

## Fostering Trustworthy (*Amanah*) Character: Investigating the Impact of Integrating Religious Values into Thermochemical Module

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### Abstract

The character of trustworthy (*amanah*) is fundamental to the inherent constitution of the human psyche, and its integration is crucial in daily practices. Thermochemistry, as a chemical discipline intricately connected to the ambient environment, encapsulates latent character values that often remain unarticulated within the educational discourse. This research aims to determine the effectiveness of a thermochemical module containing religious values on forming a trustworthy (*amanah*) character in the chemistry learning process. This research uses a quasi-experimental type with a one-group pretest and posttest design to examine the effectiveness of the module that has been developed. Data collection is taken from a pretest and posttest character assessment sheet comprising five indicators. Besides, the data analysis technique was descriptively based on the N-gain test. The results showed an increase in the formation of students' trustworthy (*amanah*) character after using the thermochemical module containing religious values, where the average pretest percentage was 68.42% in the sufficient category (starting to appear) to the average posttest percentage of 78.92% in the good category (starting to develop). In addition, the average N-gain score was 0.56 in the medium category, and the average N-gain score percentage was 56.16%, with the interpretation being quite effective. Hence, this data shows that the thermochemistry module containing religious values was helpful in the chemistry learning process and influenced the formation of trustworthy (*amanah*) character.

Keywords: religious value, thermochemical module, trustworthy

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### 1. Introduction

Education is a conscious effort made by society and the nation to prepare the young generation with good morals for their survival in the future (Panggabean, 2022). Character education is essential in forming intelligent individuals with good character (Padmadewi et al., 2018). Character education instills values adapted to national culture regarding knowledge, attitudes, and skills (Muchtar & Surtani, 2019). In education, character is crucial to recognize to realize the character of

a civilized nation (Davison et al., 2016; Shidiq et al., 2019). One of the characteristics that can contribute to a person becoming better and positively impacting on the community is trustworthy (*amanah*) character. Trustworthy (*amanah*) is one of the characteristics of the prophet Muhammad SAW, characterized as trustworthiness, honesty, and responsibility (Abidin, 2017; Tekke et al., 2018). A trustworthy (*amanah*) becomes a solid foundation in relations between people, associations, and states. Without trustworthy (*amanah*) behaviour, there is no trust in relationships and relational and authoritative

values that become a reference in behaviour; trust is crucial to apply in everyday life (Agung, 2021). Also, when someone makes a promise, it must be accompanied by good trust to avoid misunderstandings (Ali et al., 2022). Nowadays, people who can hold a trustworthy (*amanah*) are complicated to find (Irfan, 2019). Many cases are caused by deviations from human values, character, and morals in all aspects of the nation and state (Sulastrri et al., 2018). Besides, one of the actions that must be taken to improve this increasingly deteriorating character is integrating character education into learning (Surbakti & Supartono, 2016).

In Indonesia's education context, it is necessary to integrate strengthening character education in the learning process (Saputro et al., 2022). Until 2022, schools in Banda Aceh have generally implemented the 2013 curriculum, which plans to foster harmony between increasing the perspective of spiritual and social attitudes, interest, innovation, participation with knowledge, and psychomotor capacity in subject matter.

Furthermore, all subject matter contains values, which include religious, economic, ethical, aesthetic, social values, and other values. This value only requires the carrier to reveal it to students. This way requires the teacher's ability to reveal the potential value (Mauliza et al., 2022). This value becomes the moral basis for students to shape and develop their character (Sulastrri et al., 2018). The integration of value content can be transmitted into a module used in the learning process in groups and individually (Haryani et al., 2021). However, finding a book that integrates religious value content into chemistry material is still challenging, so it is difficult for teachers to teach the value content associated with chemistry material (Permatasari et al., 2019). Meanwhile, the package books or modules used in schools still only contain cognitive concepts; they need to contain values that make students aware of the importance of knowledge. Also, it is rare for books to explain that all-natural resources come from Allah SWT (Sulastrri et

al., 2018). Thus, thermochemical material is one chemical closely related to everyday life and contains character values not revealed in the learning process. Therefore, researchers would like to integrate the content of religious values with the character of trustworthy (*amanah*) into thermochemical material and develop it into a module.

A Trustworthy (*amanah*) character is a fundamental personality everyone must mobilize to realize some founding principles in establishing social relationships with others. In the meantime, positive attitudes and behavior between individuals and groups can be formed from the character of trustworthiness (Agung & Husni, 2016). Without the character of trustworthiness, interpersonal and organizational trust will not be created, giving rise to deviant behavior such as corruption, irresponsibility, betrayal, and criminal behavior (Agung, 2021). On the other hand, the implications of a trustworthy (*amanah*) character can be seen in several behaviors, including an attitude of honesty, which will create a sense of peace within oneself, gaining the trust of others quickly. If everyone is responsible, everybody can be respected by the surrounding environment. Also, diligence in carrying out duties well implies a trustworthy (*amanah*) character. Therefore, to make a harmonious and peaceful life between fellow humans and the creator, everyone must apply an attitude of trustworthiness.

## 2. Research Method

This research is quasi-experimental with a one-group pretest-posttest design to test the effectiveness of the module that has been developed. The research subject was taken from 11<sup>th</sup> grade students of mathematics and natural science majors, which consisted of 33 students. The data analysis technique was carried out descriptively based on the N-gain test. The N-gain test was used to see the effect of thermochemical modules containing religious values on the formation of trustworthy (*amanah*) character. This N-gain value was obtained by comparing the

influence value of using the module from the posttest score-pretest score with the ideal value (maximum score-pretest score) (Fatmah, 2018).

The character assessment sheet used in this research is a Likert scale assessment sheet. For each aspect of the assessment, there are five indicators of trustworthy (*amanah*) character honesty, keeping promises, responsibility, maintaining trust, and conveying messages well, accompanied by several statements that were easy for students to understand (Erihandiana, 2019). The criteria for assessing the N-Gain score are shown in Table 1.

**Table 1. Criteria for Assessing N-Gain**

N-gain	Criteria
$g > 0.7$	High
$0.3 < g \leq 0.7$	Medium
$g \leq 0.3$	Low

(Kunandar, 2015)

The N-gain effectiveness interpretation category is shown in Table 2.

**Table 2. Effectiveness Interpretation Category**

N-gain	Criteria
$g > 76$	Effective
$g > 75-56$	Enough
$g > 55-40$	Less
$g < 40$	Poor

(Kunandar, 2015)

Furthermore, the percentage of trustworthiness character assessment is obtained by comparing the total data collection scores with the maximum score multiplied by 100%. The character assessment criteria for the category are very good if the value range is 91-100%, good category if the value range is 71-90%, enough category if the value range is 61-70%, and the category is poor if the value range is 1-60% (Kunandar, 2015).


### 3. Result and Discussion

This research is quasi-experimental to see the effectiveness of the thermochemical module that has been developed containing religious values. Value is a potential within a human

being based on valuable beliefs held in high esteem and essential to everyone (Sulastris, 2018). Meanwhile, religious values are implemented in attitudes and behaviors that are obedient in carrying out the commands of each person's religion (Sukestiyarno et al., 2019). Thus, religious values can be defined as explicit or implicit concepts contained in religion that can influence human behavior (Rifa'i, 2016). On the other hand, the religious value expressed in this research is trustworthy (*amanah*). It is believed that trustworthiness plays a massive role in human life (Agung, 2021). In other words, trustworthiness can also be formulated as a servant's obligation to obey Allah SWT in doing good for the individual self, others, and the nature around them (Hermawan, 2020). Meanwhile, a trustworthy (*amanah*) character has never been integrated into chemical material. Still, this trustworthy (*amanah*) character is connected to the teaching material, thermochemistry, which consists of five sub-materials transmitted into a module.

The first sub-material is about energy and its changes, which are associated with gratitude for the photosynthesis process in nature, where solar energy is necessary. Table 3 shows a description of the religious sub-material in the module.

**Table 3. Display of the Thermochemical Module Containing Religious Values**

Component	Information
Page	Page 11 explain the concept of energy and energy changes, such as the process of photosynthesis.
Display	

Solar energy is one of the creations of Allah SWT, which implements natural laws as a form of obedience in carrying out Allah SWT's commands. Natural law itself is the meaning of decrees or provisions of Allah SWT regarding the process of natural phenomena regularly occurring without the intervention of other creatures (Sutarjo, 2020). In photosynthesis, solar energy carries out Allah SWT's orders to help plants make food in leaves containing chlorophyll, which will later produce food substances useful for other creatures.



The photosynthesis process also teaches the importance of responsibility for the needs of other creatures: giving rights in the form of food and providing comfort with green plants. Another natural law implemented by solar energy is the need for solar energy to warm the earth's surface. If the sun does not carry out the mandate of Allah SWT as well as possible, the temperature on the earth's surface will reach  $-73^\circ\text{C}$ , which can cause creatures to freeze. Seeing nature carry out orders from Allah SWT regularly makes people aware that as rational humans, everyone must also carry out these orders, such as protecting the environment well and avoiding actions detrimental to the environment, creatures, and others.

The second sub-material is the law of energy conservation, linked to the first law of thermodynamics, which states that "energy can neither be created nor destroyed, only converted from one form of energy to another." In addition, Allah SWT has shown his servants greatness and power over energy creation. No human or servant on the earth's surface can destroy energy. Apart from that, the first law of thermodynamics also confirms the belief of creatures who believe in the existence of Allah SWT with the presence of energy to provide awareness for humanity not to be arrogant. In essence, trustworthy (*amanah*) people have a straightforward attitude, and the arrogant attitude referred to

has been explained in one of the verses of the Quran, which means:

*"And do not turn your cheek [in contempt] toward people and do not walk through the earth haughtily. Indeed, Allah does not like everyone self-deluded and boastful."* (Sura Luqman [31] verse 18). Table 4 describes the energy conservation law in a module containing religious values.

**Table 4. Display the Law of Energy Conservation in the Module Containing Religious Value.**

Component	Information
Page	Page 14 explain the energy created by Allah SWT as a trust that must be used as well as possible.
Display	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p><b>Nilai Religi</b></p> <p>Konsep energi yang dinyatakan dalam hukum termodinamika I, dapat memperkuat keimanan seseorang tentang eksistensi atau hakikat keberadaan Allah SWT yang maha kekal. Walaupun tidak dapat dilihat oleh kasat mata secara langsung, keberadaan Allah SWT dapat diketahui dengan bukti-bukti yang ada, seperti adanya energi, alam semesta beserta isinya, adanya makhluk hidup bahkan adanya manusia yang diberikan kebebasan akal untuk digunakan secara benar dalam mengajkai bukti kekuasaan Allah SWT.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p><b>Nilai Religi</b></p> <p>Dari hukum kekekalan energi juga menyadarkan kita bahwa tidak ada satupun makhluk di muka bumi ini melebihi kehebatannya dari Allah SWT. Mau sepekat apapun, kita tidak bisa menciptakan atau memusnahkan energi melainkan hanya dapat mengubah energi tersebut menjadi bentuk energi yang dapat dimanfaatkan dalam kehidupan sehari-hari. Oleh karena itu kita sebagai hamba yang lemah janganlah bersikap sombong, karena Allah SWT tidak menyukai orang yang sombong.</p> <p>"dan janganlah kamu memalingkan mukamu dari manusia (karena sombong) dan janganlah kamu berjalan di muka bumi dengan angkuh. Sesungguhnya Allah tidak menyukai orang-orang yang sombong lagi membanggakan diri (QS. Luqman [31]: 18)".</p> <p>Sesungguhnya Allah SWT yang maha kuasa atas segalanya. Kita sebagai manusia hanya bisa bersyukur atas nikmat dan karunia yang telah Allah SWT limpahkan kepada kita dengan cara menjaga amanah dalam melaksanakan perintah Allah SWT dan menjauhi larangannya.</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p>Kita harus menjaga alam semesta secara amarah sehingga alam tidak rusak dan tidak akan berdampak terhadap kelangsungan hidup makhluk lainnya. QS. Al-Anfal ayat 27 yang artinya sebagai berikut: "Hai orang-orang yang beriman, janganlah kamu mengkhianati Allah dan Rasul (Muhammad) dan (juga) janganlah kamu mengkhianati amanat-amanat yang dipercayakan kepadamu, sedang kamu mengetahui (QS. Al-Anfal [8]: 27).</p> </div>

The third sub-material is about systems and the environment, which is analogous to a human qalbu (heart) as a system and the impact of human behavior as an environment. A person's behavior can be influenced by the good and bad of the heart. If the heart is good, then the behavior shown is also good towards the surrounding environment and vice versa; this proves that the system and the environment have a close relationship, like the prophet Muhammad SAW said, *"You know that in the human body, there is a clot of blood. If it is good, all its actions will be good; if it is terrible, then its entire behavior will be bad. Just know that is the heart* (Shahih Al-Bukhari and Muslim)." The hadith is associated with an attitude of honesty in the form of trustworthiness. A trustworthy

(amanah) character must be developed from an early age. Also, it is crucial to apply that character from oneself, family, community, nation, and state. More than that, a trustworthy (amanah) character is the source of all goodness in the world. Table 5 shows a description of systems and the environment in a module containing religious values.

**Table 5. Display of the Systems and the Environment in Module Containing Religious Value**

Component	Information
Page	Page 16 explain the interaction of people who have knowledge and faith who are analogous to trustworthy ( <i>amanah</i> ) people with the surrounding environment.
Display	<div data-bbox="375 862 699 1041" style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; font-weight: bold; font-size: small;">Nilai Religi</p> <p>Sistem juga dapat dianalogikan dengan sebuah hati yang dimiliki oleh seorang insan. Hati dapat membentuk kepribadian seseorang menjadi baik atau buruk. Hati dapat mempengaruhi perilaku seseorang untuk berperilaku disekitarnya. Rasulullah SAW bersabda, "Ketahuilah kamu di dalam bidden manusia terdapat segumpal darah. Apabila baik, maka dia akan baiklah keseluruhan segala perbuatannya dan apabila buruk maka buruklah keseluruhan tingkah lakunya. Ketahuilah kamu bahwa ia adalah hati (jantung)" (HR. Bukhari dan Muslim). Hati seseorang yang bersikap jujur merupakan salah satu nilai karakter yang harus dibina dan sangat penting diterapkan dalam lingkungan sekitar, seperti lingkungan sekolah, lingkungan keluarga, lingkungan masyarakat. Karena kejujuran merupakan sumber segala kebajikan.</p> </div>

The next sub-material is about exothermic and endothermic reactions, which express the attitude of giving and receiving. Exothermic reactions are caused by the system releasing heat energy into the environment, and endothermic reactions occur because the system absorbs energy from the environment. This process illustrates the characteristics of a person responsible for other human needs: paying and distributing the zakah to people entitled to receive it. It has been explained by Quran surah At-Taubah [9] verse 60, which means "*Zakah expenditures are only for the poor and for the needy and for those employed to collect [zakah] and for bringing hearts together [for Islam] and for freeing captives [or enslaved people] and for those in debt and the cause of Allah and the [stranded] traveler – an obligation [imposed] by Allah. Moreover, Allah is Knowing and Wise.*" Table 6 describes the systems and the environment in the module.

**Table 6. Display of systems and the Environment in Module Containing Religious Values**

Component	Information
Page	Page 33 explain the system for receiving and releasing heat when doing business.
Display	<div data-bbox="1045 470 1332 660" style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; font-weight: bold; font-size: small;">Nilai Religi</p> <p>Reaksi eksoterm dan endoterm dapat dianalogikan dengan kehidupan manusia di dunia, dimana umat muslim memiliki hak dan kewajiban dalam memberi dan menerima. Seorang fakir miskin mempunyai hak untuk menerima sebagian harta yang dimiliki oleh orang yang mampu (kaya) yaitu dengan cara menfakikan sebagian hartanya dengan batasan yang telah ditentukan, dalam bentuk zakat maal. Seperti yang dijelaskan dalam QI. At-Taubah [9] 40</p> <p>"Seungguhnya zakat-zakat itu, hanyalah untuk orang-orang fakir, orang-orang miskin, pengurus-pengurus zakat, Para mu'allaf yang dibujuk hatinya, untuk (memerdekakan) budak, orang-orang yang berhutang, untuk jalan Allah dan untuk mereka yang sedang dalam perjalanan, sebagai suatu ketetapan yang diwajibkan Allah, dan Allah Maha mengetahui lagi Maha</p> </div> <div data-bbox="1045 683 1332 907" style="border: 1px solid black; padding: 5px;"> <p>Penjelasan di atas merupakan salah satu sikap tanggung jawab yang harus disampaikan kepada yang berhak. Seperti yang dijelaskan dalam QI. An-Nisa' [4] 58</p> <p>"Seungguhnya Allah menyeruh kamu menyampaikan amanat kepada yang berhak menerimanya, dan (menyeruh kamu) apabila menetapkan hukum di antara manusia supaya kamu menetapkan dengan adil. Seungguhnya Allah memberi pengajaran yang sebaik-baiknya kepadamu. Seungguhnya Allah adalah Maha mendengar lagi Maha melihat".</p> <p>Selain itu, manusia juga merupakan makhluk sosial yang senantiasa memiliki kesadaran untuk selalu menasankan sikap saling memberi dan menerima. Meskipun tidak dengan harta, hal tersebut dapat dilakukan dengan menggunakan tenaga atau pikiran untuk membantu orang lain. Begitu juga reaksi yang terjadi pada reaksi eksoterm dan endoterm, dimana reaksi eksoterm adalah reaksi yang melepaskan energi dalam bentuk kalor dari sistem ke lingkungan, dan reaksi endoterm adalah reaksi yang menerima kalor dari lingkungan ke sistem.</p> </div>

The last sub-material is about thermochemical equations, which explain what happens in the body of living things that undergo a thermochemical reaction process, such as the process of breaking down one mole of glucose to produce two molecules of pyruvic acid, two molecules of ATP, and two NADH which occurs in the cytoplasm. The process of glycolysis contains trustworthiness that must be carried out by the contributing organs in the human body. If this reaction does not carry out Allah SWT's (The glorified, the highest) commands, then the food/drink that enters the body cannot be processed by the organs to be converted into energy. This material also looks at the process of making sugar. The sugar-making goes through several stages: extraction, settling, evaporation, boiling/crystallization, storage, affination, color removal, and re-boiling. In addition, the sugar-making process has undergone a thermochemical procedure, where pressure, temperature, and heat are applied. However, the trustworthy (*amanah*) nature seen in this process produces sweet sugar. Even though it is dissolved in coffee, tea, water, and other water, sugar still maintains its trustworthy (*amanah*) in providing a sweet taste to all foods and drinks

containing sugar. Hence, all humans must behave trustworthily to ensure goodness and harmony throughout their daily lives, regardless of time and place (Kasim et al., 2020). Table 7 describes the relationship between Amanah's character and thermochemical equations.

**Table 7. Display of Relationship Between Amanah Character and Thermochemical Equations**

Component	Information
Page	Page 35 explain the glucose burning reaction in the human body.

Display

Nilai Religi

Tahukah kamu, ternyata di dalam tubuh kita juga terjadi reaksi termokimia, yaitu saat satu molekul glukosa dipecah menghasilkan dua molekul asam piruvat, dua molekul ATP dan dua NADH (Reduced nikotinamida adenin dinukleotida) yang terjadi di dalam sitoplasma. Biasanya dikenal dengan proses glikolisis. Berikut reaksi kimianya:

$$C_6H_{12}O_6 + 2ADP + 2P_i + 2NAD^+ \rightarrow 2C_3H_7CO_2COO^- + 2ATP + 2NADH + 2H_2O + 2H^+$$

Dari persamaan termokimia di atas menyadarkan kita bahwa Allah SWT telah menganahkan reaksi kimia di tubuh kita untuk melaksanakan tugasnya masing-masing, jika salah satu dari mereka enggan melaksanakan perintah tersebut, tentu apa yang kita makan maka tubuh tidak akan mencerna makanan tersebut menjadi energi. Contohnya enzim pitalin pada lur akan memecah karbohidrat menjadi glukosa (gula) yang lebih kecil dan sederhana. Begitupun dengan peranan lainnya yang ada di dalam tubuh kita.

Kemudian proses pembuatan gula. Dalam proses pembuatan gula dilakukan proses ekstraksi, pengendapan (liming), penguapan (evaporasi), pendidihan/kristalisasi, penyimpanan, afinasi, penghilangan warna dan pendidihan kembali. Di situ telah mengalami proses termokimia dimana adanya tekanan, suhu dan panas. Bagaimana amanahnya gula dalam menjaga cita rasanya yang manis, walaupun disimpan dalam air kopi, air teh, air putih, gula tetap memberikan rasa manis. Berikut reaksi nyar:

Sucrose (Table Sugar)      Glucose      Fructose

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This research was carried out at Banda Aceh 1 Islamic Senior High School through the chemistry learning process. Besides, the research participants were taken from 11<sup>th</sup> of Mathematic and Natural Science major. Before conducting this research using the developed thermochemistry module, students should take the pretest (character assessment) within 15 minutes. After that, students were given the developed thermochemistry module two times during the intervention. The learning process used a guided inquiry model with a scientific approach, so the teaching focus is student-centered and active. After the learning activities were completed, students filled out the character assessment sheet as the posttest, with the time allotted for the posttest being the same as the pretest.

Furthermore, the scores obtained from the character assessment sheet were accumulated, and the percentage calculated for each student to see the effectiveness of the thermochemistry module before and after being implemented in the chemistry learning process was tested using the N-gain formula. The effectiveness test results are shown in Table 8.

**Table 8. Test Effectiveness**

Scoring Value			
Average of Pretest	Average of Posttest	Average of N-gain score	Average of N-gain percentage score
68,42%	78,92%	0,56	56,16 %

The assessment of the effectiveness test results of the thermochemical module contains religious values if analyzed on the average pretest results, the trustworthiness character assessment was classified as enough (starting to appear), and the average posttest percentage results are classified as good (starting to develop). If seen from the average of the N-gain score, the thermochemical module influenced the formation of students' trustworthy (*amanah*) character in the medium and enough category in learning based on the N-gain percentage score data.

#### 4. Conclusion

Based on the results, the thermochemical module containing religious values was quite effective in learning. It could improve the students' trustworthy (*amanah*) character in enough category range, which was interpreted as meaning that the trustworthy (*amanah*) character of students was starting to change into a good category (increase). The mean test indicates that the N-gain score had a beneficial impact on developing the trustworthy (*amanah*) character. Students who have used this thermochemical module with religious values have provided feedback, and they acknowledge that the module's content positively impacts their conduct,

comprehension of thermochemical material, and reliability. It is recommended for further chemistry lessons to look for some of the character values instilled in the other chemical materials. Hence, the kaunyah values can increase the reader's devotion to Allah SWT.

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