

The Importance of Entrepreneurship Education in Physics Education Study Program: Reviewed from Students' Perspectives

Adrian Bagas Damarsha ¹, Dwikoranto ^{1,*}, Muhammad Satriawan ¹, and Hanandita Veda Saphira ²

¹ Physics Education, Universitas Negeri Surabaya, Surabaya, Indonesia

² Faculty of the Arts, Social Sciences and Humanities, University of Wollongong, Wollongong, Australia

* Email: dwikoranto@unesa.ac.id

Abstract

The development of the world of education today requires graduates not only to master academic competencies but also to have an entrepreneurial spirit. Therefore, it is necessary to strengthen SDG 4 (Quality Education) in order to create competent human resources in entrepreneurship. In this context, the concept of edupreneurship (a combination of education and entrepreneurship) is becoming increasingly relevant, especially for graduates of the Physics Education study program, who have so far been considered primarily oriented toward conventional academic or industrial careers. This study aims to describe the perspectives and factors resulting from the edupreneur course. The method used is a mixed-methods approach, which combines quantitative and qualitative methods. Data collection techniques are carried out through questionnaires distributed to physics education students. Data analysis used is EFA analysis and thematic qualitative description. The results obtained show that the edupreneur course provides three factors for students, namely AE (Entrepreneurial Action), PE (Entrepreneurial Education), and ME (Entrepreneurial Motivation). The results of student perspectives show that the edupreneurship course is essential to teach. It proves that edupreneurship courses can shape students' entrepreneurial spirit. That is because educational programs also require entrepreneurial skills, starting from idea development. The studies suggest that integrating edupreneurship across academic programs is crucial. By highlighting the importance of entrepreneurship in education, this study recommends that edupreneurship courses be integrated evenly into all study curricula, enabling the realization of SDG 4 and 8. That is because the curriculum in Indonesia emphasizes not only academic skills but also entrepreneurial skills.

Keywords: Entrepreneur, Student Perspective, Edupreneur Education

SDGs: Goal 4 (Quality Education), Goal 8 (Decent Work and Economic Growth)

Manuscript History

Received: May 18, 2025

Revised: June 27, 2025

Accepted: July 10, 2025

How to cite:

Damarsha, A.B., et al. (2025). The Importance of Entrepreneurship Education in Physics Education Study Program: Reviewed from Students' Perspectives. *International Journal of Research and Community Empowerment*, 3(2), 72-82. DOI: <https://doi.org/10.58706/ijorce.v3n2.p72-82>.

INTRODUCTION

Sustainable development is currently being carried out a lot for the progress of the country in various fields. The United Nations (UN) has approved the 2030 sustainable development agenda, since 2015 to improve the standard of living of countries and communities, one of which is in the field of decent work (SDGS' 8) (Peña-Sánchez et al., 2020). One strategy to grow employment and industrial development through entrepreneurial activities (Moyle et al., 2020). According to Galvão et al (2020), entrepreneurship is important in facilitating employment and becoming independent in establishing a job. Therefore, it is very important to have knowledge and skills from the start to be able to build decent jobs.

Developing education does not only focus on academics, but developing skills, one of which is entrepreneurship, is the goal of developing education. To have entrepreneurial skills, one must have basic entrepreneurial skills, one of which is entrepreneurship education (Bell & Bell, 2020; Iwu et al., 2021). In addition to basic education, entrepreneurs must have entrepreneurial skills based on experience (Boldureanu et al., 2020). According to Niktina et al. (2020) to strengthen entrepreneurial education and skills, experience is needed in carrying out entrepreneurial activities. It is necessary to process entrepreneurial skills and education for students through activities that create entrepreneurial experience.

In fact, based on research conducted by Shah et al. (2020), there is little research investigating the role of entrepreneurship education on students' entrepreneurial intentions. This is because entrepreneurship can be done from a young age, so it will be easy to gain experience in exploring (Azoulay et al., 2020; Zhao et al., 2021). Therefore, entrepreneurial skills are needed for students to have a deeper experience in doing entrepreneurship. This is contrary to the policies of each study program at the university regarding student facilities for doing entrepreneurship.

In realizing sustainable development, Indonesia participates in realizing sustainable development or SDGs (Sari et al., 2022). Some of the efforts made by Indonesia to realize sustainable development are by focusing on SDGs 4 (Kuswanto et al., 2023; Zaki et al., 2022). One of the goals of SDGs 4 (quality education) is to improve education and realize quality education in Indonesia (Thamrin, 2020; Ambariyanto & Utama, 2021). Quality education is education that can facilitate students to train their abilities (González-Pérez & Ramírez-Montoya, 2022).

Through the development of SDGs 4 education, students who have graduated in the field of education are expected not only to become teachers, but also to open up employment opportunities. Through the method of opening up employment opportunities SDGs 8 will be easily realized (Chigbu et al., 2023; Cernev & Renner, 2020). This can show that to improve the quality of human resources that can open up employment opportunities, the education provided must be of high quality (Knies et al., 2024; Mousa & Othman, 2020). However, many problems regarding the relevance of lectures conducted to their fields make students unable to develop and are unbalanced. Therefore, a point of view is needed to analyze more deeply the importance of entrepreneurial knowledge.

Each study program has its own policy regarding the implementation of entrepreneurship to facilitate students in developing their entrepreneurial skills. Many assume that the facilities provided must be relevant to the study program, so that not many study programs provide facilities to hone students' entrepreneurial skills (Abidah et al., 2020; Eesley & Lee, 2021; Hahn et al., 2020). This creates a gap between study programs that do not have a basis in economics and entrepreneurship. One of the study programs that is considered irrelevant to developing entrepreneurial skills is physics education.

The physics education study program is a study program that has a basis in physics learning science and physics concepts (Akhsan et al., 2023; Banda & Nzabahimana, 2021; Kanim & Cid, 2020). Many assume that entrepreneurship knowledge is only needed by study programs that have a basis in economics and management (Malerba & McKelvey, 2020; Ruiz-Real et al., 2021). To find out these needs, it is necessary to have a student perspective regarding facilities to develop entrepreneurial skills during lectures.

Study by Jardim (2021) and Manafe et al. (2023) stated that it is important to develop entrepreneurial skills in everyone. However, this is contradictory because there is a gap in the relevance of the basic knowledge possessed. Many perspectives state that entrepreneurial skills can only be possessed by students who are interested in economics and management. If the educational unit facilitates edupreneur learning, then education students can also train their entrepreneurial skills, so that education students have outputs that are not only as educators. This study wants to discuss how important it is to study entrepreneurship in physics education study programs. In addition, this study wants to discuss the outputs produced by entrepreneurship courses in physics education study programs. Accordingly, this study aims to explore the perceived importance and outcomes of an edupreneurship course among physics education students. It addresses the following research questions:

1. What factors does the edupreneur course produce for students in the physics education study program?
2. What is the perspective of physics education students regarding the existence of entrepreneurship courses?

METHOD

Research Design

The type of research used is mix method triangulation research, with a quantitative and qualitative research approach. The type of mix method triangulation research is a combination of quantitative and

qualitative methods to obtain a more holistic understanding of the phenomenon being studied (Kawar et al., 2025; Schlunegger et al., 2024). Quantitative data obtained from numerical analysis through a comparison of the scales used in the questionnaire are combined with the results of qualitative analysis through interviews and observations (Hanif, 2020; Suprpto et al., 2022). Analysis of both methods is used in determining the results and conclusions of the research. Figure 1 is the design of the research flow used.

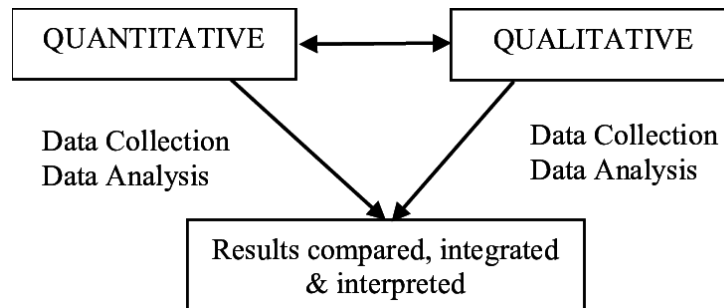


Figure 1. Research Design
(Source: Hanif, 2020)

Data Collection

The study was conducted with a population of undergraduate students of the Physics Education Study Program at Surabaya State University. The research sample was taken using the purposive sampling method with sampling adjusted to the needs based on certain criteria (Sirimewan et al., 2023). The results of the respondent criteria analysis obtained a sample of 74 physics education study program students from the total population. This is because the researcher wanted to examine the perspective of physics education students, so the questionnaire was only distributed to physics education students. Data collection using a Likert scale questionnaire instrument and interviews distributed to students of the physics education study program. Data collection provided by students includes quantitative and qualitative data collection to obtain the results and conclusions of the study.

Table 1. Research Instruments

No	Instrument Type	Indicators
1	Likert Scale Questionnaire Instrument	Entrepreneurship Education (EPE)
		Entrepreneurial Skills (EPS)
		Entrepreneurial Motivation (EPM)
		Entrepreneurial Action (EPA)
2	Interview Instruments	Relevance
		Theory and Practice

According Table 1 explains that there are two instruments that will be distributed to students. Likert scale questionnaires are used to find out students' responses, the output results of the edupreneur course. The responses consist of four indicators. Interview questionnaires are used to find out students' perspectives on the importance of edupreneurs and the results of implementing edupreneurs theoretically and practically.

Data Analysis

The first stage in quantitative method analysis is used with statistical analysis with the aim of testing the complex relationships between variables in a theoretical model. Meanwhile, for interview data analysis, thematic analysis was used (Shaver, 2025). Interview data analysis describes the results of interviews with students' perspectives on the edupreneur course thematically, and the data is elaborated in the conclusion. This analysis was carried out on a questionnaire instrument analyzed using Exploratory Factor Analysis (EFA) is a multivariate statistical technique used to identify the structure of relationships between variables by grouping them into underlying factors (Hair et al., 2019). EFA helps researchers find patterns of intercorrelation between variables and reduce data dimensions by grouping highly correlated variables into the same factor. The requirements for EFA analysis that must be met are as follows:

1. Data suitability test

- **Kaiser-Meyer-Olkin (KMO):** Measures the adequacy of the sample (> value of 0.50 is considered adequate).
- **Bartlett's Test of Sphericity:** Must be significant ($p < 0.05$) to ensure the correlation between variables is strong enough (Pallant, 2020).

2. Extraction factor

- Extraction methods such as **Principal Component Analysis (PCA)** or Maximum Likelihood are used to determine the number of factors.
- **The Eigenvalue Criterion > 1 (Kaiser's Criterion)** and the Scree Plot help determine the number of relevant factors (Tabachnick & Fidell, 2018).

3. Rotation factor

Varimax (orthogonal) or Promax (oblique) rotations are used to clarify factor structure by minimizing complexity (Watkins, 2018).

4. Interpretation factor

Variables with a loading factor of > 0.5 are considered significant in a factor (Hair et al., 2019).

RESULTS AND DISCUSSION

The results of the data analyzed using EFA to determine the factors that influence the edupremeur course on students. The data results can be represented in Table 2 showing the Kaiser–Meyer–Olkin (KMO) value of 0.856 and the significant Bartlett test results ($\chi^2 = 925.54$, $df = 120$, $p < 0.001$) indicating that the data is suitable for factor analysis (Suprpto, 2019; Damarsha et al., 2025). The eigenvalues of the three factors proposed from the Principal Component Analysis (PCA) are all greater than one (Figure 2 and Table 3).

Table 2. KMO Test

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy.			0.85
Bartlett's Sphericity	Test of	Approx. Chi-Square	925.54
		df	120.00
		Sig.	0.00

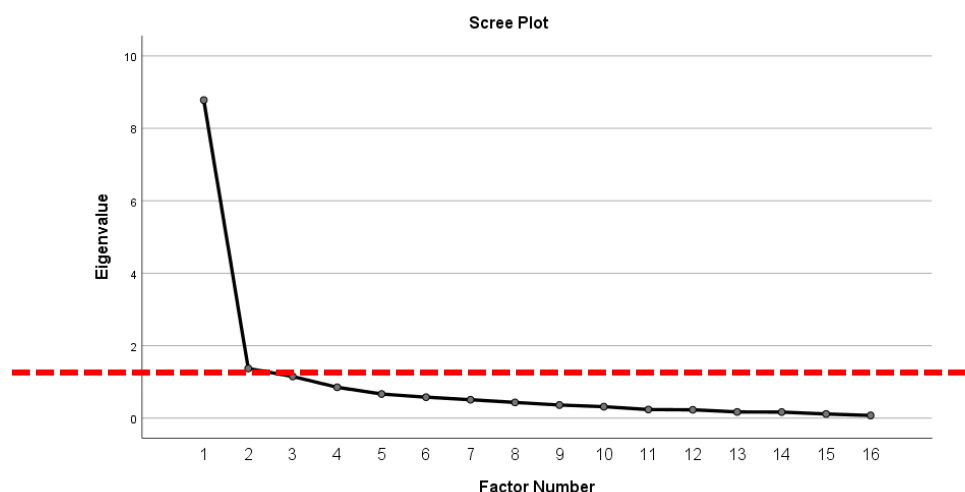


Figure 2. Eigenvalue Diagram

Table 3. Eigenvalue Factors

Component (Factors)	Initial Eigenvalue		
	Total	% of Variance	Cumulative %
1	8.78	54.87	54.87
2	1.37	8.56	63.44
3	1.15	7.18	70.62

The three factors contributed 64.07% of the total variance. The factor containing students' responses to the results learned in the edupreneur course is intended to measure each factor between 0.50 and 0.90. While the loading factor of less than 0.40 was excluded from the analysis (Suprpto & Ku, 2016; Suprpto, 2019). The Cronbach alpha value on the three factors is 0.893, 0.880, 0.898, overall, the Cronbach alpha value is 0.942 Table 4.

Table 4. Loading Factor

Item	Loading Factors					
	(AE) $\alpha = 0.893$		(PE) $\alpha = 0.880$		(ME) $\alpha = 0.898$	
EPA3	0.725	21.60% of Variance Explained				
EPM2	0.700					
EPA4	0.690					
EPA2	0.651					
EPA1	0.557					
EPE4			0.847	21.47% of Variance Explained		
EPE3			0.721			
EPS2			0.662			
EPE2			0.542			
EPS3			0.452			
EPE1			0.415			
EPM1					0.725	21.05% of Variance Explained
EPS4					0.707	
EPM4					0.686	
EPM3					0.676	
EPS1					0.672	
Total Variance Explained = 64.07% and Overall Cronbach Alpha = 0.942						

Description:

AE = Entrepreneurial Action

PE = Entrepreneurial Education

ME = Entrepreneurial Motivation

The results of the EFA analysis show that the 16-item questionnaire can be classified into 3 factors, namely AE (Entrepreneurial Action), PE (Entrepreneurial Education), ME (Entrepreneurial Motivation). These factors show students' responses to the edupreneur course. This shows that the edupreneur course provides three responses to these factors. To analyze further, the factors consisting of indicators are averaged to produce a diagram like Figure 3.

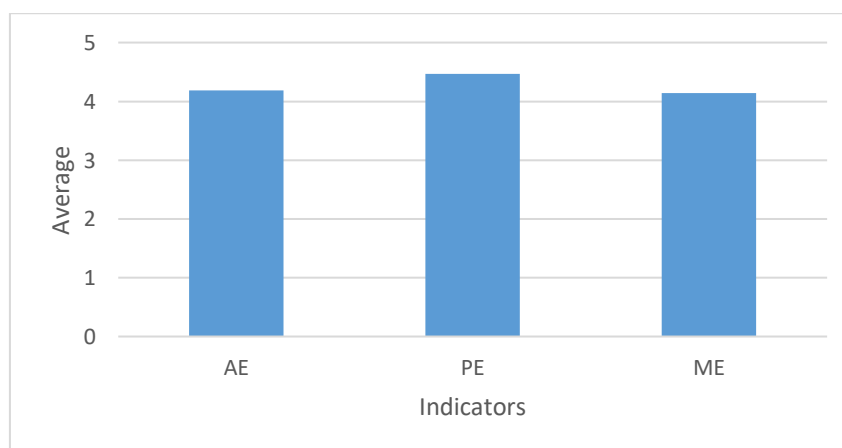


Figure 3. Diagram of Each Factor

According Figure 3 shows the average response diagram of each factor. The results show that the PE indicator has the highest value. This shows that entrepreneurial education directly provides a factor in the edupreneur course. The results obtained are relevant to previous studies, namely that entrepreneurial education

is the basis that influences entrepreneurial activities (Lackéus, 2020; Cui et al., 2021). In addition to the entrepreneurial education factor, entrepreneurial action directly provides a factor in the edupreneur course. In addition to entrepreneurial education and action, there is an entrepreneurial motivation factor that causes edupreneur results. According to Murnieks et al (2020), entrepreneurial motivation plays an important role as an intermediary because motivation develops in different theoretical structures that tend to isolate motives based on the entrepreneurial development phase. This shows that edupreneurs have succeeded in providing factors that have an impact on entrepreneurship for students. PE factors provide reflection on students of edupreneur courses. Indirectly PE has a basic knowledge of students in entrepreneurship. This can provide a basic understanding of physics education students to do entrepreneurship. This is also supported by the Indonesian curriculum that students can not only be academic, but can do entrepreneurship.

To analyze in more depth, data will be presented on the interests of students who want to become entrepreneurs after taking the edupreneur course Figure 4.

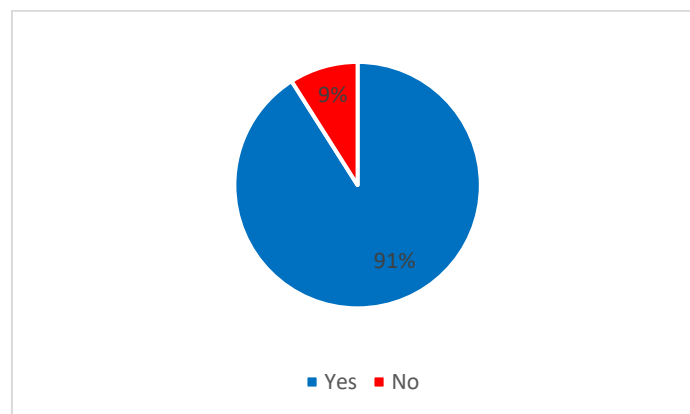


Figure 4. Student Interest in Entrepreneurship

The results obtained showed that 91.00% of undergraduate physics education students were interested in entrepreneurship. As many as 9.00% of students were not interested in entrepreneurship. This shows that edupreneurs have succeeded in fostering students' interest in entrepreneurship. Through entrepreneurship education, it can provide a stimulus for students' interest in entrepreneurship (Ismayyah et al., 2022). In addition, the existence of edupreneurs proves that everyone is capable of entrepreneurship (Olaniran & Perumal, 2021). The results are relevant to national data in general which states that Indonesia needs many entrepreneurs to open up employment opportunities. The desire of students to become entrepreneurs provides a perspective that physics education students do not only become educators, but can open up employment opportunities through entrepreneurship.

The results obtained show the great interest in the field of entrepreneurship that students want to pursue, as shown in Figure 5.

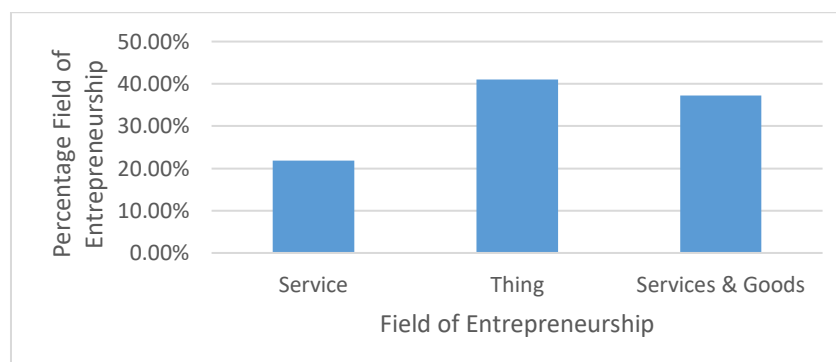


Figure 5. Student Entrepreneurial Interests

The results obtained showed that 41.00% of students were more interested in entrepreneurship in the goods sector. While 21.80% of students were interested in the services sector. This shows that the perspective of students on entrepreneurship tends more towards the goods sector than services. This perspective can be

strengthened by research conducted by Alvarez & Barney (2020) that entrepreneurship tends more towards the goods sector. Logically, entrepreneurship in the goods sector has several advantages compared to the services sector. In general, goods can be stored, distributed, and resold more easily, and their quality can be measured. In addition, the potential profit from selling goods can be higher because it can be reached by more consumers. On the other hand, many consumers need goods rather than services, one example of which is furniture. This also proves that students are more aware of opportunities in the field of entrepreneurship. Entrepreneurial interest is reinforced by research conducted by Stremikiene et al. (2021) that choosing entrepreneurship is caused by social and economic factors in the literature. The study did not explain many samples who chose this field, although the factors have been mentioned.

The results of student interview perspectives on the edupreneur course are as shown in Table 5 with the results of interviews that have been processed.

Table 5. Student Interviews from the Perspective of Entrepreneurship Courses

Question	Answer
What is the relevance of entrepreneurship lectures in the physics education study program?	Entrepreneurship lectures in the Physics Education study program are relevant because they develop students' creativity and innovation in applying physics, improve soft skills such as leadership and communication, and open up career opportunities outside the academic field, including as entrepreneurs in technology or physics-based educational tools
Give a reason why you chose the field of entrepreneurship!	I chose the field of goods entrepreneurship because it has a great opportunity to create innovative products that can meet market needs. In addition, I am interested in the production and distribution process of goods that can be managed directly, so that I can apply entrepreneurial science and creativity to create added value to the products I offer
How is the practice in entrepreneurship courses in the physics education study program?	Practice in entrepreneurship courses in the Physics Education study program involves the development of physics-based business ideas, business planning, and business management simulations. Students are trained to identify market opportunities, design products or services, and learn marketing and financial management strategies relevant to the application of physics
What is the perspective of entrepreneurial SWOT theory that is relevant to your study program?	From the perspective of SWOT theory, entrepreneurs who are relevant to the Physics Education study program see the strength in an in-depth understanding of physics that can be applied in product innovation or educational technology. The weakness may lie in the limitations of the business experience. Opportunities arise from the market's need for physics-based props or technologies, while threats can come from competition and rapid technological change
Give your suggestions, so that the entrepreneurship course program can be developed relevant to your study program?	The suggestion to make the entrepreneurship course program more relevant to the Physics Education study program is to emphasize collaboration between physics theory and business practice. Students can be encouraged to develop physics-based technology products, such as teaching aids or innovative learning tools. In addition, more case studies and field projects that relate physics to market needs will help strengthen students' entrepreneurial skills
Give your opinion, is it important to provide entrepreneurship courses in all study programs? And the reason!	It is important to provide a program of entrepreneurship courses in all courses because entrepreneurship teaches relevant skills in various areas, such as creativity, management, and problem-solving. It also opens up opportunities for students to create their own jobs, as well as develop innovations in their respective fields, be it in the fields of science, technology, arts, or society, all of which can contribute to economic growth and community development

The results obtained indicate that edupreneur lectures in undergraduate physics education have succeeded in training entrepreneurial soft skills. This is evidenced by the perspective of students who state that the

edupreneur course has a lot of practice in its activities. In addition, the most important learning related to SWOT analysis is not forgotten so that students can design the entrepreneurship that will be developed. Suggestions for improving edupreneur courses according to students are to emphasize collaboration between physics theory and business practice. This is reinforced by the statement of Galvao et al (2020) that entrepreneurship must strengthen relevant fields so that it can run with the abilities possessed. According to students, edupreneur courses are very important because they teach relevant skills in various fields, such as creativity, management, and problem-solving. According to Satriawan et al (2020) and Setiani et al (2025) through problem solving students can develop ideas which means students have high creativity skills. This is the beginning of the emergence of entrepreneurship, because through creative ideas everyone can do entrepreneurship (Setini et al., 2020; Agarwal et al., 2020).

This study is limited to asking students' opinions regarding the relevance and importance of edupreneur courses. Therefore, further research is recommended to analyze more deeply regarding the implementation and practice of edupreneur courses. This is because to find out the quality of education not only through the perspective of students regarding current educational needs, but the practice of implementing edupreneur courses is very important to analyze (Sakariyahu et al., 2025). It is expected that this research can have an impact on SDGs 4 so that SDGs 8 can be realized by providing educational facilities to the younger generation about edupreneurs. This is because Indonesia needs the contribution of the younger generation to open up employment opportunities through entrepreneurship. In addition, the demands of the Indonesian curriculum require that students not only be able to be in the academic field, but also have entrepreneurial skills.

CONCLUSION

The results of the study can be concluded that the edupreneur course in the undergraduate physics education study program has an impact on students. The factors produced based on the questionnaire are 3, namely AE (Entrepreneur Action), PE (Entrepreneur Education), ME (Entrepreneur Motivation). The edupreneur course provides a major factor in entrepreneurial education. This causes students to have a foundation for entrepreneurship. The edupreneur course provides students with an interest in entrepreneurship. Many students want to do entrepreneurship in the field of goods. The student perspective states that the edupreneur course is very important to be taught, to increase student creativity. Therefore, it is important to carry out edupreneur learning activities in education study programs. This study hopes to provide information to readers about the importance of an educational unit providing facilities to manage entrepreneurial skills. In accordance with the demands of the Indonesian curriculum, educational units not only facilitate academics, but also facilitate students to express themselves in entrepreneurship. Further research is recommended to conduct a survey on the contribution of edupreneur curriculum development in all fields, both in education and pure science. Through the development of edupreneur education curriculum can enter all majors, so that all students can be facilitated with edupreneur education.

AUTHOR CONTRIBUTIONS

Adrian Bagas Damarsha: Conceptualization, Visualization, Formal Analysis, Methodology, Writing - Original Draft; **Dwikoranto:** Validation, Resources, Supervision, Investigation; **Muhammad Satriawan:** Validation, Resources, Supervision, Investigation; **Hanandita Veda Saphira:** Writing - Original Draft, Writing - Review & Editing. All authors have read and approved the final version of this manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare no known financial conflicts of interest or personal relationships that could have influenced the work reported in this manuscript.

DECLARATION OF ETHICS

The authors declare that the research and writing of this manuscript adhere to ethical standards of research and publication, in accordance with scientific principles, and are free from plagiarism.

DECLARATION OF ASSISTIVE TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that generative artificial intelligence (Gen AI) and other AI-assisted tools were used prudently, not excessively, during the research and preparation of this manuscript. Specifically, DeepSeek was used for improving language clarity and coherence; Grammarly was used for Grammar and style correction.

All AI-generated material was reviewed and edited for accuracy, completeness, and compliance with ethical and scholarly standards. The authors accept full responsibility for the final content of the manuscript.

REFERENCES

- Abidah, A., Hidaayatullaah, H.N., Simamora, R.M., Fehabutar, D., Mutakinati, L., & Suprpto, N. (2020). The impact of covid-19 to indonesian education and its relation to the philosophy of “merdeka belajar”. *Studies in philosophy of science and education*, 1(1), 38-49. DOI: <https://doi.org/10.46627/sipose.v1i1.9>.
- Agarwal, S., Lenka, U., Singh, K., Agrawal, V., & Agrawal, A.M. (2020). A qualitative approach towards crucial factors for sustainable development of women social entrepreneurship: Indian cases. *Journal of Cleaner Production*, 274, 123135. DOI: <https://doi.org/10.1016/j.jclepro.2020.123135>.
- Ambariyanto, A. & Utama, Y.J. (2020). Educating higher education institutions to support SDGs: Indonesian case. *E3S Web of Conferences*, 202, 02015. DOI: <https://doi.org/10.1051/e3sconf/202020202015>.
- Akhsan, H., Putra, G.S., Wiyono, K., Romadoni, M., & Furqon, M. (2023). Development of a STEM-Based introduction to quantum physics module on the sub-subject of potential variations in the physics education study program. *Jurnal Penelitian Pendidikan IPA*, 9(9), 7408-7412. DOI: <https://doi.org/10.29303/jppipa.v9i9.3577>.
- Alvarez, S. & Barney, J.B. (2020). Has the concept of opportunities been fruitful in the field of entrepreneurship? *Academy of Management Perspectives*, 34(3), 300-310. DOI: <https://doi.org/10.5465/amp.2018.0014>.
- Azoulay, P., Jones, B.F., Kim, J.D., & Miranda, J. (2020). Age and high-growth entrepreneurship. *American Economic Review: Insights*, 2(1), 65-82. DOI: <https://doi.org/10.1257/aeri.20180582>.
- Banda, H.J. & Nzabahimana, J. (2021). Effect of integrating physics education technology simulations on students' conceptual understanding in physics: A review of literature. *Physical Review Physics Education Research*, 17(2), 023108. DOI: <https://doi.org/10.1103/PhysRevPhysEducRes.17.023108>.
- Bell, R. & Bell, H. (2020). Applying educational theory to develop a framework to support the delivery of experiential entrepreneurship education. *Journal of Small Business and Enterprise Development*, 27(6), 987-1004. DOI: <https://doi.org/10.1108/JSBED-01-2020-0012>.
- Boldureanu, G., Ionescu, A.M., Bercu, A.M., Bedrule-Grigoruță, M.V., & Boldureanu, D. (2020). Entrepreneurship education through successful entrepreneurial models in higher education institutions. *Sustainability*, 12(3), 1267. DOI: <https://doi.org/10.3390/su12031267>.
- Cernev, T. & Fenner, R. (2020). The importance of achieving foundational Sustainable Development Goals in reducing global risk. *Futures*, 115, 102492. DOI: <https://doi.org/10.1016/j.futures.2019.102492>.
- Chigbu, B.I. & Nekhwevha, F. (2023). Exploring the concepts of decent work through the lens of SDG 8: addressing challenges and inadequacies. *Frontiers in Sociology*, 8, 1266141. DOI: <https://doi.org/10.3389/fsoc.2023.1266141>.
- Cui, J., Sun, J., & Bell, R. (2021). The impact of entrepreneurship education on the entrepreneurial mindset of college students in China: The mediating role of inspiration and the role of educational attributes. *The International Journal of Management Education*, 19(1), 100296. DOI: <https://doi.org/10.1016/j.ijme.2019.04.001>.
- Damarsha, A.B., Saputra, O., Suprpto, N., Hariyono, E., & Nisa', K. (2025). Integration of virtual simulation of traditional kekehan games on the material of moment of inertia and angular momentum. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 14(1), 51–63. DOI: <https://doi.org/10.26740/jpps.v14n1.p51-63>.
- Eesley, C.E. & Lee, Y.S. (2021). Do university entrepreneurship programs promote entrepreneurship. *Strategic Management Journal*, 42(4), 833-861. DOI: <https://doi.org/10.1002/smj.3246>.
- Galvão, A., Marques, C., & Ferreira, J.J. (2020). The role of entrepreneurship education and training programmes in advancing entrepreneurial skills and new ventures. *European Journal of Training and Development*, 44(6/7), 595-614. DOI: <https://doi.org/10.1108/ejtd-10-2019-0174>.
- Galvao, A.R., Mascarenhas, C., Marques, C.S., Braga, V., & Ferreira, M. (2020). Mentoring entrepreneurship in a rural territory—A qualitative exploration of an entrepreneurship program for rural areas. *Journal of Rural Studies*, 78, 314-324. DOI: <https://doi.org/10.1016/j.jrurstud.2020.06.038>.
- Hahn, D., Minola, T., Bosio, G., & Cassia, L. (2020). The impact of entrepreneurship education on university students' entrepreneurial skills: a family embeddedness perspective. *Small Business Economics*, 55, 257-282. DOI: <https://doi.org/10.1007/s11187-019-00143-y>.

- Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2019). *Multivariate Data Analysis (8th ed.)*. Massachusetts: Cengage.
- Hanif, M. (2020). The development and effectiveness of motion graphic animation videos to improve primary school students' sciences learning outcomes. *International Journal of Instruction*, **13**(4), 247–266. DOI: <https://doi.org/10.29333/iji.2020.13416a>.
- Ismaiyah, N., Suyadi, S., Nadlifah, N., Putro, K.Z., & Astuti, R. (2022). Edupreneurship in stimulating the independence of early childhood. *Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini*, **7**(3), 143-150. DOI: <https://doi.org/10.14421/jga.2022.73-04>.
- Iwu, C.G., Opute, P.A., Nchu, R., Eresia-Eke, C., Tengeh, R.K., Jaiyeoba, O., & Aliyu, O.A. (2021). Entrepreneurship education, curriculum and lecturer-competency as antecedents of student entrepreneurial intention. *The International Journal of Management Education*, **19**(1), 100295. DOI: <https://doi.org/10.1016/j.ijme.2019.03.007>.
- Kanim, S. & Cid, X.C. (2020). Demographics of physics education research. *Physical Review Physics Education Research*, **16**(2), 020106. DOI: <https://doi.org/10.1103/PhysRevPhysEducRes.16.020106>.
- Kawar, L.N., Dunbar, G.B., Aquino-maneja, E.M., Flores, S.L., Squier, V.R., & Failla, K.R. (2025). Quantitative, qualitative, mixed methods, and triangulation research simplified. *Journal of Continuing Education in Nursing*, **55**(7), 338-344. DOI: <https://doi.org/10.3928/00220124-20240328-03>.
- Knies, E., Boselie, P., Gould-Williams, J., & Vandenabeele, W. (2024). Strategic human resource management and public sector performance: context matters. *The international journal of human resource management*, **35**(14), 2432-2444. DOI: <https://doi.org/10.1080/09585192.2017.1407088>.
- Kuswanto, H., Sholihin, M., & Djajadikerta, H.G. (2023). Exploring the implementation of sustainable development goals: a comparison between private and state-owned enterprises in Indonesia. *Environment, Development and Sustainability*, **25**(10), 10799-10819. DOI: <https://doi.org/10.1007/s10668-022-02505-1b>
- González-Pérez, L.I., & Ramírez-Montoya, M.S. (2022). Components of education 4.0 in 21st century skills frameworks: systematic review. *Sustainability*, **14**(3), 1493. DOI: <https://doi.org/10.3390/su14031493>.
- Lackéus, M. (2020). Comparing the impact of three different experiential approaches to entrepreneurship in education. *International Journal of Entrepreneurial Behavior & Research*, **26**(5), 937-971. DOI: <https://doi.org/10.1108/IJEBR-04-2018-0236>.
- Malerba, F. & McKelvey, M. (2020). Knowledge-intensive innovative entrepreneurship integrating Schumpeter, evolutionary economics, and innovation systems. *Small Business Economics*, **54**(2), 503-522. DOI: <https://doi.org/10.1007/s11187-018-0060-2>.
- Manafe, M.W.N., Ohara, M.R., Gadzali, S.S., Harahap, M.A.K., & Ausat, A.M.A. (2023). Exploring the relationship between entrepreneurial mindsets and business success: Implications for entrepreneurship education. *Journal on Education*, **5**(4), 12540-12547. DOI: <https://doi.org/10.31004/joe.v5i4.2238>.
- Mousa, S.K. & Othman, M. (2020). The impact of green human resource management practices on sustainable performance in healthcare organisations: A conceptual framework. *Journal of cleaner production*, **243**, 118595. DOI: <https://doi.org/10.1016/j.jclepro.2019.118595>.
- Ńikitina, T., Lapiņa, I., Ozoliņš, M., Irbe, M. M., Priem, M., Smits, M., & Nemilentsev, M. (2020). Competences for strengthening entrepreneurial capabilities in Europe. *Journal of Open Innovation: Technology, Market, and Complexity*, **6**(3), 62. DOI: <https://doi.org/10.3390/joitmc6030062>.
- Moyle, C.L., Moyle, B., & Burgers, H. (2020). Entrepreneurial strategies and tourism industry growth. *Tourism Management Perspectives*, **35**, 100708. DOI: <https://doi.org/10.1016/j.tmp.2020.100708>.
- Murnieks, C.Y., Klotz, A.C., & Shepherd, D.A. (2020). Entrepreneurial motivation: A review of the literature and an agenda for future research. *Journal of Organizational Behavior*, **41**(2), 115-143. DOI: <https://doi.org/10.1002/job.2374>.
- Olaniran, S.O., & Perumal, J. (2021). Edupreneurship: Preparing young education graduates beyond the classroom teaching. *Multicultural Education*, **7**(8), 469-479. DOI: <https://doi.org/10.5281/zenodo.5234011>.
- Pallant, J. (2020). *SPSS Survival Manual (7th ed.)*. London: Open University Press.
- Peña-Sánchez, A.R., Ruiz-Chico, J., Jiménez-García, M., & López-Sánchez, J.A. (2020). Tourism and the SDGs: An analysis of economic growth, decent employment, and gender equality in the European Union (2009–2018). *Sustainability*, **12**(13), 5480. DOI: <https://doi.org/10.3390/su12135480>.

- Ruiz-Real, J.L., Uribe-Toril, J., Torres, J.A., & De Pablo, J. (2021). Artificial intelligence in business and economics research: Trends and future. *Journal of Business Economics and Management*, **22**(1), 98-117. DOI: <https://doi.org/10.3846/jbem.2020.13641>.
- Sakariyahu, S., Makinde, S.O., Mohammed, A., Abdullahi, A., & Ahmed, A.A. (2025). Edupreneurship, technology, and quality assurance in teacher training: Al-Hikmah university's practices and outcomes. *Ilorin Journal of Education*, **45**(2), 156-175. Retrieved from <https://ije.unilorinedu.sch.ng/index.php/ije/article/view/248>.
- Sari, D.A., Margules, C., Lim, H.S., Sayer, J.A., Boedhihartono, A.K., Macgregor, C.J., & Poon, E. (2022). Performance auditing to assess the implementation of the Sustainable Development Goals (SDGs) in Indonesia. *Sustainability*, **14**(19), 12772. DOI: <https://doi.org/10.3390/su141912772>.
- Satriawan, M., Rosmiati, R., Widia, W., Sarnita, F., Suswati, L., Subhan, M., & Fatimah, F. (2020, April). Physics learning based contextual problems to enhance students' creative thinking skills in fluid topic. *Journal of Physics: Conference Series*, **1521**(2), 022036. DOI: <https://doi.org/10.1088/1742-6596/1521/2/022036>.
- Schlunegger, M.C., Zumstein-shaha, M., & Palm, R. (2024). Methodologic and data-analysis triangulation in case studies: A scoping review. *Western Journal of Nursing Research*, **46**(8), 611-622. DOI: <https://doi.org/10.1177/01939459241263011>.
- Setiani, R., Widiasih, W., Suparti, S., Dwikoranto, D., & Bergsma, L.N. (2025). Analysis of student creativity assessment instruments: Supporting SDGs and MBKM in higher education. *IJORER: International Journal of Recent Educational Research*, **6**(1), 206-217. DOI: <https://doi.org/10.46245/ijorer.v6i1.746>.
- Setini, M., Yasa, N.N.K., Supartha, I.W.G., Giantari, I.G.A.K., & Rajiani, I. (2020). The passway of women entrepreneurship: Starting from social capital with open innovation, through to knowledge sharing and innovative performance. *Journal of Open Innovation: Technology, Market, and Complexity*, **6**(2), 25. DOI: <https://doi.org/10.3390/joitmc6020025>.
- Shah, I.A., Amjed, S., & Jabooob, S. (2020). The moderating role of entrepreneurship education in shaping entrepreneurial intentions. *Journal of Economic Structures*, **9**, 1-15. DOI: <https://doi.org/10.1186/s40008-020-00195-4>.
- Shaver, K.G. (2025). 7: Experimental methods in entrepreneurship research. In *Handbook of Research Methods and Applications in Entrepreneurship and Small Business, Second Edition* (pp. 138-162). Gloucestershire: Edward Elgar Publishing. DOI: <https://doi.org/10.4337/9781035345946.00011>.
- Sirimewan, D.C., Samaraweera, A., Manjula, N.H.C., Rameezdeen, R., Rodrigo, M.N.N., & Ekanayake, E.M.A.C. (2023). Strategies for sustainable irrigation system management: a socio-technical system approach. *Engineering, Construction and Architectural Management*, **30**(2), 436-455. DOI: <https://doi.org/10.1108/ECAM-06-2021-0521>.
- Streimikiene, D., Svagzdiene, B., Jasinskas, E., & Simanavicius, A. (2021). Sustainable tourism development and competitiveness: The systematic literature review. *Sustainable development*, **29**(1), 259-271. DOI: <https://doi.org/10.1002/sd.2133>.
- Suprpto, N., Sulyanah, S., Deta, U.A., Sya'roni, I., & Nisa', K. (2022). Glocalization of bull racing: A program for preservation kerapan sapi as madurese local wisdom. *Kawalu: Journal of Local Culture*, **9**(1), 35-52. DOI: <https://doi.org/10.32678/kawalu.v9i1.5897>.
- Suprpto, N. (2019). Demographic sources as a local wisdom: Potency of Indonesian physics education researchers in conducting survey research. *Journal of Physics: Conference Series*, **1171**(1), 012003. DOI: <https://doi.org/10.1088/1742-6596/1171/1/012003>.
- Suprpto, N. & Ku, C. H. (2016). Investigating university students' preferences to science communication skills: A case of prospective science teacher in Indonesia. *International Education Studies*, **9**(8), 19-27. DOI: <https://doi.org/10.5539/ies.v9n8p19>.
- Tabachnick, B.G. & Fidell, L.S. (2018). *Using Multivariate Statistics (7th ed.)*. London: Pearson.
- Thamrin, H. (2020). Educational aspects in efforts to realize SDGs in Indonesia. *Journal of Advances in Education and Philosophy*, **4**(11), 473-477. DOI: <https://doi.org/10.36348/jaep.2020.v04i11.007>.
- Watkins, M.W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, **44**(3), 219-246. DOI: <https://doi.org/10.1177/0095798418771807>.
- Zaki, I., Zusak, M.B.F., Mi'raj, D.A., & Hasib, F.F. (2022). Islamic community-based business cooperation and sustainable development goals: A case of pesantren community in Indonesia. *International Journal of Ethics and Systems*, **38**(4), 621-632. DOI: <https://doi.org/10.1108/IJOES-12-2021-0218>.