiving demonstrations from the instructors, students performed the Qibla determination procedure in small groups under supervision. Each group was encouraged to conduct the measurement, record the results, and compare them with the Google Earth visualization.

At the final stage of practical learning, students were given opportunities to demonstrate the procedure independently. Instructors provided assistance when necessary while allowing students to take responsibility for the measurement and interpretation process. This stage was intended to assess whether the training had translated conceptual knowledge into practical competence.

Evaluation of Program Outcomes

Program effectiveness was evaluated by assessing changes in students' knowledge, practical skills, and understanding of the relationship between Islamic astronomy, science, and religious practice. Evaluation was conducted through a combination of knowledge assessment, observation of practical performance, and participant feedback.

A pre-training assessment was administered to identify students' baseline understanding of Qibla determination and Islamic astronomical concepts. Following the training and practical sessions, a post-training assessment was conducted using questions addressing the same core learning domains. The results were compared descriptively to identify changes in students' understanding following participation in the program.

Practical competence was assessed using an observation checklist covering several components: (1) understanding the purpose of Qibla determination, (2) identifying the principles of the Istiwa'aini method, (3) correctly performing the measurement procedure, (4) using Google Earth to identify and verify the Qibla direction, and (5) explaining the relationship between astronomical observations and religious practice.

Participant responses and observations during the training were also used to identify difficulties encountered during the activities and aspects requiring further assistance. This information served as the basis for developing follow-up recommendations for the partner school.

Data Analysis

Quantitative results from the pre- and post-training assessments were analyzed descriptively by comparing the scores obtained before and after the program. Changes in the proportion of students achieving the predetermined competency level were also examined.

Practical skills were assessed based on the observation checklist and summarized according to the level of achievement of each competency indicator. Qualitative observations from discussions and practical activities were used to complement the quantitative findings and describe students' experiences, difficulties, and responses to the training.

The evaluation results were subsequently used to determine the extent to which the program contributed to improvements in students' Islamic astronomical literacy and their ability to determine the Qibla direction independently using both the Istiwa'aini method and Google Earth.

Table 1. Stages of program implementation

Stages	Activities	Description	Output
Preparation	Identify Partner Needs	Initial discussion with teachers and students to find out the level of understanding of the direction of the qibla and Islamic astronomy	Map of partners' needs in Islamic astronomical literacy and religious practices.
	Preparation of Training Modules	Compile two training modules: (1) Method Istiwa'aini, and (2) The use of Google Earth for the direction of the qibla.	Training modules are complete and ready to use.
	Preparation of Tools and Media	Prepare practical tools such as upright objects, laptops, compasses, Google Earth, projectors, and observation logbooks.	The equipment and learning materials are ready for use.
	Coordination and Scheduling	Determining the training dates, particularly during **Istiwa A'zam** (May 27/28 and July 15/16).	The partner agreed on the activity schedule
Implementation	Istiwa'aini methods training	Introduction to the Theory and Hands-on Practice of Determining the Qibla Direction during Istiwa A'zam.	Students understand the concept and are able to independently perform the Istiwa'aini method.
	Simulation and Field Observation	Direct observation using simple tools to observe the shadow of an object when the Sun is directly above the Kaaba.	Two field observation sessions were conducted, with a minimum of 30 participants per session.
	Google Earth training	Using the Google Earth application to draw the Qibla direction line from the school and students' homes.	85% of participants were able to determine the Qibla direction using digital applications.
	Verification of school Qibla direction.	Rechecking the Qibla direction of the school prayer room based on the Qibla line obtained from Google Earth.	At least one prayer room was accurately recalibrated for the Qibla direction.
	Development of an Islamic Astronomy Extracurricular Program	Developing instructional materials and establishing an Islamic astronomy extracurricular class using a practical and scientific approach.	One extracurricular class was established with at least 15 active students.
	Establishment of a Qibla Direction Verification Team	Establishing a student–teacher team to monitor and provide guidance for further Qibla direction verification at the school and students' homes.	A small team was established and actively provided guidance to students in applying scientifically grounded religious practices.
Evaluation and Follow-Up	*Pre-test* and *post-test*	Assessing changes in students' understanding before and after the training using a test instrument.	A minimum 30% increase in the post-test score compared with the pre-test score.
	Field-based practical assessment	Conducting direct evaluation while students performed Qibla direction determination using the Istiwa'aini method and Google Earth.	90% of participants demonstrated mastery of the technique through hands-on practice.
	Reflection and Feedback Forum	Conducting an open discussion forum with students and teachers to evaluate the activity and gather suggestions for improvement.	A documented reflection session was conducted.
	Activity Reporting and Documentation	Preparing the final report and compiling photographs, videos, and supporting documentation from the activity.	The final activity report and visual documentation were completed.

RESULTS AND DISCUSSION

The activity commenced with a pre-test designed to assess participants' baseline understanding of the Qibla direction, the fundamental principles underlying its determination, and the use of Google Earth as a digital tool for Qibla-direction determination. The pre-test consisted of simple questions addressing the concept of the Qibla direction, the importance of accurate Qibla orientation in performing *salah*, and participants' prior experience in using digital technology to support religious practices. The pre-test was administered to establish a baseline profile of participants' knowledge and skills before the training.

The pre-test results served as a basis for the community service team to identify participants' levels of understanding, previous experience with digital mapping technology, and potential challenges that could affect the learning process. This information was subsequently considered in selecting appropriate instructional strategies and methods according to the participants' characteristics and learning needs. When participants showed limited familiarity with Google Earth or insufficient understanding of the scientific principles of Qibla determination, the material was delivered using a simpler, more contextual, and practice-oriented approach. Thus, the pre-test functioned not merely as an assessment of baseline knowledge but also as a basis for adapting the training process to participants' levels of understanding and learning needs.

The subsequent stage involved delivering instructional material on the use of Google Earth as a supporting tool for determining the Qibla direction. During this session, the community service team first introduced Google Earth as a digital mapping application that enables users to identify and interactively visualize geographical locations. Participants were introduced to the basic functions of the application, including location searches, map navigation and visualization, identification of geographical coordinates, and the use of measurement features to establish the spatial relationship between the user's location and the Kaaba in Makkah.

The material was delivered in a gradual and systematic manner to facilitate participants' understanding of each procedure. The community service team explained that Qibla-direction determination using Google Earth begins with identifying the geographical location of the place of worship or prayer, such as a mosque, school, residence, or other relevant location. The identified location was then connected to the geographical coordinates of the Kaaba as the reference point for the Qibla direction. The resulting connecting line on the digital map enabled participants to visualize the Qibla orientation more concretely and intuitively.

A hands-on demonstration of the application was employed to reinforce participants' conceptual understanding. The community service team demonstrated the complete sequence of procedures, beginning with opening the application, searching for and identifying the relevant location, locating the Kaaba, using the measurement feature to establish a line connecting the two points, and interpreting the resulting visualization of the Qibla direction. Following the demonstration, participants were guided to independently practice these procedures using their own devices or devices provided by the community service team. This combination of demonstration and hands-on practice was intended to strengthen both participants' conceptual understanding and their practical ability to operate the application.

The delivery of instructional material and practical training was intended to improve participants' understanding of the importance of accurate Qibla orientation while developing their ability to use digital technology as a supporting tool for Qibla determination. Through this activity, participants were expected to operate Google Earth appropriately and utilize its relevant features to obtain a systematic visualization of the Qibla direction based on geographical information. The activity also demonstrated the practical integration of religious knowledge, scientific principles, and digital technology, providing participants with knowledge and skills that can be applied in everyday religious practices.

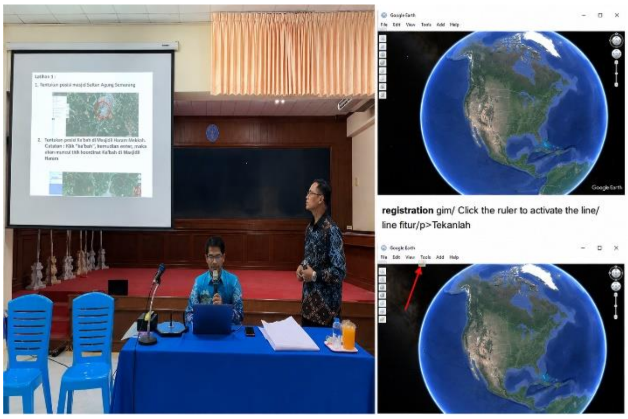

Figure 1. Instructional materials on qibla direction using Google Earth

The next stage involved delivering instructional material on the Istiwa'aini method as an approach to determining the Qibla direction based on the position of the Sun and changes in the direction of the shadow cast by a vertical object. The method offers advantages in terms of affordability and ease of application, as it can be implemented using simple equipment, such as a stick or other vertical object, a flat surface, a ruler, writing instruments, and a timekeeping device. By utilizing solar shadows as observational references, participants were able to directly observe the relationship between astronomical phenomena and Qibla-direction determination in a systematic manner.

The material was delivered using a communicative and contextual approach to facilitate students' understanding while strengthening teachers' conceptual knowledge. The community service team explained the basic principles of the Istiwa'aini method and its relationship to the apparent daily motion of the Sun. The explanation was intended to develop an understanding that natural phenomena can serve as a basis for measurement in religious practices. Thus, the Istiwa'aini method represents an accessible form of integration between Islamic knowledge and science, particularly Islamic astronomy, which can be applied both in educational settings and in everyday religious practices [19].

The subsequent stage involved a demonstration of the Istiwa'aini method. The community service team introduced the equipment and materials required and explained the function of each component in the observation process. A stick or other vertical object was used to cast a shadow, while a flat surface served as the observation medium. Supporting equipment, such as a ruler and writing instruments, was used to mark the observed positions and identify the lines established from the direction of the Sun's shadow [20].

The demonstration was conducted systematically through several stages. First, participants were instructed to prepare a level observation surface exposed directly to sunlight. Second, a stick or other vertical object was positioned upright on the surface to produce an observable shadow. Third, participants observed the position and direction of the shadow at a predetermined time according to the Istiwa'aini procedure. Fourth, the shadow position was marked and used as one of the references for establishing the Qibla direction line. Each stage was accompanied by an explanation of the underlying scientific principles so that participants did not merely follow the procedure but also understood the relationship between the Sun's position, shadow formation, and Qibla orientation.

Figure 2. Qibla direction training using the Istiwa'aini method

The demonstration was conducted as a preparatory stage before participants proceeded to independent practice. The community service team emphasized several factors that could affect the accuracy of the observations, including the precision of the measurement time, the vertical alignment of the upright object, the levelness of the observation surface, and the availability of an area with adequate exposure to direct sunlight. In addition, the observation site needed to be free from potential obstructions, such as buildings, trees, or other objects that could interfere with the formation and observation of shadows. Understanding these factors was expected to improve participants' accuracy in applying the Istiwa'aini method and enable them to determine the Qibla direction in a more measurable and scientifically defensible manner.

The final stage of the activity focused on evaluating program outcomes by measuring changes in participants' Islamic astronomical literacy before and after the training. The evaluation involved 30 students from Patna Witya School, Thailand, who served as participants. The training on Qibla-direction determination using the Istiwa'aini method and Google Earth was conducted over two days, with a total duration of eight hours.

A pre-test–post-test design was used to assess changes in participants' knowledge following the training. The pre-test was administered before the instructional sessions, whereas the post-test was administered after the entire training program had been completed. The evaluation instrument consisted of a 15-item multiple-choice knowledge test, with a maximum score of 100. The pre-test and post-test scores were compared to assess improvements in participants' Islamic astronomical literacy and to provide an indication of the effectiveness of the training in enhancing their understanding of astronomy-based Qibla-direction determination and its practical application.

Table 2. Comparison of participants' Pre-test and Post-test scores

Statistic	Pre-test	Post-test
N	30	30
Mean	43,87	92,83
Median	42,00	92,00
Standard Deviation	5,41	1,62
Minimum	35	90
Maximum	49	95
Range	14	5

A substantial increase in participants' knowledge scores was observed following the training on Qibla-direction determination using the Istiwa'aini method and Google Earth (Table 2). All 30 participants completed both the pre-training and post-training assessments. The mean pre-test score of 43.87 (SD = 5.41) increased to 92.83 (SD = 1.62) in the post-test. This represents a mean increase of 48.96 points, equivalent to approximately 111.63% relative to the baseline score. The magnitude of this increase indicates a substantial improvement in participants' mastery of the training material following the learning intervention.

A similar pattern was observed in the median scores. The median increased from 42.00 at pre-test to 92.00 at post-test. At baseline, participants' scores ranged from 35 to 49, representing a 14-point range. Following the training, scores ranged from 90 to 95, with a considerably narrower 5-point range. This pattern suggests that the improvement in knowledge was not limited to a subset of participants but was experienced relatively consistently across the group. Notably, the minimum post-test score (90) exceeded the maximum pre-test score (49), indicating a consistent upward shift in participants' knowledge attainment following the training.

In addition to changes in measures of central tendency, the reduction in the standard deviation provides an important finding. The standard deviation decreased from 5.41 at pre-test to 1.62 at post-test. This reduction in score variability suggests that differences in participants' levels of understanding became smaller following the training. At baseline, participants exhibited relatively greater variation in their initial knowledge, whereas post-test scores were concentrated within a relatively narrow range. This finding indicates that the training may have contributed not only to an overall increase in knowledge but also to more consistent learning outcomes among participants.

From a substantive perspective, these findings suggest that a learning approach combining conceptual explanation, demonstration, and hands-on digital technology practice may contribute positively to participants' understanding of Islamic astronomy, particularly in relation to Qibla-direction determination. Google Earth provided participants with a visual experience for understanding geographical orientation, while the Istiwa'aini method introduced them to the use of astronomical phenomena, particularly the Sun's position and the resulting shadows, as references for determining the Qibla direction. The combination of these approaches provided participants with a learning experience that integrated both conceptual understanding and practical application.

Nevertheless, the effectiveness of the training should be distinguished between descriptive improvement and inferential evidence. The data demonstrate a clear descriptive increase in participants' scores; however, these findings alone cannot establish statistical significance without an appropriate inferential analysis of the paired observations (Table 2). To strengthen the evidence regarding training effectiveness, further analysis could employ a statistical test appropriate for paired data, such as a paired-samples *t*-test when the relevant parametric assumptions are satisfied, or the Wilcoxon signed-rank test when the normality assumption is not met. In addition, reporting an effect size would provide complementary information regarding the practical magnitude of the observed improvement.

Overall, the descriptive statistics demonstrate a marked improvement in participants' knowledge following the training. Both the mean and median scores increased substantially, while the score range and standard deviation decreased. These findings provide preliminary evidence that Qibla-direction training integrating the Istiwa'aini method and Google Earth can improve and, at the same time, promote greater consistency in participants' understanding of the concepts and practical applications of Islamic astronomy. However, inferential statistical testing and effect-size estimation are still required to provide stronger evidence regarding the effectiveness and practical significance of the program.

The findings also highlight the important role of digital technology in supporting Islamic astronomy education. The use of Google Earth provided participants with an accessible and visual means of understanding geographical orientation and the spatial relationship between their location and the Kaaba. This technology-assisted learning approach enabled participants to connect abstract astronomical and geographical concepts with concrete religious practices. The integration of digital tools with hands-on astronomical observation through the Istiwa'aini method further created a complementary learning experience that combined visual, conceptual, and practical dimensions. Such an approach is particularly relevant in contemporary Islamic education, where digital literacy can serve as a means of strengthening students' ability to understand, verify, and apply religious knowledge through scientifically informed practices [21,22].

CONCLUSION

Based on the results of the program, the training on Qibla direction determination using the *Istiwa'aini* method and *Google Earth* made a positive contribution to participants' Islamic astronomical literacy. The observed changes in learning outcomes indicate that an approach integrating conceptual understanding, demonstration, and technology-based practice can support participants in understanding the concept of Qibla direction while applying it in practical contexts. In addition to improving participants' mastery of the subject matter, the training resulted in relatively more consistent learning outcomes across participants. These findings suggest that integrating science, digital technology, and Islamic knowledge can serve as a relevant educational strategy for strengthening Islamic astronomical literacy in educational settings. Therefore, the *Istiwa'aini* method supported by *Google Earth* has the potential to be further developed as an applied learning model for introducing scientifically grounded, contextual, and accessible approaches to Qibla direction determination.

RECOMMENDATIONS

Further assistance should be provided to teachers and students to ensure the continuity and sustainability of the training outcomes. Such follow-up support can be delivered online through communication groups, periodic consultations, or simple practical assignments. Teachers may also be encouraged to integrate Qibla direction and Islamic astronomy topics into religious education lessons or school-based extracurricular activities.

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