

The Potential of Research-Based Halal Lifestyle to Improve the Bioentrepreneurship of UIN Sunan Kudus Students

Shofwatun Nada*, Salmanera Senja

Universitas Islam Negeri Sunan Kudus, Indonesia

Email: shofwatunnada@uinsunankudus.ac.id*, salmanerasenja@uinsunankudus.ac.id

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Abstract

This study aimed to apply a research-based halal lifestyle approach to strengthen the bioentrepreneurship competencies of students at UIN Sunan Kudus through the development of a learning module integrated with the Sistem Jaminan Produk Halal (SJPH) module for halal product development. The study employed a Research and Development (R&D) method using the Borg and Gall development model, which consists of research and information gathering, planning, product development, preliminary testing, product revision, main field testing, operational revision, operational field testing, final revision, and dissemination. The development process began with an analysis of students' needs related to halal lifestyle knowledge, followed by the design of a Canva-assisted module adapted from the SJPH module. The module was then validated by material experts and a validation team before undergoing field testing. The preliminary field trial involved 19 fifth-semester students from Class A, while the broader field trial involved 68 fourth-semester Biology Education students enrolled in a bioentrepreneurship course. The findings showed that the research-based halal lifestyle module was positively received by students and was considered highly feasible for use in bioentrepreneurship learning. In the extended trial involving 68 students, the student response score reached 87%, which was categorized as highly feasible based on the 86–100% feasibility range. These results indicated that the developed module could support the integration of halal lifestyle principles, research activities, and bioentrepreneurship learning in a sustainable manner. Further research is recommended to quantitatively evaluate the effectiveness of the module in improving bioentrepreneurship knowledge, skills, and learning outcomes.



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INTRODUCTION

The global halal industry has undergone a remarkable transformation from a niche religious market into a mainstream economic force, with the halal food market alone valued at an estimated USD 2.71 trillion in 2024 and projected to reach USD 5.91 trillion by 2033, reflecting a compound annual growth rate of 8.92% from 2025 to 2033. This expansion is driven not only by demographic factors but also by changing consumer values: a global Muslim population exceeding 1.9 billion, combined with increasing interest among non-Muslim consumers who perceive halal products as hygienic, ethically produced, and high quality, has reshaped the market landscape. The broader halal economy, encompassing food, pharmaceuticals, cosmetics, modest fashion, Muslim-friendly tourism, and media, reached

USD 2.6 trillion in consumer spending in 2024, with projections reaching USD 3.56 trillion by 2029. These figures demonstrate that halal is no longer a segmented market but represents a significant shift in global consumption patterns, requiring corresponding developments in education and entrepreneurship (Fauzan & Pambudi, 2025; Hidayat et al., 2022; Rustam & Lubis, 2026; Tieman, 2015).

In Indonesia, the world's largest Muslim-majority country, this global trend has particular significance. With 248.6 million Muslims representing 87.13% of the total population in 2025 and Muslim consumer spending estimated at Rp11,182 trillion, Indonesia possesses both a substantial domestic market and a strategic opportunity to become a global halal production hub. The Indonesian government has responded by accelerating halal industry development through regulatory frameworks and institutional support, including the mandatory halal certification system administered by the Badan Penyelenggara Jaminan Produk Halal (BPJPH). However, translating these macroeconomic opportunities into human capital development remains uneven, particularly in higher education, where the integration of halal knowledge and entrepreneurial competencies is still emerging. The gap between market demand and educational preparedness represents a critical challenge in realizing Indonesia's halal economy potential (Ardana & Sugiarti, 2026; Risza, 2024; Syamsiyah & Ardana, 2022; Wafiyah, 2025; Zustika, 2025).

Within higher education, the integration of halal values into biology and bioentrepreneurship curricula remains an underexplored area. A systematic review of the role of higher education in promoting halal knowledge and values found that although universities play an important role in advancing halal studies, significant gaps remain in incorporating practical halal applications into existing programs. The review emphasized the need to implement halal education as part of the Tri Dharma Perguruan Tinggi mandated for Indonesian universities, while noting that many programs remain focused on theoretical discussions rather than applied research and product innovation. This gap is particularly relevant in biology education, where the integration of biological sciences, halal product development, and entrepreneurial skills could generate substantial benefits; however, structured pedagogical frameworks for achieving these outcomes remain limited (Agilliana et al., 2025, 2025; Bakar et al., 2025; Pamungkas et al., 2024; Rahman, 2025).

Bioentrepreneurship education has also gained increasing attention, although its implementation remains uneven. Research on undergraduate biology entrepreneurship education in the United States involving a network of 16 faculty members across 14 institutions revealed that, despite the recognized importance of entrepreneurship education in biosciences, many undergraduate biology curricula still lack entrepreneurial learning opportunities. A needs assessment survey involving 211 students highlighted variations in entrepreneurial interest across racial and gender identities, indicating the need for targeted interventions to ensure equitable access to entrepreneurial skill development (Bahaw et al., 2025; Cadenas et al., 2020; O'Brien et al., 2019; Orser & Elliott, 2022; Rahmatika & Rachma, 2025). In Indonesia, studies on bioentrepreneurship textbooks have demonstrated that locally based teaching materials can effectively foster students' entrepreneurial spirit; however, these efforts have not systematically integrated halal values as a foundation for product development and business model design.

Recent pedagogical innovations have begun to address this integration challenge. The Hi-STEM module, developed to create halal food entrepreneurs based on the Wasatiyyah principle and technology, demonstrated that undergraduate students participating in the module

achieved higher learning outcomes and entrepreneurial competencies compared with pre-intervention levels, with the greatest improvements observed in business skills and halal ethics. Similarly, project-based learning modules for biotechnology innovation in Indonesian senior high schools have been validated as appropriate for fostering edupreneurship, with readability assessments confirming their accessibility for learners. These findings suggest that well-designed, research-based modules can effectively bridge halal knowledge and entrepreneurial application; however, such approaches have not been systematically adapted for university-level biology education with an explicit halal lifestyle orientation.

The research gap addressed by this study is threefold. First, there is a lack of structured, research-based learning modules integrating halal lifestyle principles with bioentrepreneurship competencies at the university level. Second, empirical validation of such modules within the Indonesian higher education context, particularly Islamic higher education institutions (Perguruan Tinggi Keagamaan Islam Negeri [PTKIN]), remains limited. Third, insufficient attention has been given to sustainable competency development measured through both conceptual understanding and entrepreneurial interest rather than isolated knowledge acquisition (Ploum et al., 2018; Trencher et al., 2018). Although previous studies have examined halal education and bioentrepreneurship separately, few have attempted to integrate these domains into a coherent pedagogical intervention that prepares students to address the regulatory, ethical, and technical aspects of halal product development.

The urgency of this research is reinforced by the rapid growth of the global halal market and Indonesia's policy commitment to developing the halal industry. Without a workforce equipped with both halal knowledge and entrepreneurial competencies, Indonesia risks remaining primarily a consumer rather than a producer within the halal value chain. The Ministry of Industry has identified human capital development as a priority for maximizing global halal market opportunities; however, educational infrastructure to develop such human capital remains under development. Biology students represent a strategic population because their scientific background enables innovation in halal product development, including food science and biotechnology, provided that their education meaningfully integrates halal principles with entrepreneurial practices. The absence of such integration may limit the ability of biology graduates to contribute effectively to the halal economy despite possessing relevant scientific knowledge.

The novelty of this research lies in the development of a research-based halal lifestyle module specifically designed for bioentrepreneurship courses using the Borg and Gall development model to ensure systematic validation and refinement. Unlike previous halal education initiatives that have primarily focused on theoretical concepts or religious studies, this module integrates halal lifestyle principles with scientific inquiry and business planning. Students engage with laboratory-based approaches, such as pork DNA detection methods, regulatory frameworks including the Sistem Jaminan Produk Halal (SJPH), and practical halal certification procedures through BPJPH. The research-based orientation distinguishes this module from conventional learning materials because students are encouraged to generate and apply scientific evidence to support halal assurance. The integration of research, halal ethics, and entrepreneurship represents a pedagogical innovation that has not been widely documented in Indonesian higher education.

The purpose of this research was to determine how a research-based halal lifestyle module could be applied to improve the bioentrepreneurship competencies of UIN Sunan Kudus students, with particular attention to the module development process, validation

through expert review and field testing, and its potential contribution to student learning outcomes. The study aimed to produce a validated instructional product that could be adopted by biology education programs seeking to align their curricula with the demands of the halal economy. By documenting the development process from needs analysis through dissemination, this research aimed to provide a replicable model for institutions seeking to integrate halal values into science-based entrepreneurship education.

The contribution of this research extends to theoretical, practical, and policy domains. Theoretically, this study contributes to understanding how halal values can be integrated into discipline-specific entrepreneurship education and expands discussions on value-based learning in higher education. Practically, it provides educators with a validated learning module that combines halal lifestyle content with bioentrepreneurship pedagogy, including assessment instruments and implementation guidelines. For policymakers, the findings provide evidence-based recommendations for PTKIN institutions seeking to fulfill their Tri Dharma Perguruan Tinggi responsibilities while supporting national halal industry development. The module's emphasis on sustainability ensures that students not only acquire knowledge but also develop halal lifestyle principles as an enduring orientation toward ethical business practices.

The research objective was to develop and validate a research-based halal lifestyle module through the systematic application of the Borg and Gall development model, including needs analysis, product design, expert validation, preliminary field testing, main field testing, and revision. Specifically, this study aimed to: (1) identify the needs of biology students and faculty regarding halal lifestyle education in bioentrepreneurship courses; (2) design a module integrating halal principles with research-based learning and entrepreneurial skill development; (3) assess the validity and practicality of the module through expert evaluation and student responses; (4) evaluate the module's effectiveness in improving students' conceptual understanding of halal lifestyle and entrepreneurial interest; and (5) produce a final disseminated product that could be adopted by other institutions.

The benefits of this research extend to multiple stakeholders. For students, the module provides a structured pathway for developing competencies increasingly valued in the labor market and entrepreneurial ecosystem, enabling meaningful participation in the halal economy. For educators, the research provides a validated instructional resource and a documented development process adaptable to different contexts. For PTKIN institutions, the findings support the development of distinctive halal-oriented curricula aligned with institutional missions. For policymakers and industry stakeholders, this research contributes to strengthening the talent pipeline required for Indonesia's ambition to become a global halal hub. Ultimately, by demonstrating that halal lifestyle education can function not only as a framework of compliance but also as a foundation for ethical innovation and sustainable business practices, this research provides a model for how higher education can respond to global market trends while maintaining local values.

METHOD

This study employed a Research and Development (R&D) method using the Borg and Gall model, which consists of ten stages from information collection to dissemination and implementation. The study population included Biology Education students at UIN Sunan Kudus who were enrolled in the bioentrepreneurship course. The sample was selected using purposive sampling through three stages: an initial field test involving 19 fifth-semester Class A students, a main field test involving 68 fourth-semester Class A students, and an

implementation test involving 49 students. The instrument was validated by 25 fourth-semester students enrolled in the Halal Lifestyle (TBR) class.

The research instruments included validation sheets assessed by subject matter experts, media experts, and halal auditors; a 10-item student response questionnaire; a bioentrepreneurship interest instrument; and an instrument measuring understanding of halal lifestyle concepts. Instrument validity was assessed using Pearson's product-moment correlation, while reliability testing was conducted to evaluate internal consistency. Data were collected through surveys, semi-structured interviews with the head of the LP3H (Lembaga Pendamping Proses Produk Halal), halal auditors, and PPH (Pendamping Proses Produk Halal) at UIN Sunan Kudus, as well as questionnaires administered to students.

The research procedure followed the ten stages of the Borg and Gall model, including needs analysis, Canva-assisted module design, expert validation, preliminary field testing, product revision, main field testing, operational revision, implementation testing, final revision, and dissemination. The software used included Canva for module development, SPSS or Microsoft Excel for statistical analysis, and barcode/QR code generators to provide access to SJPH forms and practicum videos. Data were analyzed quantitatively and descriptively by calculating the module feasibility percentage. The preliminary test obtained a feasibility score of 82%, categorized as feasible, while the expanded test achieved 87%, categorized as highly feasible. Inferential analysis was also conducted to examine differences in conceptual understanding and bioentrepreneurship interest between the experimental and control groups.

RESULT AND DISCUSSION

Needs Analysis

The initial stage carried out by researchers in the application and development of halal lifestyle modules is to analyse the needs of students who are used as research sites, namely Tadris Biology UIN SUNAN KUDUS, this needs analysis is carried out to obtain information related to the use of research-based halal lifestyle modules, especially in bioenterpreunership courses. Data collection methods used by researchers to explore the information needed are surveys, interviews, systematically and semi-structured to the head of LP3H UIN SUNAN KUDUS, Halal Auditor UIN SUNAN KUDUS, Head of LPH UIN Siber Syekh Nurjati and Auditor LPH UIN Sunan Kalijaga, PPH UIN SUNAN KUDUS.

Based on the results of interviews with the heads of LP3H and LPH, the application of halal lifestyle in universities has not been in the realm of laboratory research, the introduction of halal products so far to umkm is through a self-declare program is socialisation to several umkm to take care of halal certification on their products, as well as what is done by LPH UIN SSC and UIN Sunan Kalijaga, the socialisation of halal products has not been included in the course and students have never done structured research on the products they make in entrepreneurship or bioenterpreuner courses.

The socialisation of halal products, even to the extent of product ingredients, has indeed been carried out by PPH and Auditors at LP3H or LPH formed at PTKIN, socialisation has been given to MSMEs that will apply for a halal product. Depicting bioenterpreuner courses, biological research and the addition of a halal logo.

Initial product description

This learning module was developed in the form of printed media or in the form of softcopy due to the practicality and efficiency of using the module. The module that is applied is research-based with the composition of introductory halal lifestyle material, student project

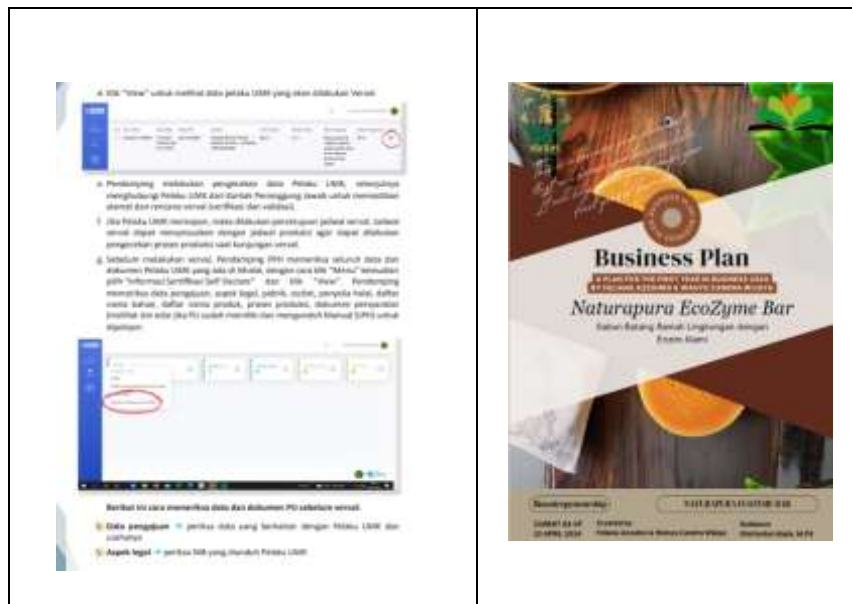


Figure 2. Partial display of material

Source: Authors' documentation.

In the development of research-based halal lifestyle modules, validity is carried out by:

- 1) Content validation: Involving lecturers to assess the completeness of the material.
- 2) Construct validation: Ensuring that the materials support students' analytical skills.
- 3) Empirical validation: Testing the material on students and seeing if learning outcomes improve compared to previous methods.

The following is a descriptive presentation of the results of material expert research on research-based module development products submitted by the questionnaire method.

Initial Product Revision

Based on the direction of the validator in the form of suggestions for improvement and input from the validator, the next step is to revise several parts of the product that have been suggested, as for the overall revision of improvements to the module are:

- a. The identity of the module maker is placed on the front cover
- b. Include the BPJPH logo because some material is adopted from the BPJPH module
- c. The colour display in the material section is not much so that it provides comfort to the reader, but there needs to be a variation of the barcode code so that students can access the complete SJPH form.

Validator Suggestions	Before improvements	After improvements
The identity of the module author is placed on the front cover.		

Addition of BPJPH Logo and Researcher Name on the cover

There is a need for a variety of barcode codes so that students can access the SJPH form or complete practical work steps.

dari daging sapi yang dijual di beberapa pasar tradisional di Kudus, Demak, Pati dan Jepara. Sampel yang digunakan dalam penelitian ini adalah sampel daging sapi mentah sebanyak 20 sampel dan 1 sampel daging babi. Penelitian ini dilakukan selama Mei sampai dengan Juli 2024. Pengambilan sampel secara acak untuk dilakukan pengujian kualitatif yaitu pemeriksaan organoleptik (uji warna, bau, dan konsistensi) serta pengukuran nilai pH.

C. Alat dan Bahan

1. Daging Sapi/ Kambu
2. Pork Detection kit
3. Mortar
4. Tabung Reaksi
5. Pipet meter
6. Tusuk Gigi/Garpu
7. Tabung Reaksi (2 buah)
8. Pipet (3 buah)
9. Bakor Gelas
10. Aquadest
11. Timbangan Digital

D. Petunjuk Praktikum

Sehingga akan langkah kerja praktikum analisis uji kualitas dan cemaran daging babi

TABEL HASIL

Tabel 1. Hasil uji Fisik kualitas daging, Rapid pork detection dan PCR

Kode	Sampel	Parameter Uji			Rapid Pork Detection	PCR
		Bau	Warna	pH		
I						
II						
III						
IV						
V						
VI						
VII						
VIII						

Modul Petunjuk Praktikum – Nada 2024

Langkah Kerja

Pengambilan sampel daging sapi yang dijual di beberapa pasar tradisional di Kudus, Demak, Pati dan Jepara. Sampel yang digunakan dalam penelitian ini adalah sampel daging sapi mentah sebanyak 20 sampel dan 1 sampel daging babi. Penelitian ini dilakukan selama Mei sampai dengan Juli 2024. Pengambilan sampel secara acak untuk dilakukan pengujian kualitatif yaitu pemeriksaan organoleptik (uji warna, bau, dan konsistensi) serta pengukuran nilai pH.

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B. Petunjuk Praktikum

Sehingga akan langkah kerja praktikum analisis uji kualitas dan cemaran daging babi

Gambar 1. Barikot petunjuk praktikum

The work steps on the practicum page are equipped with a barcode code that contains a YouTube page with more complete and in-depth practical work steps for the pork detection kit test.

Figure 3. Initial Product Revision

Source: Authors' documentation based on product revisions.

Field trial (initial)

After an initial field trial, an initial stage of improvement was carried out to find out student responses related to material, media and language aspects, the question consists of 10

questions covering the feasibility of using a research-based halal lifestyle module conducted on 4ATBR class students with a total of 19 students, the limited trial sample has been determined using a class that does not get action, namely in class A with the same bioenterpreunership course, the field trial is conducted with subjects who do not go through treatment with the following table results:

Table 1. Student Responses to the Feasibility of the Research-Based Halal Lifestyle Module in the Initial Field Trial

Criteria		Student														Avarage	Prosentase (%)
o		1	2	3	4	5	6	7	8	9	10	11	12	...Σ			
1.	The module display already interprets the learning material that will be presented.	3	3	3	3	3	3	3	3	3	3	3	3	56	0,815789474	81	
2.	The font type, color components used in the module are appropriate	3	2	3	3	3	3	3	3	2	4	2	50	0,842105263	84		
3.	Halal material presented in the update module.	4	3	2	4	3	2	3	4	3	3	3	58	0,776315789	77		
4.	The halal lifestyle presented in the module is tailored to the students' learning experiences.	4	3	3	3	3	3	3	3	3	3	3	58	0,855263158	85		
5.	The explanations in the module are easy for users to understand	3	3	3	3	3	3	3	3	3	3	3	57	0,815789474	81		
6.	The material presented is based on scientific research	4	4	4	3	3	3	3	3	3	3	3	60	0,802631579	80		
7.	The material presented is in line with biological science.	3	3	3	3	3	3	3	3	3	3	3	56	0,802631579	80		
8.	The research presented in the module provides up-to-date, in-depth knowledge regarding halal.	3	4	3	3	4	4	4	3	3	4	4	57	0,789473684	78		

9.	ModulThe module is tailored to research that leads to entrepreneurship. adapted to research that leads to entrepreneurship	3	4	4	4	4	4	4	3	3	4	3	55	0,855	85
														2631	
														58	
10.	The presentation of print media or softcopy language is considered effective and efficient.	3	4	3	3	3	3	4	4	4	4	4	56	0,815	81
														7894	
														74	
	Amount	3	3	3	3	3	3	3	3	3	3	3			
		2	1	1	2	2	0	1	2	0	4	2			

Source: Primary data from the questionnaire administered to 19 students, processed by the authors.

Based on the assessment data from 19 students in the research-based module development product trial, it can be seen that the average percentage of student responses to the use of the module is 82%. This number is between 77-85% which shows the use of research-based halal lifestyle modules is feasible to use and does not require repeated product revisions to be continued in stage 2 product trials involving 68 respondents.

Stage 2 Product Trial

After making improvements to the research-based halal lifestyle module according to the suggestions of the validators, the next step was the field trial. The trial was carried out at Tadris Biology UIN SUNAN KUDUS , semester 4 with a total of 68 students for one semester or approximately 16x meetings FY 2024. Field trials include data collection on module quality, pretests and posttests as a reference for understanding concepts related to halal lifestyle and Pork detection kit tests conducted during the learning process of the 9th, 10th, and 11th meetings. Module assessment is done through a google form that is distributed to students at the 5th meeting.

Based on the assessment data from 68 students in the research-based module development product trial, it can be seen that the average percentage of student responses to the use of the module is 87%. This number is between 84-100% which shows the use of research-based halal lifestyle modules is very feasible to use and does not require repeated product revisions.

Field Implementation Test (Application of Halal Lifestyle Module)

Field trials were conducted on students of UIN SUNAN KUDUS involving a population of 68 students, with a sample of 49 students for field implementation tests with the aim of obtaining a better product. The results of the field trial from the initial data were continued with validity and reliability tests with data including, The validity of the test is carried out to see whether the instruments given to students are suitable for use. The instruments validated in this study include bioenterpreunership interest instruments and instruments about students' concept understanding of halal lifestyle.

Validity Test of Interest and Concept Understanding Question Items

The validation and reliability test of the test was conducted in class 4TBR with a total of 25 students. The test validation results obtained using the Pearson product moment correlation formula are presented Tabel 2.

Table 2. Descriptive Statistics of Posttest Scores in the Experimental and Control Classes

Statistik	Classes	
	<i>Kelas</i>	<i>Kelas Kontrol</i>
	<i>Eksperimen</i>	
	<i>Posttest</i>	<i>Posttest</i>
Number of Students	25	24
Average	85,60	76,96
Standard Deviation	10,765	13,42
Lowest Score	66	60
Highest Score	100	100
Theoretical Minimum Score	0	0
Theoretical Maximum Score	100	100
Completion	25(100%)	17(73%)

Source: Primary data from student posttest results, processed by the authors.

CONCLUSION

The implementation of a research-based halal lifestyle approach was carried out through the development of a research-based halal lifestyle module following several stages, including needs analysis in the Biology Department of UIN Sunan Kudus, product design (research-based halal lifestyle module development), validation by media experts, subject matter experts, and halal auditors, initial trials involving 19 UIN Sunan Kudus students, expanded trials involving 68 Biology Department students, module refinement based on validator feedback, and the implementation and dissemination stages.

The research-based halal lifestyle module demonstrated significant potential for application in bioentrepreneurship courses. This was indicated by students' responses to the module, assessed through questionnaires administered by the researchers. Based on the expanded trial involving 68 students, the student response percentage reached 87%. This score fell within the 86–100% category, indicating that the halal lifestyle module was highly feasible for use in the bioentrepreneurship learning process.

The use of the halal lifestyle module improved students' understanding of halal lifestyle concepts compared with students who did not use the module. Students' learning interest in bioentrepreneurship also increased after using the module compared with those who learned without the module. Overall, the developed module demonstrated good quality and was considered feasible for use based on assessments of content feasibility, language, visual presentation, presentation structure, and graphic aspects.

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