



# Perceived Conflict Overshadows Knowledge: A Mixed Methods Study of Religious Muslim Undergraduate Students' Acceptance of the Theory of Evolution

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Received: 8 January 2025 / Revised: 17 July 2025 / Accepted: 26 July 2025  
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## Abstract

The main purpose of this study was to explain that perceived conflict is an important factor influencing the acceptance of the theory of evolution among Muslim undergraduate students in Indonesia. This study used a sequential explanatory mixed methods design. In the first step, we used an established instrument to survey 507 Biology and Biology Education students regarding their acceptance, knowledge of evolution, religiosity, perceived conflict, and demographic factors. In the second step, the findings from the previous step were used as the basis for conducting focus group discussions with 16 students about the role of religion in influencing their views on the theory of evolution. The results revealed that acceptance of the theory of evolution, knowledge, and perceived conflict were moderate, whereas religiosity was high. The study indicated that knowledge and religiosity accounted for less than 3%. Another important finding was that students' perceived conflict between religion and evolution was a strong predictor, accounting for approximately 12%. In our sample, perceived conflict was more accurate in predicting acceptance of the theory of evolution than knowledge and religiosity were. In addition, demographic variables such as academic year, study program, and ethnicity were statistically associated with acceptance. The results of the qualitative data also confirm that students have fairly good acceptance and knowledge of evolution. At the same time, students also feel that there are conflicting perceptions about human evolution. By implementing integrative learning that combines the angles of the nature of science and religion, it is possible to foster a harmonious understanding of evolution among students.

**Keywords** Acceptance of evolution · Religiosity · Perceived conflict

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# 1 Introduction

Islamic universities in Indonesia have demands to prepare their students to become scientists and religious professionals who can respond to the challenges of modernism while upholding Islamic values. Islamic universities emphasize the importance of Islamic rationality, which encourages the integration of science and religion. Practically, they insist that teaching at Islamic universities must return to its fundamental sources, including the Koran, Sunnah, and the practices of the Prophet's successors (Aydın, 2014). Therefore, the main principle of teaching in Islamic universities should encompass the integration of general science and religious science (Islam) (Nasrudin et al., 2019; Suyadi & Sutrisno, 2018).

To respond to modernization, Islamic universities in Indonesia include general science disciplines, such as biology (Lukens-Bull, 2013). One major effort the government has made is to change Islamic institutes, which focus solely on religion, into Islamic universities that incorporate science and technology. However, critically, this effort may lead Islamic universities away from their intended goals. As a result, Islamic universities face difficulties in pursuing new directions (science) while maintaining old traditions (religiosity) (Azra, 2017; Lukens-Bull, 2013).

Islamic university students have a unique perspective, where they view studies in the context of divine revelation. However, developing logical and critical reasoning skills based on scientific knowledge is also important. Therefore, it is crucial for students to study both science and religion, as these disciplines may sometimes appear contradictory, especially in regard to topics such as the theory of evolution, which requires careful consideration.

One of the most essential theories in biology is the theory of evolution (Athanasios et al., 2016). Despite this, the success of the theory of evolution has faced many obstacles, especially from people with strong religious beliefs who do not accept this theory (Reiss et al., 1999). The conflict between science and religion is a persistent issue that has not yet been resolved (Glaze & Goldston, 2015). Although studies using regression (Dunk et al., 2017; Fiedler et al., 2024; Gutowski et al., 2023) and structural equation modeling (SEM) (Rissler et al., 2014) have explored the roles of knowledge and religiosity in predicting evolution acceptance, a growing body of research highlights perceived conflict, particularly between religion and evolution, as a more robust and direct predictor—supported consistently across both regression (Barnes et al., 2019) and SEM analyses (Barnes et al., 2021a, b; Nadelson & Sinatra, 2009; Sbeglia & Nehm, 2020).

However, despite its acknowledged relevance, the contribution of knowledge and religiosity remains a subject of ongoing debate and analytical complexity. Studies employing regression analysis (Dunk et al., 2017; Glaze et al., 2015) and SEM (Rissler et al., 2014) have sometimes reported nuanced or inconsistent findings. It is difficult to conclude this matter because it depends on complex factors. Consequently, addressing perceived conflict may be more crucial than solely focusing on knowledge or religiosity. In particular, this study aimed to investigate whether knowledge, religiosity, and a perceived conflict between science and religion play major roles in student acceptance and whether student acceptance differs across groups in terms of demographic factors. To the best of our knowledge, this is the first study to examine a range of science and religion conflicts perceived by Indonesian students.

## 1.1 Perceived Conflict Between Knowledge and Religiosity Has Emerged as One of the Strongest Predictors of Evolution Acceptance

Knowledge of evolution and religiosity has overlapping roles in influencing acceptance (Fiedler et al., 2024; Rissler et al., 2014). In this sense, there has been a negative relationship between religiosity and acceptance of evolution. The positive relationship between knowledge and acceptance of evolution can be eliminated by religiosity. Religiosity is among the factors that can interfere with the perception and acceptance of evolution (Aini et al., 2024; Salazar-Enriquez et al., 2023; Southerland et al., 2001). As mentioned earlier, previous research has shown that the more religious individuals are in a population, the less likely they are to accept the theory of evolution (Barnes et al., 2020a, b; Ferguson et al., 2024; Moore et al., 2009). In accordance with the Koran's theological interpretation of nature, religious students have the propensity to use explanations focused on the magnificence and order of nature. Conversely, nonreligious students tend to use theological reasons less and adhere to mechanistic explanations. Closely related to religiosity, understanding religious doctrine concerning evolution can lead religious individuals to reject the theory of evolution when they perceive that their understanding of evolution conflicts with their religious doctrine (Manwaring et al., 2018). Many groups have a neutral or affirmative attitude toward evolution (Colburn & Henriques, 2006; Taslamani, 2022). The Islamic population is one example of a group that has a neutral doctrine. However, it has been reported as one of the most resistant groups (Ali, 2023; BouJaoude et al., 2011; Downie & Barron, 2000; Southcott & Downie, 2012).

As a guidance book of life for every Muslim, the Koran requires appropriate interpretations for specific matters, such as science and evolution. In this context, many individuals who acknowledge being members of this "receiver" religion still perceive that evolution has been contrary to their religion (Hawley et al., 2011; Lindsay et al., 2019; Reiss et al., 1999). The greatest potential contributing factor is individuals' unawareness of their religion's overall views on evolution. Students with perceived conflict tend to reject evolution (Barnes et al., 2021a, b; Winslow et al., 2011).

Given these various patterns, concluding the relationship between acceptance of evolution and religiosity might not be possible. These results also prompt questions about how Muslim Biology students perceive evolutionary theory in Indonesia. Previous studies have suggested that perceptions of perceived conflict and typological thinking regarding the relationship between science and religion can predict acceptance (Barnes et al., 2021a, b; Ferguson et al., 2024). Students may have religious beliefs about creation that conflict with mechanistic explanations of evolution (Barnes et al., 2017, 2020a, b). Other studies have revealed that students' acceptance of evolution is related to perceived conflict due to their belief in God (Barnes et al., 2017; Winslow et al., 2011), religious teachings, and religious texts (Barnes et al., 2020a, b). Compared with knowledge and religiosity, perceived conflict is considered the strongest predictor of acceptance of evolution (Barnes et al., 2021a, b).

## 1.2 Typologies of the Science–Religion Relationship as a Source of Conflict or Coherence

The growing demand for integrating science with religion within Islamic universities has resulted in a range of diverse typological perspectives among students. The influence of modernization in Muslim countries, especially Indonesia, has led to complex innovation and polarization within Islamic universities. With respect to religiosity, individuals are

likely to interpret religious doctrine differently (in contrast to the Koran), which is known as typological thinking. There are three categories of typological thinking: textual, semitextual, and contextual (Saeed, 2006). This classification is based on two factors: first, the extent to which the interpreter relies solely on linguistic criteria to determine the meaning of the text, and second, the extent to which the classification considers both the socio-historical context of the Koran and the current contemporary context. According to Saeed's (2006) classification of three types of thought and its further elucidation by Nash (2006) and Guessoum (2018) regarding the connection between science and religion, we can draw conclusions about the probability and inclination of teaching methods and their acceptance of the theory of evolution from these three groups.

The textualist group, also known as the traditionalist group, emphasizes the distinction between religion and science and their respective domains (Aydın, 2014) using the Non-Overlapping Magisteria (NOMA) approach (Guessoum, 2018). This approach can make students think that the theory of evolution is unproven and not scientific. Despite the thriving Darwin myth, traditionalist groups consider it the most significant fraud, leading to the rejection of the theory of evolution (Nash, 2006).

The semitextualist group, also known as integrationists, has a culture that only makes it possible to put aside their old education and thought patterns when dealing with scientific ideas. This group accepts the explanation of creation as described in the Koran. However, they are more open to translating the scientific language of evolution into the language and teachings of the Koran rather than the textualist group (Aydın, 2014). They are willing to provide a more flexible interpretation, and the text does not strictly bind them. After acknowledging the truth of the Koran, they evaluate the validity of evolution's claims in light of the Koran. The semitextualist group uses the Softly Overlapping Magisteria (SOMA) approach (Guessoum, 2018). This approach minimally and gently raises some religious ideas without advocating any particular point of view. They acknowledge that some evolutionary topics may give rise to religious issues and that there may be discussions and various perspectives on evolution and religion. They usually balance between understanding the text and using logical sense. Therefore, they tend to be selective when accepting or rejecting the theory of evolution.

The contextual group, known as modernists, often uses reason and logical analysis to interpret religious texts (Aydın, 2014). They use the "bridge course" approach. This approach involves thoughtful discussions of the relationship between science and religion (Guessoum, 2018), particularly with respect to intricate subjects such as the origins of life. This approach adopts an interdisciplinary or multidisciplinary framework, facilitating a comprehensive exploration that incorporates diverse and complementary scientific and religious perspectives, making the group more open and accepting of the theory of evolution.

### 1.3 Demographic Factors

Sbeglia and Nehm (2019) explained that measuring acceptance of evolution potentially follows patterns of persistence in STEM programs, such as gender (Lauer et al., 2013; Wright et al., 2016), academic year, study program, age (Shin et al., 2018), race, or ethnicity (Ghazzawi et al., 2021; Ma & Liu, 2017). Among these, gender has received the most consistent and extensive attention over the past two decades (Kim & Nehm, 2011; Peker et al., 2010). In contrast, other demographic variables, such as academic year and age—particularly within the undergraduate population—have received relatively limited

empirical attention, often appearing in only one or two studies. This gap highlights the need for further research exploring how these demographic factors may be related to students' acceptance of evolution.

Gender has been shown to influence acceptance of evolution (Barnes et al., 2021a, b), where men are considered more receptive to evolution than women are (Sbeglia & Nehm, 2019). However, another study by Miller et al. (2022) revealed gender differences due to educational attainment in the same period. Evolutionary learning can eliminate differences in acceptance between men and women (Dunk et al., 2017; Sbeglia & Nehm, 2019).

Surprisingly, Sbeglia and Nehm (2019) reported no significant differences in acceptance of evolution among students with different degrees or prior biology courses. Research has also shown that biology majors and nonmajors have similar misconceptions about evolution (Nehm & Reilly, 2007). In Indonesia, there are two biology majors: Biology and Biology Education. Biology focuses on students who are preparing to become scientists in biology. Conversely, Biology Education focuses on students who will work as teachers in science and biology at the secondary school level (Rusmana et al., 2021). Both majors have similarities regarding the subjects included in the scientific core, such as ecology, genetics, and taxonomy. The Biology Education program includes courses related to education and teaching, resulting in fewer courses supporting evolution, such as embryology and molecular biology. In the evolution course, both students receive almost the same material, including material covering natural selection, various types of evidence for evolution, and mechanisms of evolution. Biology Education students tend to focus on the historical development of the theory of evolution and the origins of life. Conversely, Biology students typically connect it to speciation, the construction of phylogenetic trees, and the practical applications of phylogenetics.

Previous studies have demonstrated that age is a substantial factor influencing the acceptance of evolutionary theory (Dunk et al., 2017; Miller et al., 2022). However, the study of college students' acceptance of evolution has focused primarily on a relatively narrow age range (Dunk et al., 2017). Although the accumulation of biological knowledge has been questioned as a positive influence on the acceptance of evolution (Ha et al., 2012), a difference in age of only a few years may not be enough to describe the variation in students' understanding or acceptance of evolution. To address this nuance, this study considered age and academic year level. It is believed that informal and basic ideas about understanding the world acquired during the learning process play a more important role in shaping one's beliefs about evolution (Coley & Tanner, 2012).

At university, students can take various courses that support evolution, such as biochemistry, ecology, genetics, and cell biology (Rusmana et al., 2021). Fourth-year students can also take bioethics, biotechnology, and molecular biology courses. However, courses on bioethics may lead to discussions about the fact that humans are a product of biological evolution, which can have various implications for the study of ethics (Sober, 2016). Interestingly, studies have shown conflicting results regarding the relationship between age and acceptance of evolution. Previous studies have suggested that the higher the grade level of students who have fundamentalist religious beliefs is, the less active their engagement with scientific information and acceptance of evolution (Miller et al., 2022). In essence, the academic year may more directly correlate with students' exposure to coursework, scientific reasoning, and opportunities for reconciling scientific principles with religious beliefs. By incorporating both age and academic year into the analysis, a more comprehensive understanding of how demographic and educational positioning influence students' acceptance rates can be gained.

However, after combining age with the ethnicity variable, the effect no longer has significance (Dunk et al., 2017). Once again, by controlling for demographic and background variables, ethnicity can also play a crucial role in accepting evolution (Sbeglia & Nehm, 2019). Yet, the Pew Research Center (2015) showed no differences in acceptance and views of evolution across different ethnicities and races. However, cultural background can potentially affect cognitive difficulties in evolutionary thinking patterns (Rachmatullah et al., 2018). Studies on ethnic differences in Indonesia have been underexplored. A recent report revealed that integrationist students had greater academic achievement than their peers with modernist and traditionalist thinking typologies. Additionally, integrationists are more prevalent in Java than in other regions (Muttaqin et al., 2020).

Interestingly, Javanese culture is more likely to avoid conflict because students should know precisely what they can and cannot do based on the ideology of peaceful living (Irawanto et al., 2011). The importance of obedience should be upheld, especially by those in higher positions, such as lecturers. In addition, Javanese people are also deeply attached to a life philosophy called “nerimo,” which emphasizes the importance of always accepting someone’s arguments with respect. According to Kuswaya and Ma’mun (2020), the Javanese practice “nerimo” as a passive and obedient acceptance of any given problem. As a result, students may exhibit a greater level of agreement with the theory of evolution because of the persuasive arguments presented by their instructors.

#### 1.4 Research Question (RQ)

This study aimed to determine the extent to which perceived conflict can predict acceptance of evolution more precisely than knowledge and religiosity can. In addition, we wanted to identify which groups are reluctant to accept evolution due to demographic factors. In particular, the research questions that guided the present study are as follows.

**RQ1:** To what extent does knowledge predict Islamic university students’ acceptance of evolution in Indonesia?

**RQ2:** To what extent does religiosity predict Islamic university students’ acceptance of evolution in Indonesia?

**RQ3:** To what extent does perceived conflict predict Islamic university students’ acceptance of evolution compared with knowledge and religiosity in Indonesia?

**RQ4:** What is the relationship between demographic factors and the level of acceptance of evolution among Islamic university students in Indonesia?

## 2 Methods

### 2.1 Research Design

The research design of this study involved collecting and analyzing quantitative and qualitative data to gain a deeper, richer, and more reliable understanding of a phenomenon than using a single approach (Creswell & Clark, 2010). The quantitative research focused on the variables acceptance of the theory of evolution, knowledge of the theory of evolution, religiosity, and perceived conflict, which were measured carefully using scales. Moreover, qualitative research was carried out to understand the phenomenon as interpreted by the participants through focus group discussions (FGDs). The explanatory sequential design was

used as a research methodology (Creswell, 2014), where quantitative data (survey) were collected first, followed by qualitative data (case studies) to explain the quantitative data. After the quantitative data were collected, the researcher identified which parts of the quantitative data needed to be explained and used the FGD technique. Quantitative data were the priority of this research, and qualitative data were the data used for triangulation. To achieve this objective, the mixing process was carried out only at the interpretation stage to ensure the triangulation of the data sources (Creswell, 2014).

## 2.2 Participants and Data Collection

The researcher requested permission from each target university's dean and department head to distribute questionnaires to the students. This research targets at least half of the Islamic universities with Biology or Biology Education programs and can be considered a representative sample for Indonesia. Usually, the dean or department head suggested contacting a particular lecturer. Then, we met with the lecturer (this could be done online) and explained the procedure, including its voluntary nature, confidentiality for ethical considerations, and research permission. All participants provided informed consent to participate in the study. This research received ethical approval from Universitas Negeri Malang (Number: 5.4.493). This study was conducted in accordance with the Declaration of Helsinki.

### 2.2.1 Quantitative Data

The lecturer shared the questionnaire link as a Google Form through the WhatsApp Group (WAG) in class; students needed to complete the survey during class and were not allowed to do so at home. The students were given approximately 60 min to complete a series of questionnaires. The internet survey was selected based on cost-effectiveness, fast data collection, and easy accessibility. Thus, the sampling type in this research is an unrestricted sample, where every student in the group has the right to fill out the questionnaire.

This research focused on Islamic students in universities where all members have special characteristics that are interesting for examining how they perceive the theory of evolution. In these studies, a specific population was tracked over a specific period, but selective sampling within that sample occurred. The participants who volunteered to take part in this research (1) were registered at the target university, (2) had taken evolution courses, and (3) signed a consent form. The consent form was explained before all the students were asked to complete the questionnaire in writing on the WAG and the Google Form home page. This research included 507 students from two Biology and Biology Education degree programs at six Islamic universities in Indonesia. This survey was conducted between March and April 2023. Table 1 provides the sample sizes based on demographic factors in the survey stage.

### 2.2.2 Qualitative Data

After the survey, the research continued with a descriptive case study with a multiple-case design. Table 2 shows that 16 participants were included in this stage based on the demographic factors. Thus, the sampling technique used was purposive sampling based on the results of demographic factor analysis in quantitative research. The sample selection rested on demographic considerations for multiple reasons. First, variations in the acceptance of evolution were identified solely across academic years, study programs, and ethnicities.

**Table 1** Demographic distribution of the participants in the survey

| Criteria      | Group             | Number | Percentage (%) |
|---------------|-------------------|--------|----------------|
| Gender        | Female            | 74     | 14.6           |
|               | Male              | 433    | 85.4           |
| Academic year | 2nd               | 178    | 35.1           |
|               | 3rd               | 266    | 52.5           |
|               | 4th               | 63     | 12.4           |
| Study program | Biology           | 155    | 30.6           |
|               | Biology Education | 352    | 69.4           |
| Age           | ≤ 20 years        | 309    | 60.9           |
|               | ≥ 21 years        | 198    | 39.1           |
| Ethnicity     | Javanese          | 338    | 66.7           |
|               | Non-Javanese      | 169    | 33.3           |

*N*, number of participants

**Table 2** Demographic distribution of the participants in the interviews

| Group | Students | Academic year | Study program     | Ethnicity    |
|-------|----------|---------------|-------------------|--------------|
| 1     | #1       | 2nd           | Biology           | Javanese     |
|       | #2       | 2nd           | Biology           | Javanese     |
|       | #3       | 2nd           | Biology           | Javanese     |
|       | #4       | 2nd           | Biology           | Javanese     |
| 2     | #5       | 3rd           | Biology Education | Javanese     |
|       | #6       | 3rd           | Biology Education | Javanese     |
|       | #7       | 3rd           | Biology Education | Javanese     |
|       | #8       | 3rd           | Biology Education | Javanese     |
| 3     | #9       | 2nd           | Biology Education | Non-Javanese |
|       | #10      | 2nd           | Biology Education | Non-Javanese |
|       | #11      | 2nd           | Biology Education | Non-Javanese |
|       | #12      | 2nd           | Biology Education | Non-Javanese |
| 4     | #13      | 4th           | Biology Education | Non-Javanese |
|       | #14      | 4th           | Biology Education | Non-Javanese |
|       | #15      | 4th           | Biology Education | Non-Javanese |
|       | #16      | 4th           | Biology Education | Non-Javanese |

Second, no discernible distinctions surfaced among groups concerning knowledge and religiosity variables. Third, disparities in perceived conflict emerged exclusively within age and ethnic categories, with ethnic Javanese individuals exhibiting lower perceived conflict than their non-Javanese counterparts. Consequently, selecting a sample based on these three factors was deemed a more appropriate approach. Qualitative data were collected in four groups using Zoom meetings using online FGD techniques. The quantitative research provided information about the extent of students' acceptance and knowledge of evolutionary theory. Moreover, this qualitative research aimed to strengthen and expand the findings concerning knowledge, religiosity, and perceived conflict obtained from the quantitative survey. Therefore, data triangulation was intended to improve the interpretation of quantitative data and provide a deeper understanding of the research results (Mertens & Hesse-Biber, 2012).

### 2.3 Questionnaire Instruments

As previously noted, quantitative data were collected through a survey that consisted of two main sections: demographic characteristics and four variables. The demographic questionnaire collected information on gender, academic year, study program, age, and ethnicity. First, the Measure of Acceptance of the Theory of Evolution (MATE) scale, which consists of 20 statement items, was used to assess acceptance of the theory of evolution (Rutledge & Warden, 1999). The MATE scale contains six measurement topics: the evolutionary process, scientific validity, human evolution, evidence, views of the scientific community, and the Earth's age. The MATE scale Has possible scores ranging from 20 to 100 (Appendix 1). The MATE scale was selected as the preferred instrument because it is the most frequently used (Sbeglia & Nehm, 2019), simple (Rutledge & Warden, 1999), and highly reliable (Barnes et al., 2019). In our sample, the descriptive index criteria for Pearson correlation outlined by Kolte (2015) indicated acceptable to excellent validity for the MATE scale ( $r=0.152\text{--}0.684$ ,  $p<0.01$ ). The reliability classification by Guilford (1956) using Cronbach's  $\alpha$  showed high reliability for the questionnaire (0.773).

Although the MATE scale is widely used to measure evolution acceptance, it has faced criticism for including particular views and aspects of evolutionary understanding. This criticism is partly due to the lack of agreement on the definition of evolutionary acceptance in the scientific community (Smith, 2010). Moreover, Barnes' findings explain that students answer items on the MATE based on constructs other than their acceptance of evolution (Barnes et al., 2022). One of the issues with this instrument is that it often uses the word "evolution" without providing enough context, such as whether it refers to micro- or macroevolution and scale (Barnes et al., 2024). Despite these limitations, we chose the MATE scale to ensure consistency with previous research and facilitate comparability of the results. Given these concerns, we interpreted MATE scores with caution and triangulated them with perceived conflict and religiosity qualitative data to gain a more comprehensive understanding. Furthermore, the instrument was reviewed for contextual appropriateness by experts in Biology Education and Islamic perspectives to ensure its readability and alignment with our study population.

Second, the Evolution Content Knowledge (ECK) questionnaire, which consists of eight items, was used to measure knowledge of evolution (Nehm & Schonfeld, 2007). The ECK scales Have possible scores ranging from 8 to 40 (Appendix 2). ECK encompasses comprehensive measurements of critical topics, including mutation, natural selection, molecular clocks and radiometric dating, phylogenetic analysis, and the fossil record (Nehm & Schonfeld, 2007). The ECK was employed to streamline assessments, minimize test duration, and maximize student response efficiency (Gefaeil et al., 2020). This study also contributed further empirical support, reinforcing the selection of the MATE and ECK combination identified in prior research (Kim, 2016; Kim & Nehm, 2011).

Importantly, the concise ECK format was deliberately selected to increase efficiency and facilitate the conduct of extensive surveys employing multiple instruments, as exemplified in this study. Notably, this choice was made without compromising the instrument's usability or validity. However, selecting a shorter instrument, particularly when dealing with a homogeneous sample, can lead to a lower alpha value (Ary et al., 2018). In our population, the Cronbach's alpha coefficient for the ECK instrument was 0.468 (intermediate), with  $r$  values ranging from 0.369 to 0.555 and  $p<0.01$  (good–excellent). This finding aligns with those of previous studies, such as those reported by Kim

(2016), which demonstrated comparable reliability for the same instrument. Although this value is considered moderate, Tavakol and Dennick (2011) reported that reliability remains within acceptable limits for brevity instruments, particularly those comprising fewer than ten items. Consequently, despite its moderate reliability, with expert review, the ECK still significantly contributes to revealing students' evolutionary knowledge and serves as a valuable tool in evolutionary education research.

Third, to measure religiosity, we developed a 22-item instrument by integrating components from three widely referenced frameworks. The religiosity instrument was designed and developed by researchers combining components from intrinsic religiosity (Beniermann, 2019), narrative aspects of the scripture scale (Manwaring et al., 2018; Teixeira, 2019), and the Duke University Religion Index (Koenig & Büssing, 2010) for religious activity. The instrument thus captures the cognitive, affective, and behavioral aspects of religiosity relevant to the student context. The religiosity scale Has a possible score ranging from 22 to 110 (Appendix 3). To enhance contextual relevance, particularly in our sample, we included two custom questions: we also asked students how frequently they conducted religious activities (i.e., reading the Koran) and how they translated verses from the Koran (textual, semitextual, or contextual). The latter serves as a proxy for students' interpretive orientation, which some scholars associate with typological versus contextual religious thinking.

The religiosity instrument underwent expert review to ensure conceptual and contextual relevance for the Muslim student population. Internal item analysis using item–total correlation coefficients ( $r$  values ranging from 0.091 with  $p < 0.05$  to 0.691 with  $p < 0.01$ ) demonstrated that most items exhibited moderate to high correlations with the total score, which is consistent with the findings of Guilford's interpretation (Guilford, 1956). This indicates adequate internal consistency at the item level. Although no factor analysis was conducted, the Cronbach's alpha coefficient ( $\alpha = 0.668$ ) falls within the acceptable to high category for early-stage research, particularly for scales with relatively homogeneous samples and a moderate number of items (Ary et al., 2018; Kolte, 2015; Tavakol & Dennick, 2011).

Fourth, the perceived conflict instrument was adapted from Barnes et al., (2021a, b). The advantage of this instrument is that it employs a novel multidimensional measure and constitutes an update of the previous unidimensional instrument. This instrument comprises five items that capture the sources of perceived conflict, namely, belief in God, personal religion, religious teachings, and community. In essence, this instrument facilitates sensitive reflection on students' perceived conflict between religion and evolution. This instrument Has a total score range of 5–25 (Appendix 4) and uses a 5-point Likert scale, the same as the other three instruments employed in this study. All instruments were provided in the Indonesian language.

Importantly, the adaptation process involved expert review to ensure the instrument's validity and relevance within the context of our population. The empirical validity in our homogeneous population demonstrated item–total correlation coefficients ranging from 0.526 to 0.684, which are considered moderate to high in accordance with Guilford's criteria (Guilford, 1956). Furthermore, the instrument exhibited a Cronbach's alpha of 0.610, which falls within the acceptable threshold for exploratory research and brief instruments (Ary et al., 2018; Kolte, 2015; Tavakol & Dennick, 2011).

## 2.4 FGD Guidelines

The FGD protocol was developed by the researcher following the logic of a quantitative research questionnaire and through discussions with the supervisor in this research. The FGD was conducted with a moderator so that participants could clarify their responses. Each FGD lasted approximately 60 min. The FGD consisted of three main open-ended questions to investigate how interview participants thought when they responded to questionnaire items as follows:

- a) Tell me about your knowledge and understanding of the theory of evolution. (knowledge)
- b) How do you understand that religion can guide the study of evolution? (religiosity)
- c) Have you ever wondered about the meaning of evolution in humans? (perceived conflict)

Students received their original answers during the FGD. This check member ensured that the transcript results matched the answers the participants gave.

## 2.5 Data Analysis

### 2.5.1 Quantitative Analysis

The Google Forms platform automatically generated a spreadsheet containing each participant's answers in different columns of the same row. The data were processed and analyzed with SPSS version 16. Based on the literature (Carifio & Perla, 2008; Harwell & Gatti, 2001; Norman, 2010; Sullivan & Artino, 2013), composite scores derived from Likert-type items can be treated as interval data, particularly when aggregated or averaged across multiple items. Furthermore, numerous studies have demonstrated that parametric tests are generally robust to violations of the assumptions of normality and homogeneity, especially when sample sizes are sufficiently large, by the principles of the Central Limit Theorem (Lumley et al., 2002). The number of techniques for data analysis used in this research are as follows:

- a) Descriptive statistics, namely, the mean ( $M$ ) and standard deviation (SD) of knowledge, acceptance, religiosity, and perceived conflict, were calculated, as were the exact number ( $n$ ) and frequency ( $f$ ) of religiosity activities and typological thinking.
- b) Correlation test: Pearson correlation techniques were used to explore the relationships among knowledge, acceptance, religiosity, and perceived conflict.
- c) Regression test: Hierarchical (or sequential) regression analysis was used to examine the extent to which each variable was statistically associated with the acceptance of evolution. Variables were entered in steps to observe changes in explanatory power. We entered the variables knowledge, religiosity, and perceived conflict (steps 1–3), followed by religiosity activities and typological thinking (steps 4–5), and then, all demographic factors were entered as additional tests (step 6).
- d) Comparison test: Independent  $t$  tests were used to explore the differences by gender, study program, age, and ethnicity. Moreover, ANOVA was used to analyze the differences by academic year. Previously, we tried to determine how demographic variables were connected. We used chi-square tests to determine how the variables were distributed across the scale, and the results confirmed that they were related.

## 2.5.2 Qualitative Analysis

The demographic data of the FGD respondents and scores on the three scales were recorded in tables to assist qualitative data analysis. The qualitative data analysis technique used constant comparison (Leech & Onwuegbuzie, 2007). The results from three focus group discussions (FGDs) were transcribed using Microsoft Word. To protect participants' identities, we used coded identifiers: for instance, "G1" refers to Focus Group 1, and "S1" refers to Student 1 within that group. The participants' transcripts were read thoroughly, carefully, and repeatedly to assign codes. In the coding process, codes were formed "inductively" from students' responses and views on several questions during the FGD (Bradley et al., 2007). We began without predetermined codes or categories, allowing them to emerge from student responses. To establish credibility, two individuals, as coder and co-coder, coded two FGD transcripts independently, and then, intercoder kappa calculations were performed to calculate agreement. If there were differences between the two coders, they were resolved through discussion. Finally, the researcher coded the remaining transcripts and discussed the codes with the previous co-coder. The agreement between the two intercoders reached more than 85%.

## 3 Results

### 3.1 Perceived Conflict Can Predict Acceptance of Evolution More Precisely than Knowledge and Religiosity in Different Demographic Factors

Overall, students' knowledge ( $M=26.51$ ,  $SD=3.11$ ), religiosity ( $M=87.38$ ,  $SD=6.55$ ), and perceived conflict ( $M=16.49$ ,  $SD=3.03$ ) were classified as moderate, high, and moderate, respectively. The students' acceptance of the theory of evolution using the MATE questionnaire Had a mean score of 68.88 ( $SD=7.64$ ). Most students ( $n=440$ ;  $f=86.8\%$ ) were devout Muslims who must pray five times daily. More than Half of them Had at least taken the time to read the Koran 1 ( $n=174$  students;  $f=34.3\%$ ) or two times ( $n=120$  students;  $f=23.7\%$ ). In addition, most students ( $n=470$ ;  $f=92.7\%$ ) were integrationists.

The Pearson correlation test results revealed positive and weak relationships between acceptance and knowledge ( $r=0.108$ ;  $p=0.015$ ) and between acceptance and religiosity ( $r=0.146$ ;  $p=0.001$ ). Increased knowledge and religiosity were associated with increased acceptance of evolution. Therefore, the positive trend can be highlighted where student acceptance of the theory of evolution increased as understanding and religiosity increased. Moreover, the correlation calculation results between perceived conflict and acceptance of evolution revealed that it was significant and negative ( $r=-0.299$ ;  $p<0.01$ ), which means that high perceived conflict was related to low acceptance of evolution.

Hierarchical regression analysis (Table 3) indicated that ECK and religiosity explained 2.9% of the variance ( $F=8.521$ ;  $p<0.01$ ), with a significant regression coefficient  $\beta$  (steps 1–2). When perceived conflict was added,  $R^2$  increased to 14.2%, with a significant regression coefficient  $\beta$  (step 3). Adding the variables of religious activity and typology of thinking increased the variance by 0.4%. In total, the five characteristics (ECK, religiosity, conflict perception, religious activity, and typology of thinking) explained 14.6% of the variance, with  $F=18.332$ ,  $p=0.000$ . We found that perceived conflict was statistically associated with lower acceptance of evolution ( $\beta=-0.344$ ). Specifically, students who strongly agreed with the statement "It is hard to believe that humans evolved from ancient

**Table 3** Summary of hierarchical (or sequential) regression analysis of the variables associated with acceptance of evolution theory

| Variable             | <i>B</i> | SE <i>B</i> | $\beta$   | Adjusted $R^2$ | <i>F</i> |
|----------------------|----------|-------------|-----------|----------------|----------|
| <b>Step 1</b>        |          |             |           | 0.010          | 5.977*   |
| ECK                  | 0.265    | 0.109       | 0.108*    |                |          |
| <b>Step 2</b>        |          |             |           | 0.029          | 8.521**  |
| ECK                  | 0.263    | 0.107       | 0.107*    |                |          |
| Religiosity          | 0.169    | 0.051       | 0.145**   |                |          |
| <b>Step 3</b>        |          |             |           | 0.142          | 28.981** |
| ECK                  | 0.339    | 0.101       | 0.138**   |                |          |
| Religiosity          | 0.235    | 0.049       | 0.201**   |                |          |
| Perceived conflict   | -0.870   | 0.106       | -0.345**  |                |          |
| <b>Step 4</b>        |          |             |           | 0.143          | 22.079** |
| ECK                  | 0.347    | 0.102       | 0.142**   |                |          |
| Religiosity          | 0.244    | 0.049       | 0.209**   |                |          |
| Perceived conflict   | -0.869   | 0.106       | -0.344**  |                |          |
| Religious activities | -0.217   | 0.189       | -0.048    |                |          |
| <b>Step 5</b>        |          |             |           | 0.146          | 18.332** |
| ECK                  | 0.341    | 0.101       | 0.139**   |                |          |
| Religiosity          | 0.240    | 0.049       | 0.205**   |                |          |
| Perceived conflict   | -0.855   | 0.016       | -0.339**  |                |          |
| Religious activities | -0.252   | 0.190       | -0.056    |                |          |
| Typology of thinking | 2.109    | 1.219       | 0.072     |                |          |
| <b>Step 6</b>        |          |             |           | 0.204          | 14.007** |
| ECK                  | 0.315    | 0.098       | 0.128**   |                |          |
| Religiosity          | 0.225    | 0.048       | 0.193**   |                |          |
| Perceived conflict   | -0.0770  | 0.104       | -0.305**  |                |          |
| Religious activities | -0.229   | 0.185       | -0.051    |                |          |
| Typology of thinking | 0.258    | 1.214       | 0.009     |                |          |
| Gender               | -1.971   | 0.607       | -0.168**  |                |          |
| Academic year        | -2.674   | 0.736       | -0.0161** |                |          |
| Study program        | 1.896    | 0.871       | 0.088*    |                |          |
| Age                  | 1.120    | 0.758       | 0.072     |                |          |
| Ethnicity            | -1.822   | 0.719       | -0.112*   |                |          |

\*\* $p < 0.01$ 

ape ancestors" (Item 3 of the perceived conflict questionnaire) were more likely to hold this belief (24.3% strongly agreed, and 40.4% agreed). This belief was influenced primarily by their belief in God (42.4%), followed by religious teachings (31.8%), whereas the influence of the community was minimal (2.5%).

Finally, when demographic factors were included, the five characteristics and demographic factors accounted for 20.4% of the variance in the outcome variable, with an  $F$  value of 14.007 and  $p < 0.000$ . The regression coefficients for gender, academic year, study program, and ethnicity were significant (step 6).

- a) Gender: The regression coefficient for gender was  $\beta = -0.168^{**}$ ,  $p < 0.01$ . This finding indicates that being female (coded as “2”) was associated with a significant decrease in evolution acceptance compared with being male (coded as “1”).
- b) Academic year: The regression coefficient for academic year was  $\beta = -0.161^{**}$ ,  $p < 0.01$ . This coefficient indicates that each increase in academic year (coded as “1” for the 2nd year, “2” for the 3rd year, and “3” for the 4th year) was associated with a significant decrease in evolution acceptance.
- c) Study program: The regression coefficient for the study program was  $\beta = 0.088^{*}$ ,  $p < 0.05$ . This finding indicates that having a Biology Education (coded as “2”) was associated with a significant increase in evolution acceptance compared with being a biology major (coded as “1”).
- d) Ethnicity: Finally, the regression coefficient for ethnicity was  $\beta = -0.112^{*}$ ,  $p < 0.05$ . This coefficient indicates that being non-Javanese (coded as “2”) was associated with a significant decrease in evolution acceptance compared with being Javanese (coded as “1”).

As shown in Table 4, descriptive frequencies for different demographic variables, as well as the results of  $t$  tests to differentiate each group (gender, academic study, age, and ethnicity) and ANOVA tests to differentiate academic year groups, were examined. Acceptance rates based on demographic criteria did not significantly differ between groups in terms of age ( $p = 0.318$ ) or gender ( $p = 0.064$ ). The other factors that influenced the acceptance of evolutionary theory were academic year ( $p = 0.000$ ), study program ( $p = 0.000$ ), and ethnicity ( $p = 0.000$ ). With respect to the study program, Biology students accepted evolutionary theory more than Biology Education students did. Concurrently,

**Table 4** Acceptance of evolution theory by demographic variables

| Characteristics   | Mate                          |                      | Perceived conflict |                     | ECK              |        | Religiosity      |       |
|-------------------|-------------------------------|----------------------|--------------------|---------------------|------------------|--------|------------------|-------|
|                   | M $\pm$ SD                    | t/F                  | M $\pm$ SD         | t/F                 | M $\pm$ SD       | t/F    | M $\pm$ SD       | t/F   |
| Gender            |                               |                      |                    |                     |                  |        |                  |       |
| Female            | 69.14 $\pm$ 7.70              | -1.853               | 16.44 $\pm$ 2.90   | 1.018               | 26.60 $\pm$ 3.07 | -1.400 | 87.36 $\pm$ 6.46 | 0.873 |
| Male              | 67.36 $\pm$ 7.20              |                      | 16.82 $\pm$ 3.72   |                     | 26.04 $\pm$ 3.35 |        | 88.00 $\pm$ 7.09 |       |
| Academic year     |                               |                      |                    |                     |                  |        |                  |       |
| 2nd               | 69.69 $\pm$ 7.89              | 10.092 <sup>**</sup> | 16.28 $\pm$ 2.90   | 2.913               | 26.37 $\pm$ 2.76 | 0.269  | 88.06 $\pm$ 5.86 | 1.661 |
| 3rd               | 69.27 $\pm$ 7.43              |                      | 16.43 $\pm$ 2.97   |                     | 26.59 $\pm$ 3.28 |        | 87.13 $\pm$ 6.37 |       |
| 4th               | 63.93 $\pm$ 6.67 <sup>*</sup> |                      | 17.33 $\pm$ 3.46   |                     | 26.57 $\pm$ 3.41 |        | 86.56 $\pm$ 8.78 |       |
| Study program     |                               |                      |                    |                     |                  |        |                  |       |
| Biology           | 71.00 $\pm$ 6.86              | 4.217 <sup>**</sup>  | 16.20 $\pm$ 2.87   | -1.447              | 26.74 $\pm$ 3.10 | 1.118  | 87.42 $\pm$ 5.46 | 0.079 |
| Biology Education | 67.95 $\pm$ 7.80              |                      | 16.62 $\pm$ 3.09   |                     | 26.40 $\pm$ 3.12 |        | 87.37 $\pm$ 6.99 |       |
| Age               |                               |                      |                    |                     |                  |        |                  |       |
| $\leq 20$ years   | 69.15 $\pm$ 7.84              | 1.000                | 16.27 $\pm$ 3.01   | -2.031 <sup>*</sup> | 26.46 $\pm$ 3.06 | -0.474 | 87.74 $\pm$ 6.32 | 1.517 |
| $\geq 21$ years   | 68.45 $\pm$ 7.32              |                      | 16.83 $\pm$ 3.02   |                     | 26.59 $\pm$ 3.20 |        | 86.83 $\pm$ 6.89 |       |
| Ethnicity         |                               |                      |                    |                     |                  |        |                  |       |
| Javanese          | 70.09 $\pm$ 7.51              | 5.170 <sup>**</sup>  | 16.27 $\pm$ 3.05   | -2.332 <sup>*</sup> | 26.49 $\pm$ 3.01 | -0.181 | 87.55 $\pm$ 6.72 | 0.833 |
| Non-Javanese      | 66.46 $\pm$ 7.33              |                      | 16.93 $\pm$ 2.94   |                     | 26.54 $\pm$ 3.32 |        | 87.04 $\pm$ 6.21 |       |

<sup>\*\*</sup> $p < 0.01$ ;  $p < 0.05$

students in the fourth academic year were less likely to accept evolutionary theory than those in the second and third years were. Moreover, Javanese students showed greater acceptance of evolutionary theory than non-Javanese students did. In addition, there were no differences observed in the ECK or religiosity rates between the groups, regardless of the demographic variables considered. Moreover, perceived conflict rates based on demographic criteria significantly differed between groups in terms of age ( $p=0.043$ ) and ethnicity ( $p=0.020$ ). These findings reinforce the regression results that perceived conflict is a stronger predictor than religiosity and knowledge are.

### 3.2 Students' Perspective on the Role of Knowledge, Religiosity, and Perceived Conflict

Q1. Tell me about your knowledge and understanding of the theory of evolution.

Four Biology students said that they mastered the concept of evolution but provided information on problematic topics when studying evolution. They identified and reported their difficulties in understanding evolution from mutation and natural selection perspectives. They had difficulty explaining how simple organic molecules can become complex (chemical evolution). Then, there are small changes in gene frequency (microevolution) from generation to generation, let alone in human evolution. This concept requires a deep understanding of cell and molecular biology, and the lack of direct experience in practical applications makes this concept even more difficult for students to understand:

It is difficult to understand evolution from a genetic perspective, such as mutation and natural selection. (G1, S1).

Lack of understanding in applied biology, unable to associate molecular evolution and its application in life. (G1, S2).

Human evolution is related to chemical evolution, and this part is a topic that I need to study more. (G1, S3).

Molecular evolution needs to be understood further. It is difficult to understand microevolution, how small changes occur as part of evolution. (G1, S4).

Moreover, most Biology Education students (10 out of 12) associated the challenges in studying evolution more with controversial issues. Students stated that the existing fossil evidence is insufficient to support the chronology of evolution and prove that evolution has occurred. They believe that this has been the cause of the debate over the theory of evolution to date. Thus, Biology Education students expressed feelings of doubt, especially with respect to human origins, even though they understood the concept of evolution:

Studying evolution is more about origins, and evolution is more directed toward the beginning of human formation, then changes in form, so doubts arise for me. (G3, S3).

When I learned about cells, I was more able to prove it. When studying evolution, many questions arose as a form of doubt within me. (G3, S1).

Evidence of evolution in the form of fossils is still lacking. I doubt the existence of evolution, even though I have studied the evidence and clues to evolution. (G4, S1).

It is difficult when I have to study the timeline of the evolution controversy. (G2, S1).

Q2. How do you understand that religion can guide the study of evolution?

There were striking differences in opinion between Javanese and non-Javanese students. These differences were influenced by their cultural background and approach to knowledge. Javanese students tried to use a more dialogical approach to understanding the relationship between religion and science and viewed religion as a framework for further exploring science, including evolution. Javanese students have more intellectual openness, which is likely influenced by the cultural value of “*nerimo*.” Eight Javanese students reported that the relationship between religion and science could be at the level of ethical alliance or even integration, as explained by eight Javanese students as follows:

I am still guided by religion to study evolution. If there is confusion, something needs to be explored and learned more. Science reveals divine secrets and reveals everything that is not yet known. (G1, S4).

What is held firmly is religion. If there are different studies between evolution and religion, I will be independent (separating studies from religion). (G1, S3).

There is no conflict between religion and science in evolution, that in Koran Surah An-Nur (24) verses 45 states *wallâhu khalaqa kulla dâbbatim mim mâ'* (And Allah created all kinds of animals from water), within reach of ordinary human reason, there are those who believe it and those who do not, with evolution, it can be proven that the beginning of life is water, this is a support and explanation for what is in the Koran. Both express each other in different ways. (G2, S1).

Religion and evolution are interrelated. In the Koran, there is an explanation of evolution, of course, but it is a different explanation. Apart from that, many Muslim scientists expressed their opinions about evolution in books, and they provide explanations of its relation to religion. (G2, S2).

In contrast to Javanese students with a dialogical relationship, eight non-Javanese students gave brief responses but reflected a conflicted position. Students identified their belief in religion as the most important thing and as a barrier to accepting evolution. This view revealed a more literal orientation toward religion, where students tend to view evolution as contradicting their religious beliefs, as students revealed below:

Religiosity influences my opinion about evolution. (G3, S2).

Religion remains the biggest factor in viewing evolution. (G3, S1).

Religion is more influential than evolutionary science. (G3, S4).

I am more believe in religion because religion must come from God. (G4, S2).

Q3. Have you ever wondered about the meaning of evolution in humans?

Most students highly perceived conflict when they were asked about human evolution. Only two out of eight Javanese students gave positive statements about human evolution. Students who supported evolution tended to not only be able to use an interpretive approach to religious narratives related to Prophet Adam but also had an accurate scientific understanding of evolution. In addition, they tried to correct the disinformation that exists in society.

There is no conflict yet. In fact, I actually understand from religious explanations of evolution, for example, about human life, the height of the Prophet Adam A.S. 30 cubits, long life, but conditions now are different, can be explained by evolution science. (G1, S4).

At first, I understood that humans are from apes, but it turns out that is not the case. It is just a misguided argument from the general public. Just mention that humans and apes come from the same ancestor. (G2, S2).

Moreover, most interview participants (14 out of 16 students) referred negatively to human evolution. This rejection was essentially due to their belief in religious teachings that the Prophet Adam was the first human. In addition, they also revealed that evolution does not apply to all living things, only to animals and plants, and not humans, as noted by students as follows:

There are still contradictions. Darwin said that humans came from apes, which is contrary to what the Koran says about the creation of humans. In general, I refuse on the grounds of my religious beliefs. (G1, S1).

There are still contradictions because there are statements that humans came from the evolutionary process of monkey ancestors, even though in religion, the first human was the Prophet Adam. I believe more that humans have not evolved (creation theory). (G3, S1).

There is a contradiction. I do not believe that humans came from apes. (G3, S2).

Animals and plants evolve due to adaptation. In animals and plants, it happens more convincingly, whereas I am not sure that evolution also occurs in humans. (G4, S2).

Darwin did not say that humans came from apes. In fact, the theory does not exclude God. Some things are contradictory, and some are not. In general, I accept it, but I am still confused about whether humans have evolved or not. (G4, S3).

## 4 Discussion and Conclusion

The findings of this study indicated that participants had a moderate level of acceptance, following various measurement results in various countries worldwide, such as Mexico (Salazar-Enriquez et al., 2023), Brazil (Teixeira, 2019), Spain (Gefaeil et al., 2020), the UK (Betti et al., 2020), several European countries (Kuschmierz et al., 2020), and the USA (Fiedler et al., 2019). A similar study in Indonesia reported that 29% of Biology students were moderately accepting, whereas 36% were hesitant to believe in its validity (Yulianty et al., 2022). Concurrently, research conducted by Haviz et al. (2024) on the profile of Indonesian Muslim Biology instructor candidates' engagement with the theory of evolution reveals that the majority of them exhibited a propensity for peacemaking. Furthermore, only a limited number of individuals could be categorized as opponents or explorers within this group. Moreover, students' knowledge of evolution was moderate, and their religiosity was high. These results provide optimism among evolution teachers regarding

Muslim students' attitudes toward evolutionary theory. Our respondents indicated that they had good acceptance of evolution despite their high religiosity and moderate perceived conflict, which could be attributed to adequate knowledge.

Pearson correlation analysis revealed a positive relationship between knowledge and acceptance. These findings indicated that the better a student's knowledge of evolution is, the higher the acceptance rate, as reported by previous studies on similar (Betti et al., 2020; Deniz & Sahin, 2016; Ha et al., 2012; Kim & Nehm, 2011) and different samples (faculty and general population) (Rice et al., 2015; Weisberg et al., 2018). Concurrently, research conducted by Bulandari et al. (2019) in Indonesia revealed a substantial positive correlation between comprehension of the theory of evolution and acceptance of the theory of evolution. Similarly, Ramadani and Sukmawati (2022) conducted research on the Muslim population and reported that the majority had a strong religious educational background from Islamic boarding schools.

Conversely, these findings were also inversely proportional to other research, which showed the rejection of the relationship between acceptance and knowledge (Coleman et al., 2015; Gefaell et al., 2020; Lawson & Worsnop, 1992). Importantly, these studies utilized distinct measures of evolutionary knowledge, such as the Knowledge of Evolution Exam (KEE), which evaluates various cognitive domains, in contrast to the Likert-scale knowledge survey employed in this study. Furthermore, variations in cultural, religious, and educational backgrounds among participants, predominantly from non-Muslim and Western contexts, may also contribute to the observed discrepancies. However, as indicated by the weak correlation results ( $r=0.108$ ), and considering the data distribution, some students accepted evolution without having good knowledge and vice versa (Nadelson & Sinatra, 2009; Salazar-Enriquez et al., 2023). These findings generally revealed that adequate knowledge was necessary for students but insufficient to predict acceptance (Nehm & Schonfeld, 2007). This statement was also strengthened by the results of hierarchical regression analysis, which showed that knowledge only predicted approximately 1% of the variance.

The second factor considered to predict acceptance was religiosity, which has been suggested in many studies of university students (Fiedler et al., 2024; Metzger et al., 2018; Moore et al., 2011; Rissler et al., 2014). In our study, although there was a positive trend depicting the relationship between acceptance and religiosity, it was unexpected that religiosity had a weak positive relationship with acceptance ( $r=0.146$ ). It was considered a small predictor that explained only 2.9% of the variance together with knowledge. In a subsequent study conducted among Muslim Biology students in Indonesia, a positive and statistically significant correlation was discovered between acceptance (attitude) and religiosity (Haviz, 2023). This finding suggests that students exhibited a high level of acceptance despite their relatively high level of religiosity. These results indicate that Islam is a religion that accepts the theory of evolution (Stanisavljevic et al., 2013).

Our work also contradicts previous research showing that Muslim religions oppose evolutionary theory (Betti et al., 2020; Southcott & Downie, 2012; Stanisavljevic et al., 2013). This discrepancy may be attributed to variations in religious interpretation, educational exposure, and sociocultural factors across different contexts. The Indonesian educational system, in particular, may provide more opportunities for students to integrate scientific and religious perspectives, potentially reducing perceived conflict and increasing acceptance (Irham, 2025). These results indicate that religiosity is not the main cause of evolution rejection and that religious students can still accept evolution (Betti et al., 2020; Southcott & Downie, 2012; Stanisavljevic et al., 2013). Research conducted by Darussyamsu et al. (2018) revealed that certain aspects of emotional and spiritual intelligence can enhance students' acceptance of evolutionary theory.

However, although undergraduate students' perceived conflict has a negative association with acceptance, as was observed in Pearson correlation analysis, which previous studies have reported (Barnes et al., 2021a, b; Truong et al., 2018), they were willing to accept evolution within some limits. The qualitative data collected in this study revealed that high resistance was present regarding human evolution. The rejection of the theory of evolution was more about objections to the idea of human origins (Downie & Barron, 2000) and closely related to the factor of religiosity. In Indonesia, the majority religion is Islam, which is also based on the idea of creationism. Notably, a study by Haviz (2023) indicated that items related to evidence for evolution are perceived as conflicting by students, who tend to favor religious narratives over evolutionary explanations. This preference is associated with the highest factor loading strength. Another study conducted among Muslim biologists in Indonesia indicated that the ambiguous response to the concept of evolution within Muslim societies can be attributed to the absence of an explicit discussion of the creation of the first humans in the Quran (Luthfi & Farhana, 2018; Mujiharto, 2010).

These findings suggest that Indonesian students experience significant perceived conflict between their religious beliefs and the theory of evolution, even when they possess high levels of understanding of evolution and religiosity. It is unsurprising that Muslim students take the Koran narrative about the origin of species and appear to have a marked conflict with the idea of species change. In other words, students with good acceptance considered micro-evolution a component of evolutionary theory (Betti et al., 2020; Nadelson & Southerland, 2012). Indeed, including three reason options allowed us to develop a more nuanced view of why students were experiencing perceived conflict, especially concerning human evolution. The students expressed that the main reasons for perceived conflict were their belief in God and religious teachings (Barnes et al., 2017; Winslow et al., 2011). Some students stated that their religious community influenced their perceived conflict (Barnes et al., 2020a, b).

Findings were derived from the regression analysis to identify potential associations among the four factors (acceptance, knowledge, religiosity, and perceived conflict). Therefore, if neither knowledge nor religiosity were important predictors, then demographic factors and perceived conflict between science and religion were potentially the major predictors. Interestingly, the study revealed that students' acceptance of evolution can be influenced by their perceived conflict between science and religion. We can also observe the contributions of these two factors separately, which are indicated as the predictors of acceptance. In other words, religiosity and knowledge were not directly responsible for the rejection of evolution but rather were affected by a perceived conflict between students' religious identity and evolution, commonly known as identity-protective cognition (Barnes et al., 2021a, 2021b). One factor that could explain this finding is that students' theistic views may confront evolutionary beliefs more directly (Rice et al., 2015).

With respect to the regression and hierarchical models in our study, the ranking of the factors can be arranged as follows: perceived conflict > religiosity > knowledge. This ranking only represents samples with characteristics comparable to those in this research, i.e., Muslim students with high religiosity and moderate knowledge. If knowledge is important, we expect Biology and Biology Education students to show high acceptance. Additionally, if religiosity is the primary predictor, we would expect Muslim students to have high resistance levels. Therefore, our results indicate that perceived conflict may be more relevant and plausible as a barrier to acceptance of evolution than religiosity and knowledge are, at least among Muslim students.

Demographic analysis revealed three significant criteria for the comparison test: academic year, study program, and ethnicity. With respect to academic year, fourth-year students had lower acceptance than second- and third-year students did. According to Coley and Tanner (2012), informal and fundamental ideas of understanding the world received during the

learning process have influenced the acceptance of the theory of evolution. However, the positive effect of accumulated biological knowledge on students' acceptance of the theory of evolution has yet to be demonstrated (Ha et al., 2012). In addition, the results revealed no significant differences in knowledge of evolution across the three academic year groups. Fourth-year students were likely to have strong fundamentalist beliefs (Miller et al., 2022) and had greater perceived conflict than second- and third-year students did; however, the difference was not significant. Another potential explanation is that fourth-year students may have strengthened their religious identity due to the increased number of courses, including final projects, that require the integration of religion and science. This integration may lead to heightened perceptions of conflict. This explanation aligns with the concept of identity-protective cognitions, as described by Kahan (2013). In essence, fourth-year students may reject concepts in evolutionary theory because they perceive them as detrimental to their fundamental religious identity.

The results of this study support the claim made by Hayati (2021) that there is variation in the acceptance of evolution among students from different fields of study. However, when viewed from the perspective of knowledge as a significant predictor between the two study programs being compared, no difference was discernible. A recent study conducted among Biology Education students in Indonesia revealed that their understanding of evolutionary mechanisms has remained inadequate. The most prevalent misconceptions identified were content-related errors (Helmi et al., 2019). This is corroborated by other research that reveals that Biology Education students Harbor misconceptions regarding fundamental concepts pertaining to the interpretation and extent of evolution, affecting approximately 39.52% of respondents and 15.86% of respondents regarding Darwinian evolution specifically (Fauziah et al., 2019). In a subsequent report on the Biology study program, concept mastery was at a suboptimal level, with percentages ranging from 41.25 to 48.25% in the second dataset. Conversely, misconceptions were high, with percentages ranging from 60.25 to 61.25% (Putri et al., 2017).

In more detail, the reasons for the varying admissions of Biology and Biology Education students can be elucidated by analyzing qualitative data. Our findings suggest that Biology study programs prioritize mechanistic learning. In contrast, Biology Education considers other aspects in preparation for becoming preservice teachers. Biology students are likely to express a more positive attitude toward science, including a willingness to question their ideas and consider different viewpoints (Salazar-Enriquez et al., 2023). In the meantime, students studying Biology Education may face certain limitations due to the need to understand values as a crucial part of their preparation to become biology teachers. These students may encounter challenges in reconciling their religious beliefs with concepts related to evolution (Silva & Mortimer, 2020).

The findings of this study align with other research on how ethnicity affects acceptance of evolution (Sbeglia & Nehm, 2019) and also contradict other research reports (Pew Research Center, 2015). Our research uniquely indicated that ethnic Javanese students were more likely to accept the theory of evolution than non-Javanese students were. The Javanese philosophy of "nerimo" not only encourages adherence to the ideology of integration (Muttaqin et al., 2020) but also teaches students to passively accept and obey their lecturer's arguments (Kuswaya & Ma'mun, (2020)). Javanese students tend to avoid conflict, as highlighted by Irawanto et al. (2011), leading to greater acceptance of the theory of evolution. We also found that non-Javanese students reported higher levels of perceived conflict than did Javanese students, with no significant differences in knowledge and religiosity. In other words, high perceived conflict may be related to low acceptance of non-Javanese ethnic groups. Another possibility is that the mindsets of non-Javanese students may be related to their parents' education (Deniz et al., 2008). In the future, further research is needed to confirm the influence of parental educational background and culture.

Despite these promising results, we acknowledge the limitations of this study. First, knowledge measurement was evaluated using the ECK questionnaire. In this study, we determined that the reliability of this instrument was intermediate, although it can be used to draw statistical conclusions. However, this condition limits our ability to interpret students' knowledge of evolution and understand its relationship with evolution acceptance. Second, the religiosity instruments were exploratory in that they combined several dimensions from various questionnaires. This instrument needs to be adjusted and validated on a broader scale, even though it has demonstrated high reliability.

This research also has several advantages. First, this research employs various instruments, particularly to quantify religiosity, and utilizes the MATE tool, which has faced several criticisms. Second, the samples involved in the study were students at more than half of the Islamic universities in Indonesia. Our use of established instruments and a representative sample was beneficial for reducing the intrinsic variability of respondent responses. Third, regarding the scopes that have been measured, this research measured religiosity (Barnes et al., 2019, 2021a, b; Dunk et al., 2017; Glaze et al., 2015) and perceived conflict and demographics. Fourth, this research used both correlation and regression analyses, providing evidence of potential causal relationships between the factors measured.

## 5 Conclusion and Implications

Our findings revealed a high level of religiosity and moderate acceptance of the theory of evolution, knowledge, and perceived conflict among Muslim students. The correlations between knowledge, religiosity, and acceptance were positive and significant. With respect to demographic factors, acceptance of the theory of evolution was also influenced by academic year, study program, and ethnicity. Finally, the important and main finding showed that perceived conflict negatively impacted acceptance. Students only accepted some components of evolution and had poor acceptance of human evolution components because they related to religion and belief. In summary, we can describe the factors influencing acceptance in the following order: perceived conflict > religiosity > ECK knowledge, which indicated that perceived conflict was the most relevant. The most important contribution of our data considered that a crucial part of accepting evolution is closely related to students' perceived conflict, which was previously unknown with certainty.

Based on the results of this research, we propose several practical implications for teaching evolution: (1) Given the relationship between acceptance and understanding of evolution theory, it is necessary to increase evolution acceptance as part of the evolution course learning outcomes. (2) Emphasize the differences between scientific theories and religious beliefs without presenting them as opponents to avoid prejudices that lead to rejection of evolution theory. (3) For Education students, developing a more realistic view of how science creates evolutionary knowledge is necessary to reduce misunderstandings about this topic (Cotner et al., 2016; Rutledge & Mitchell, 2002). In summary, educators should be able to demonstrate to their communities that the perceived conflict between evolution and religion is inconsistent with what neither evolution nor religion explains and should take steps to change it (Truong et al., 2018). Educators should use strategies to eliminate a priori prejudices against the concept by integrating science and Islam (Husamah et al., 2022; Purwati et al., 2018; Sahil et al., 2024; Suciati et al., 2022a, b; Suciati et al., 2022a, b), as experienced by participants in this study.

## Appendix 1

**Table 5** MATE scale

| English version                                                                                                  | Indonesian version                                                                                                          |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 1. Organisms existing today are the result of evolutionary processes that have occurred over millions of years   | 1. Semua spesies yang ada saat ini telah berevolusi dari spesies yang hidup jutaan tahun sebelumnya                         |
| 2. The theory of evolution is incapable of being scientifically tested                                           | 2. Teori evolusi tidak mampu dibuktikan secara ilmiah                                                                       |
| 3. Modern humans are the product of evolutionary processes which have occurred over millions of years            | 3. Manusia modern telah berevolusi dari spesies bukan manusia yang hidup jutaan tahun sebelumnya                            |
| 4. The theory of evolution is based on speculation and not valid scientific observation and testing              | 4. Teori evolusi didasarkan pada dugaan, pengamatan, dan pengujian ilmiah yang tidak valid                                  |
| 5. Most scientists accept evolutionary theory to be a scientifically valid theory                                | 5. Sebagian besar ilmuwan menerima evolusi sebagai teori yang valid secara ilmiah                                           |
| 6. The available data are ambiguous as to whether evolution actually occurs                                      | 6. Data yang tersedia saat ini tidak cukup membuktikan apakah evolusi benar-benar terjadi                                   |
| 7. The age of the earth is less than 20,000 years                                                                | 7. Umur bumi tidak akan lebih dari 20.000 tahun                                                                             |
| 8. There is a significant body of data which supports evolutionary theory                                        | 8. Ada sejumlah data besar yang mendukung teori evolusi                                                                     |
| 9. Organisms exist today in essentially the same form in which they always have                                  | 9. Semua spesies yang ada saat ini memiliki bentuk yang sama dengan spesies yang hidup jutaan tahun sebelumnya              |
| 10. Evolution is not a scientifically valid theory                                                               | 10. Teori evolusi tidak valid secara ilmiah                                                                                 |
| 11. The age of the earth is at least 4 billion years                                                             | 11. Umur bumi dapat lebih dari 4 milyar tahun                                                                               |
| 12. Current evolutionary theory is the result of sound scientific research and methodology                       | 12. Teori evolusi diperoleh dari hasil penelitian melalui metodologi ilmiah yang baik                                       |
| 13. Evolutionary theory generates testable predictions with respect to the characteristics of life               | 13. Teori evolusi diperoleh dari hasil prediksi terkait karakteristik kehidupan yang dapat dibuktikan secara ilmiah         |
| 14. The theory of evolution cannot be correct since it disagrees with the Biblical account of creation           | 14. Teori evolusi tentang penciptaan tidak mungkin benar karena tidak sesuai dengan penjelasan kitab suci (Al-Qur'an)       |
| 15. Humans exist today in essentially the same form in which they always have                                    | 15. Manusia yang ada saat ini memiliki bentuk yang sama dengan spesies yang hidup jutaan tahun sebelumnya                   |
| 16. Evolutionary theory is supported by factual, historical, and laboratory data                                 | 16. Teori evolusi didukung dari berbagai data meliputi data faktual, historis, dan laboratorium                             |
| 17. Much of the scientific community doubts if evolution occurs                                                  | 17. Banyak ilmuwan meragukan terjadinya evolusi                                                                             |
| 18. The theory of evolution brings meaning to the diverse characteristics and behaviors observed in living forms | 18. Gagasan bahwa spesies dapat berevolusi menjadi spesies baru dapat menjelaskan keragaman karakteristik kehidupan di bumi |
| 19. With few exceptions, organisms on earth came into existence at about the same time                           | 19. Semua spesies yang ada di bumi muncul pada waktu yang hampir bersamaan                                                  |
| 20. Evolution is a scientifically valid theory                                                                   | 20. Evolusi adalah teori yang valid secara ilmiah                                                                           |

## Appendix 2

**Table 6** ECK scale

| English version                                                                                                                                             | Indonesian version                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1. Mutations are harmful and therefore cannot give rise to new characteristics                                                                              | 1. Mutasi bersifat berbahaya sehingga tidak dapat memunculkan karakteristik baru                                    |
| 2. Fossil species have been found that are intermediate between humans and apes                                                                             | 2. Catatan fosil dapat mendokumentasikan mata rantai yang hilang antara nenek moyang dan spesies keturunanya        |
| 3. The survival of early humans was difficult because of predatory dinosaurs                                                                                | 3. Manusia purba memiliki kehidupan yang sulit disebabkan adanya dinosaurus predator                                |
| 4. The organisms that cause malaria, gonorrhea, and tuberculosis have become resistant to antibiotics. The biological cause of this resistance is evolution | 4. Organisme penyebab malaria, gonore, dan tuberkulosis menjadi resisten terhadap antibiotik karena terjadi evolusi |
| 5. Radiometric dating of rocks indicates that the Earth is billions of years old                                                                            | 5. Penanggalan (kalender) radiometrik batuan menunjukkan bahwa Bumi berusia miliaran tahun                          |
| 6. If evolution were true, “living fossils” like the horseshoe crab would not have stayed the same for millions of years                                    | 6. Jika evolusi benar, “fosil hidup” seperti hewan belangkas bentuknya tidak akan tetap sama selama jutaan tahun    |
| 7. The fossils of early human species found are intermediate between humans and apes                                                                        | 7. Fosil spesies manusia purba yang ditemukan merupakan perantara antara manusia dan kera                           |
| 8. Chance cannot be a key factor in the origin of complex organisms                                                                                         | 8. Peluang acak tidak dapat menjelaskan asal-usul organisme yang kompleks                                           |

## Appendix 3

**Table 7** Religiosity scale

| English version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Indonesian version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. How often do you pray “sholat” in a day?</p> <p>a. 5<br/>b. 4<br/>c. 3<br/>d. 2<br/>e. 1</p> <p>If not, another option...</p> <p>a. Once a week<br/>b. Once a month<br/>c. Never</p> <p>2. How often do you spend time on personal religious activities, such as reading and studying the Koran daily?</p> <p>a.5<br/>b.4<br/>c.3<br/>d.2<br/>e.1</p> <p>If not, another option...</p> <p>a. Once a week<br/>b. Once a month<br/>c. Never</p> <p>3. Which of the following three types best represents your characteristics?</p> <p>a. Type 1, a person who interprets Koran verses “textually”, usually aims to understand Nash or Koran text without connecting it with other Nash or Koran text or relating it with others sociocultural. A person who believes the evolution theory is false and can not be proven or is not scientific</p> <p>b. Type 2, a person who interprets Koran verses emphasising “linguistic” and ignoring the socio-historical context, but they present in modern terms, which are sometimes shown apologetically (defending their faith and religion). A person who acknowledges the truth of the Koran and then checks the genuine claims of evolution in the Koran</p> <p>c. Type 3, a person who believes that the messages and teachings of the Koran should be applied in different ways by considering the historical context of the text and the historical context of the application of the text. A person who likes discussing science and religion in an interdisciplinary or multidisciplinary manner so that they can bring diverse and complementary perspectives</p> | <p>1. Seberapa sering Anda melaksanakan sholat dalam 1 hari?</p> <p>a. 5<br/>b. 4<br/>c. 3<br/>d. 2<br/>e. 1</p> <p>Jika tidak, pilihan lainnya...</p> <p>a. Seminggu sekali<br/>b. Sebulan sekali<br/>c. Tidak pernah</p> <p>2. Seberapa sering Anda meluangkan waktu untuk kegiatan keagamaan pribadi, seperti membaca dan mempelajari Al-Qur'an dalam sehari?</p> <p>a. 5<br/>b. 4<br/>c. 3<br/>d. 2<br/>e. 1</p> <p>Jika tidak, pilihan lainnya...</p> <p>a. Seminggu sekali<br/>b. Sebulan sekali<br/>c. Tidak pernah</p> <p>3. Menurut diantara tiga golongan berikut yang paling mencerminkan karakteristik Anda?</p> <p>a. Tipe 1, orang yang menafsirkan ayat-ayat Al-Qur'an secara “tekstual” biasanya bertujuan untuk memahami teks Nash atau Al-Qur'an tanpa menghubungkannya dengan teks Nash atau Al Qur'an lain atau mengaitkannya dengan sosiokultural lain. Orang yang meyakini teori evolusi adalah salah dan tidak dapat dibuktikan atau tidak ilmiah</p> <p>b. Tipe 2, orang yang menafsirkan ayat-ayat Al Qur'an dengan menekankan “linguistik” dan mengabaikan konteks sosio-historis, namun hadir dalam istilah modern, yang terkadang ditampilkan secara apologetis (membela keimanan dan agama). Orang yang mengakui kebenaran Al-Qur'an dan kemudian memeriksa kebenaran pernyataan evolusi dalam Al-Qur'an</p> <p>c. Tipe 3, orang yang berpendapat bahwa pesan dan ajaran Al-Qur'an harus diterapkan dengan cara yang berbeda dengan mempertimbangkan konteks sejarah teks dan konteks sejarah penerapan teks tersebut. Orang yang gemar berdiskusi tentang ilmu pengetahuan dan agama secara interdisipliner atau multidisiplin sehingga dapat menghadirkan sudut pandang yang beragam dan saling melengkapi</p> |

**Table 7** (continued)

| English version                                                                                         | Indonesian version                                                                                 |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1. In my life, I feel the presence of God                                                               | 1. Dalam hidup saya, saya merasakan kehadiran Tuhan                                                |
| 2. My religion is the result of my whole approach to life                                               | 2. Agama saya merupakan hasil dari seluruh pendekatan saya terhadap kehidupan                      |
| 3. I don't always bring religion into all other matters in life                                         | 3. Saya tidak selalu membawa agama dalam semua urusan lain dalam hidup                             |
| 4. I believe in God                                                                                     | 4. Saya percaya pada Tuhan                                                                         |
| 5. I feel that God exists                                                                               | 5. Saya merasa bahwa Tuhan itu ada                                                                 |
| 6. I think there are no good arguments that confirm the existence of God                                | 6. Saya berpikir tidak ada argumen bagus yang menegaskan keberadaan Tuhan                          |
| 7. I would describe myself as an ordinary person and not particularly religious                         | 7. Saya akan menggambarkan diri saya sebagai orang yang biasa saja dan tidak terlalu religius      |
| 8. Without faith, my life would be meaningless                                                          | 8. Jika tanpa iman, maka hidup saya tidak akan berarti                                             |
| 9. I believe that heaven exists                                                                         | 9. Saya percaya bahwa surga itu ada                                                                |
| 10. I pray with faith that my prayers can change future events                                          | 10. Saya berdoa dengan iman bahwa doa saya dapat mengubah peristiwa di masa depan                  |
| 11. I feel fulfilled when I am in God's presence                                                        | 11. Saya merasa terpenuhi ketika saya berada di hadirat Tuhan                                      |
| 12. Because of faith, I hope to live after death                                                        | 12. Karena iman, saya memiliki harapan bahwa saya akan hidup setelah mati                          |
| 13. What happens in my life is God's destiny                                                            | 13. Apa yang terjadi dalam hidup saya merupakan takdir Tuhan                                       |
| 14. The Koran gives us the best explanation of human characteristics and behaviour                      | 14. Al-Qur'an memberi kita penjelasan terbaik tentang karakteristik dan perilaku manusia           |
| 15. The theory of evolution is probably correct because no specific explanation in the Koran rejects it | 15. Teori evolusi mungkin benar karena tidak ada penjelasan khusus dalam Al-Qur'an yang menolaknya |
| 16. The earth and the sky were created in 6 days                                                        | 16. Bumi dan langit diciptakan dalam 6 hari                                                        |
| 17. The first man (Adam) was created directly by God from the dust of the ground                        | 17. Manusia pertama (Adam) diciptakan langsung oleh Tuhan dari debu tanah                          |
| 18. The scriptures must be interpreted textually                                                        | 18. Kitab suci harus ditafsirkan secara tekstual                                                   |
| 19. Adam and Eve were the first humans on earth                                                         | 19. Adam dan Hawa adalah manusia pertama di bumi                                                   |
| 20. Humans are the most perfect creatures                                                               | 20. Manusia adalah makhluk paling sempurna                                                         |
| 21. All humans today are direct descendants of Adam and Hawa                                            | 21. Semua manusia saat ini adalah keturunan langsung dari Adam dan Hawa                            |
| 22. Evolution occurs in living things but not in humans                                                 | 22. Evolusi terjadi pada makhluk hidup, namun tidak terjadi pada manusia                           |

## Appendix 4

**Table 8** Perceived impact scale

| English version                                                                                                                                                                                                                                                                | Indonesian version                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Harder to believe that all of life on Earth evolved from ancient microscopic life<br>According to statement number 1, what factor that leads to your answer?<br>My belief in God<br>My personal religious beliefs<br>The teachings of my religion<br>My religious community | 1. Sulit untuk percaya bahwa semua kehidupan di Bumi berevolusi dari kehidupan mikroskopis kuno<br>Lanjutan no 1. Apa faktor yang menyebabkan?<br>Keyakinan saya pada Tuhan<br>Keyakinan pribadi agama saya<br>Ajaran agama saya<br>Komunitas agama saya |
| 2. Harder to believe that humans evolved from ancient ape ancestors<br>According to statement number 2, what factor that leads to your answer? Idem                                                                                                                            | 2. Sulit untuk percaya bahwa manusia berevolusi dari nenek moyang kera purba<br>Lanjutan no 2. Apa faktor yang menyebabkan?<br>Idem                                                                                                                      |
| 3. Harder to believe that nonhuman life evolved from previous different species<br>According to statement number 3, what factor that leads to your answer? Idem                                                                                                                | 3. Saya sulit untuk percaya bahwa kehidupan bukan manusia berevolusi dari spesies berbeda sebelumnya<br>Lanjutan no 3. Apa faktor yang menyebabkan?<br>Idem                                                                                              |
| 4. Harder to believe that humans have changed over time due to evolution<br>According to statement number 4, what factor that leads to your answer? Idem                                                                                                                       | 4. Sulit untuk percaya bahwa manusia telah berubah dari waktu ke waktu karena evolusi<br>Lanjutan no 4. Apa faktor yang menyebabkan?<br>Idem                                                                                                             |
| 5. Harder to believe that nonhuman life has changed over time due to evolution<br>According to statement number 5, what factor that leads to your answer? Idem                                                                                                                 | 5. Sulit untuk percaya bahwa kehidupan bukan manusia telah berubah dari waktu ke waktu karena evolusi<br>Lanjutan no 5. Apa faktor yang menyebabkan?<br>Idem                                                                                             |

**Acknowledgements** This study is funded by the Universitas Negeri Malang and conducted at the Biology Study Program Universitas Islam Negeri Maulana Malik Ibrahim Malang in collaboration with the Association of Biological and Educational Biology Lecturer of Islamic Religious Colleges (ADBPB-PTKI).

**Author Contribution** M.S., H.S., and Y.H. conceptualized and designed the study. M.S., H.S., and Y.H. contributed to the development of materials and data collection. M.S., H.S., Y.H., and C.C. performed the data analysis. All authors participated in the interpretation of the data, contributed to drafting the manuscript, and reviewed and approved the final version of the article.

**Funding** This work was supported by Universitas Negeri Malang (contract number 5.4.493/UN32.20.1/LT/2023 and 4.4.590/UN32.14.1/LT/2024).

**Data Availability** The data supporting the findings of this study are available from the corresponding author upon reasonable request.

## Declarations

**Ethics Approval** Ethics approval was granted by the Universitas Negeri Malang (project number 5.4.493).

**Conflict of Interest** The authors declare no competing interests.

**Clinical trial number** Not applicable.

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