Proceedings of the 6th International Conference on Future of Education, Vol. 6, 2023, pp. 133-151

ISSN 2630-7413 online
DOI: https://doi.org/10.17501/26307413.2023.6111

DEVELOPMENT OF MODULES BASED ON LOCAL NATURAL RESOURCES IN MALUKU IN PROJECT BASED LAERNING (PJBL) TO INCREASE CHEMICAL LITERACY AND ENTREPRENURIAL INTEREST OF CLASS XII HIGH SCHOOL STUDENTS ON MACROMOLECULAR MATERIALS

Salelatu V* and Rohaeti E

Department of Chemistry Education, Faculty of Mathematics and Natural Sciences, Yogyakarta State University, Indonesia

Abstract: The availability of teaching materials that pay attention to local natural resources integrated into project-based learning is rarely found when chemistry learning occurs in the classroom. This research aims to develop learning modules and assess the impact of the module on chemical literacy and the entrepreneurial interest of students. This research adopts the 10-step development model by Borg and Gall 10 steps. The data collection instruments in this study are feasibility sheets, practicality sheets, student readability sheets, questions on chemical literacy skills, and entrepreneurial interest questionnaires. This study is a quasi-experimental research with a pretest-posttest one-group design. The total sample was 131 students of class XII high school science which was chosen using the cluster random sampling method. The Manova test was used to analyze differences in chemical literacy and entrepreneurial interest of learners in experimental and control classes. The results of this study show that: (1) The distribution of students' chemical literacy skills in the very high category in the experimental class was 35.48% while the control class was 21.87%. The level of entrepreneurial interest of students in the category was very high in the experimental class at 67.74% and the control class at 21.87%, (2) the percentage of effective contribution of the module to chemical literacy and entrepreneurial interest is 47%, chemical literacy is 12.4%, entrepreneurial interest is 43.8%; (3) The practicality test of the module by five chemistry teachers showed a very practical category with a percentage of 84.5%. (4) The module readability test by students obtained a percentage of 91.26% in the very good category. Thus, modules that have been developed can increase students' chemical literacy and entrepreneurial interest.

Keywords: Entreprenurial interest, Chemical literacy, Module development, Project-Based Learning, Borg and Gall

Introduction

Indonesia is known as an archipelagic country that has abundant natural resources. (Agung et al., 2022). In addition, Indonesia consists of various regions with a cluster of very beautiful islands. Maluku Province, including the eastern part of Indonesia also known as the province of the sea-island which is famous for its abundant natural wealth in both the fisheries and agricultural sectors (Ruhulessin, 2021).

*Corresponding Author's Email: *viviansalelatu.2021@student.uny.ac.id*

The diversity of natural resources in Maluku has the uniqueness to be developed into teaching materials on macromolecular materials (Masihu & Agustyn, 2021). However, the natural potential that is owned has not been developed much in chemistry learning at school. By utilizing the various potentials that exist in the surrounding environment, of course, students not only understand teaching materials theoretically but also are more applicable and care more about the surrounding environment (Jumriani et al., 2021). According to Ramly et al (2022), chemistry learning that pays attention to local natural products is one of the things that need to be considered in curriculum development in Indonesia, especially in the chemistry curriculum at the secondary school level (Imansari & Sumarni, 2018). Based on the results of the questionnaire given to teachers, it was found that the teaching materials that were often used only contained a summary of the subject matter and some practice questions in it. The teaching materials used have not been widely associated with natural resources which is closely related to the daily life of students, so students are less encouraged to produce chemical products from local natural resources. The lack of teaching materials that pay attention to local natural resources in macromolecular material makes students less enthusiastic to learn and leads to low chemical literacy (Undeogalanva, 2022).

Chemical literacy is one of the important elements that must be developed in education. The importance of chemical literacy, in general, is to improve the quality of life, where the knowledge gained can be used to overcome the problems of the general public (Kohen et al., 2020). One indicator of the lack of actualization of the article is the lack of scientific literacy, including chemical literacy. In Indonesia, a study on PISA (Programme for International Student Assessment) in 2018 shows that Indonesian students' science literacy level is still low. The results of the 2018 PISA survey put Indonesia in 74th place, which is ranked sixth from the bottom. The reading ability of Indonesian students, with a score of 371, is in position 74. the ability of science, with a score of 396, is in position 71 (OECD, 2018). Indonesian students' low chemical literacy ability is influenced by several things, including the curriculum and education system, teacher selection of learning methods and models, learning facilities, learning resources, and teaching materials (Muntholib et al., 2020). The problem of low chemical literacy can be helped by providing relevant teaching materials to students. (Luthfianah & Hidayah, 2022).

Another important skill that needs to be developed in learning at school is an interest in entrepreneurship (Jena, 2020). Entrepreneurship has become a subject that must be included in vocational high schools (SMK), as well as in several Senior High Schools (SMA) (Lestari et al., 2022). This shows how important it is to instill an entrepreneurial spirit in students as early as possible. (Sang & Lin, 2019). According to data from the Central Statistics Agency of Indonesia in 2022, the open unemployment rate as of August 2022 for public high school graduates is still the highest rank compared to the level of education at universities, which is 8.57%, while at universities the unemployment rate reaches 4.80% (BPS, 2022). In Maluku Province, the open unemployment rate reached 6.44% as of February 2022, with the distribution of public high school education levels reaching 10.31%, Diploma I/II/III reaching 6.75%, vocational schools reaching 8.44%, junior high schools 1.82% and elementary schools 1.83%. The next highest open unemployment rate is found in vocational universities and high Schools. In other words, there is an excess labor supply, especially at the equivalent high school and university education levels. One of the efforts to reduce the number of open unemployment rates among high school graduates is to teach entrepreneurship education to students (Putro et al., 2022). Humans who have an entrepreneurial spirit are someone whose personality has been instilled entrepreneurial values (Listiningrum et al., 2020). Entrepreneurial values include creativity, innovation, exploration, critical thinking, hard work, discipline, daring to take risks, independence, communication skills, and work ethic. (Siska et al., 2023). All entrepreneurial values can be taught through entrepreneurial education that seeks to form quality students who can create jobs for themselves or provide jobs for others, not just as job seekers. (Iwu et al., 2021).

Based on interviews that have been conducted with chemistry teachers, it shows that chemistry learning in the classroom has not been widely associated with entrepreneurial activities because several factors become obstacles in the application of entrepreneurship education, namely the lack of budget and time allocation that is too short so that entrepreneurship education is not delivered optimally. Macromolecular material is a very strategic material to hone students' entrepreneurial interests because one indicator in learning requires students to create a chemistry project as an impact of macromolecular learning. However, based on the results of interviews with class XII students, most students are considered boring material because they are only limited to learning the theory (Lestari & Guspanti, 2023). When referring to the high school chemistry curriculum for macromolecular materials, one indicator requires students to create a chemistry project. However, teachers rarely implement these indicators during chemistry learning in class. These indicators can allow students to produce a project and hone students entrepreneurial interests through chemistry learning. (Pardede, 2023). By incorporating entrepreneurial values in chemistry, it is hoped that students can feel the benefits directly from the chemistry learning they do at school (Dewi & Mashami, 2019).

Several related studies have been widely conducted. Yoo et al. (2020) research shows that developing project-based learning modules can strengthen students' competency in community practice areas. Research by Haatanien & Aksela (2021), states that project-based learning has a good influence on understanding concepts and developing skills of teachers and students in schools. Research conducted by Hidayah et al. (2020) found that project-based learning can foster students' entreprenrial onterest. The results of research conducted by Marjana et al. (2021) concluded that The application of project-based modules can improve students' scientific literacy. Based on the problem description above, the author is interested in researching and developing modules based on local natural resources in Maluku in project-based learning on class XII High School Science Macromolecule material. This study aims to determine the feasibility, practicality, and influence of macromolecular modules based on local natural resources in Maluku in project-based learning (PjBL) on chemical literacy and entrepreneurial interests of Class XII high school students

Materials and Methods

The type of research used is R&D (Research & Development). This research model uses Borg and Gall development, including ten steps consisting of (1) research and information collecting, (2) planning, (3) developing the preliminary form of the product, (4) preliminary field testing, (5) primary product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, and (10) dissemination and implementation. The study subjects consisted of 1) instrument validators, namely expert validators known as material experts and media experts; 2) chemistry teachers; 3) students of class XII of high school science. Data collection techniques in this study are validation analysis and product practicality questionnaires. The instruments used in this study were material validation sheets, media validation sheets, student response questionnaires and teacher response questionnaires, entrepreneurial interest questionnaires, and chemical literacy questions. To apply the module of development results in schools in this study using cluster random sampling techniques using quasi-experimental research methods with a pretest-posttest research design in one group, there were 32 students XII IPA1 in the control class and 31 students XII IPA3 in the experimental class. This research was conducted at SMA Negeri 12 Ambon, Maluku, Indonesia.

Validity Analysis

Expert validation data is examined by considering validator inputs, comments, and suggestions. The analysis's findings serve as a guide for updating the created modules. The validation sheet's measuring scale employs a 5 (five). A formula is used to calculate the validation results' average score, which is calculated by dividing the total score by the number of aspects evaluated. (Sujana, 2016)

$$\bar{X} = \frac{\sum Xi}{n}$$

$\bar{X}$ = Average validation score

$\sum Xi$ = The overall validation result score

n = The number of aspects evaluated

In addition, Arsyad (2016) provides an interpretation of the average score in the validation category, which can be found in Table below:

Table 1. Product Category Validity

Interval Score	Criteria
$4.10 < \bar{X} \leq 5.00$	Very Valid
$3.10 < \bar{X} \leq 4.10$	Valid
$2.10 < \bar{X} \leq 3.10$	Valid Enough
$\bar{X} < 2.10$	Invalid

Teacher and student analysis of the response

Based on the findings of surveys that teachers and students had completed, responses to the generated instructional materials were examined. A rating score measurement scale with a maximum value of 5 (five) was employed in this study. The following formula is then used to process the questionnaire's data.

$$\text{Practicality Value} = \frac{\text{Total obtained score}}{\text{Maximum score}} \times 100\%$$

The acquisition results are transformed to the following Table 2 once the proportion of the product's usefulness is determined:

Table 2. Practicality Value Criteria

Percentage	Category
0-20%	Impractical
21-40%	Less practical
41-60%	Quite Practical
61-80%	Practical
81-100%	Very Practical

Chemical Literacy Analysis of Students

A pretest measures the increase in students' chemical literacy before students learn using chemistry modules based on local natural resources, and posttest is measured after students learn using the modules developed. Chemical literacy research on cognitive aspects of students was measured using the Normality Gain test according to the formula (Sugiyono, 2010):

$$\text{N Gain} = \frac{Score\ Postetst - Score\ pretest}{Score\ Ideal - Score\ Pretest}$$

Table 3. N-Gain Score Criteria

Score g	Criteria
$g > 0{,}7$	High
$0{,}3 \leq g \leq 0{,}7$	Medium
$g < 0{,}3$	Low

Analysis of Student Entrepreneurial Interest

After learning in each class, students will fill out an entrepreneurial interest questionnaire. In this study, a rating score measurement scale was used on a scale of 5 (five). Data from the questionnaire is then processed to calculate the percentage of interest in each indicator using a formula (Purwanto, 2010) as follows:

$$\text{Answer Percentage} = \frac{\textit{Average Interest Score}}{\textit{Number of statement items}} \times 100\%$$

Furthermore, the results obtained are categorized as follows Table 4. Categorization of Entrepreneurial Interests

Table 4. Categorization of entrepreneurial interests

Percentage	Category
86-100%	Very high
76-85%	High
60-75%	Enough
55-59%	Low
<54%	Very Low

Results and Discussion

The development of chemistry modules based on local natural resources of Maluku in project-based learning of grade XII students on macromolecular materials has been developed. Development of learning modules using the Borg and Gall development model. The chemistry module developed is designed in the A4 size module format (21 x 29.7 cm).

Content validation results

Validation by content experts focuses on the module's content that is evaluated by specialists in the field of chemistry. Assessments given in accordance with the National Education Standards Board (BNSP). The following (Table 5) lists the findings of the review of the macromolecular material composition in the chemistry module.

Table 5. Results of material expert validation

Assessment aspect	Average Score	Category
Content Feasibility	4.33	Very Valid
Linguistic Feasibility	4.75	Very Valid
Presentation Feasibility	4.66	Very Valid

Graphics Feasibility	4.25	Very Valid
Average	4.49	Very Valid

Table 5 reveals that subject-matter experts' evaluation findings (validation) had an average total score of 4.49 or were classified as highly valid criteria. Content received an average score of 4.33 for eligibility; 4.75 for linguistics; 4.25 for presentation feasibility; 4.25 for graphics; and 4.50 for overall impression. Based on the evaluation results by material expert validators, the project-based learning on macromolecular materials in the chemistry module of class XII pupils based on local natural resources in Maluku was determined to be highly valid. The suggestion for module improvement from content experts is to add practice questions.

Learning Media Expert Validation Results

Learning design experts test the product's feasibility in delivering learning through modules. The findings of validation by professionals in learning design are shown in Table 6 based on National Education Standards Board (BNSP)

Table 6. Media expert validation results

Assessment aspect	Average Score	Category
Content Feasibility	4.83	Very Valid
Linguistic Feasibility	4.66	Very Valid
Presentation Feasibility	4.75	Very Valid
Graphics Feasibility	4.50	Very Valid
Average	4.68	Very Valid

According to Table 6, the evaluation findings conducted by media experts (validation) received an overall average score of 4.68, which indicates that these criteria are considered highly valid. The recommendation made by media professionals for enhancing the module is to pay attention to the neatness of the paragraphs. Therefore, based on the research conducted by the two expert validators, it was determined that the chemistry module for macromolecular materials based on local natural resources in Maluku in project-based learning of students in grade XII is feasible for development trials on target users, specifically students and teachers. This conclusion was reached due to the research findings conducted by the two expert validators.

Teacher Assessment Results

After getting an assessment from material and media experts, researchers make revisions based on the advice provided by validators. Furthermore, a development trial was conducted on chemistry teachers to analyze teacher responses to chemistry modules based on local natural resources in Maluku in project-based learning of grade XII students on the macromolecular material developed. The number of teachers who were the subjects of the study was five chemistry teachers consisting of one teacher from YPKPM Ambon Christian Senior High School (Teacher 1), one teacher from SMAN 12 Ambon (Teacher 2); one teacher from Pertiwi Ambon Senior High School (Teacher 3); one teacher from SMAN 4 Amahai (Teacher 4); one Teacher from SMAN 1 Seram Barat (Teacher 5).

No	Aspect	Average Score	Maximum Score	Percentage	Category
1.	Module	8.2	10	82%	Very Practical
2.	Matter	25.2	30	85%	Very Practical
3.	Presentation	17	20	85%	Very Practical
4.	Language	26	30	86%	Very Practical
Total Average Score		76.4	90	84.5%	Very Practical

Table 7. Practicality test by chemistry teachers

Table 7 shows that the outcomes of development trials conducted on five class XII chemistry teachers were incredibly realistic achievement qualifications with a percentage of 84.5%. According to the teacher's evaluation results, the chemistry module for students in grade XII that focuses on macromolecular material and uses local natural resources in Maluku generates a very practical average. Suggestions from teachers include adding local natural products from Maluku that are relevant to macromolecular materials.

Small Group Trial Results

After the teacher gives an assessment, the researcher revised according to the advice given by the teacher. The next step is to conduct a small group test for nine students at SMAN 6 Ambon. Module assessment indicators include aspects of module functions and benefits for students, material aspects, module presentation, and language aspects. Small respondents examined the assessment of development products through hard copy and soft copy modules. The following are the findings from the small group trial data analysis (Table 8):

Table 8. Small group trials result

Respondent	1	2	3	4	5	6	7	8	9
Total Score	112	113	113	114	108	114	114	115	110
Percentage %	93.3	94.1	94.1	95	90	95	95	96	91.6
Maximum Score	120								
Average	93.6%								

The development results from the module's small group testing analysis revealed an average percentage of 93.6%, falling under the very practical category.

Field Trial Results

In the field test stage, the module was piloted involving 54 students from class XII science students at Ambon. The data from field trials are shown in the following (Table 9):

Table 9. Readability test results by students

No	Aspect	Average Score	Maximum Score	Percentage	Category
1.	Function and benefit of Module	22.5	25	88 %	Very Good
2.	Material	32.28	35	92,2%	Very Good
3.	Presentation	26.9	30	89,6%	Very Good
4.	Language	27.84	30	92,8%	Very Good
Total Average Score		109.52	120	91.26	Very Good

Table 9 demonstrates that the average percentage of student assessment questionnaires for modules in field trials is 91.26%, indicating that modules are highly practical qualifications

Application of Development Module

The module application uses a post-test-only control group design research design. This research was carried out at SMAN 12 Ambon consisting of class XII IPA1 as a control for 32 students and class XII IPA3 as an experiment for 31 students. The Manova test is used to see the difference in the learning of students who use who do not use local natural resource-based modules in project-based learning on macromolecular materials. The results of the manova test for this hypothesis can be seen in the following table 10

Table 10. Manova test results

	Effect	Value	F	Hypothesis df	Sig	Partial Eta Square
In	Pillai's Trace	0.997	8698.433b	2.000	0.000	0.997
Te	Wilks's Lambda	0.003	8698.433b	2.000	0.000	0.997
Rc	Hotteling's Trace	289.948	8698.433b	2.000	0.000	0.997
Ep	Roy's Largest Root	269.948	8698.433b	2.000	0.000	0.997
T						
C	Pillai's Trace	0.470	26.622b	2.000	0.000	0.470
L	Wilks's Lambda	0.530	26.622b	2.000	0.000	0.470

H0: There is no difference between chemical literacy and entrepreneurial interest in control classes and experimental classes

H1: There is a difference between chemical literacy and entrepreneurial interest in control classes and experimental classes

Based on the results of the manova test in Table 10, a significance value of 0.000 is obtained. The significance value of the manova test results is smaller than the significance level of 0.05 (0.000<0.05) and the Hotelling trace value of 0.887. this shows that H_0 is rejected and H_1 is accepted, assuming that there are simultaneous differences in the literacy skills and entrepreneurial interests of students who use and those who do not use local natural resource-based modules in project-based learning on macromolecular materials. The difference in chemical literacy skills and entrepreneurial interests obtained shows that learning using local natural resource-based modules in project-based learning on macromolecular material influences students' chemical literacy and entrepreneurial interests The magnitude of the influence given by learning using local natural resource-based modules in project-based learning on macromolecular material with the value shown by the partial eta square is 0.470, so it can be concluded that learning using local natural resource-based modules in project-based learning on macromolecular material has a significant influence on chemical literacy and entrepreneurial interest of students by 47%.

Student Chemical Literacy Results

Based on the second hypothesis test aims to determine whether or not there are differences in chemical literacy of students who use and those who do not use local natural resource-based modules in project-based learning on macromolecular materials. The results of the univariate test of students' chemical literacy ability can be seen in the following table.

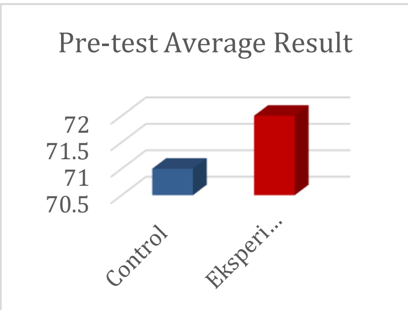
Table 11. Chemical literacy test results

Variabel	df	Mean Square	F	Sig.	Eta Square
Chemical Literacy	1	245.093	8.659	0.005	0.124

H0: There is no difference between chemical literacy in control classes and experimental classes

H1: There is a difference between chemical literacy in control classes and experimental classes

Based on the test results in table 11, a significance value is obtained, which is 0.005. The significance value of the results of this hypothesis test is smaller than the significance level of 0.05 (0.005<0.05). This shows that H_0 was rejected and H_1 was accepted with the analysis results that there were simultaneous differences in the chemical literacy ability of students who used and those who did not use local natural resource-based modules in project-based learning on macromolecular material. Before learning begins, students in the control and experimental classes will be given a pretest to measure students initial understanding before receiving macromolecular material. Based on the pretest results of the experimental class, an average score of 72.17 was obtained, while the pretest results in the control class obtained an average value of 70.97. The average value of the experimental and control classes, that is, the average value of the experimental class is greater than the average value of the control class, as shown in the following figure 1 below:



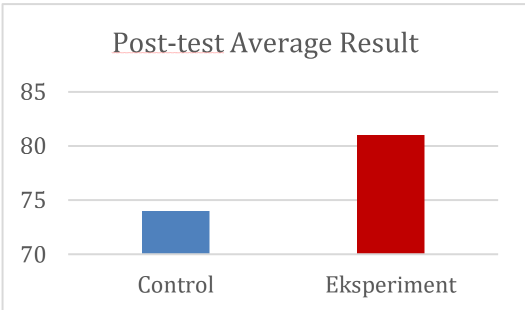
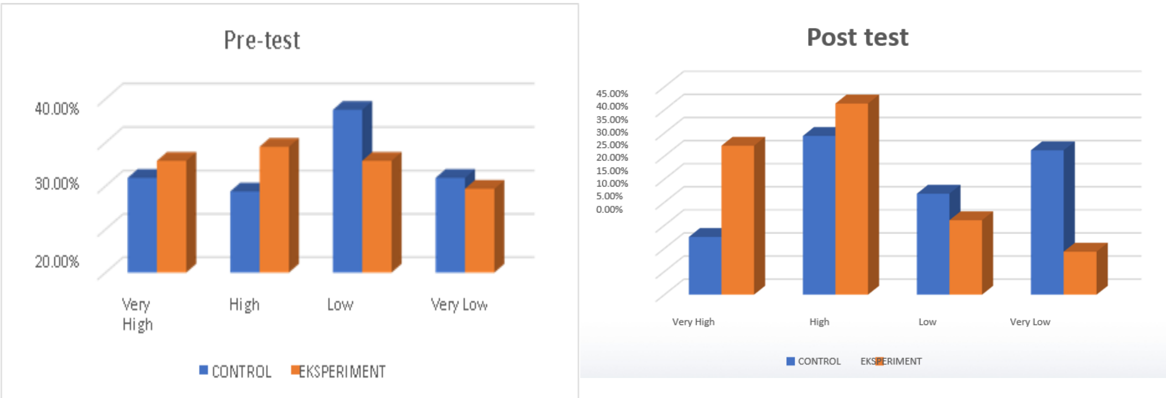


Figure 1. *Results of Pre-Test and Posttest Scores in Control Class and Experimental Class*

Result on chemical literacy skills were obtained from the post-test at the end of learning. Based on the analysis of the N-gain test, the results showed an overall increase in student learning outcomes between the pretest and post-test, namely differences in student test results before and after the implementation of learning. In the control class, students' pretest results got an average score of 70.97, and post-test scores got an average of 73.93. The N-Gain value obtained was 0.11, so the average pretest and posttest scores increased in a low category. While in the experimental class, the pretest results students got an average score of 72.17, and the post-test score got an average score of 80.94. The N-Gain value obtained at 0.31 means that the average pretest and post-test score increase is in the medium category.



Figue 2. *Distribution of chemical literacy categories of students*

Based on Figure 12, it can be seen that the percentage of distribution of chemical literacy ability of the control class is very low 31.5%, low category 21.87%, high category 34.37%, and very high category 12.50%. Meanwhile, the most significant percentage was dominated by experimental classes for chemical literacy in the high category of 41.3% and the very high category of 32.25%. The difference in chemical literacy skills shows that learning using local natural resource-based module modules in project-based learning on macromolecular material influences students' chemical literacy abilities. The magnitude of the influence exerted by learning using local natural resource-based module modules in project-based learning on macromolecular material with a value indicated by a partial eta square, which is 0.124. This value shows a high category, or it can be concluded that learning using local natural resource-based modules in project-based learning on macromolecular material greatly influences chemical literacy ability by 12.4%. The application of modules based on local natural resources in project learning is considered capable of increasing the chemical literacy of students. This is supported by relevant research conducted by (Anggraini & Wulandari, 2021). It was concluded that the project-based learning model could influence increasing student activeness in learning. Another study conducted (Nuraini et al., 2021) states that the project-based learning model can improving student learning outcomes in ecosystem materials with an N-Gain of 0.76. In line with this (Yulianti et al., 2019) explained the research results that using teaching materials in learning could improve the results of students' chemical literacy and help students learn motivation.

Results of Entrepreneurial Interest

The results of the univariate test of entrepreneurial interest of students can be seen in the following table 12 below.

Table 12. Entrepreneurial interest results

Variable	Mean Square	F	Sig.	Eta Square
Entrepreneurial Interest	1669.973	47.565	0.000	0.438

H0: There is no difference between entrepreneurial interest in control classes and experimental classes

H1: There is a difference between entrepreneurial interest in control classes and experimental classes.

Interest in entrepreneurship is a desire in a person to meet the needs of life, advance the business, produce and create a business. The students' entrepreneurial interest results are based on 6 indicators of entrepreneurial interest: self-confidence, task and result-oriented, risk-taking courage, leadership, future-oriented, and originality. Table 13 shows the outcomes of students' entrepreneurial interest in experimental and control classrooms for each factor.

Table 13. Results of entrepreneurial interest in each indicator

Indicators of Entrepreneurial Interest	Eksperiment class		Control class	
	Average Score	% Interest	Average Score	% Interest
Confidence	14,03	93,53%	11,28	75,2%
Task and result-oriented)	14,12	94,13%	11,53	76.86%
Risk-taking courage)	13,70	91,33%	11,24	74,99%
Leadership	14,06	93,73%	11,71	78,12%
Future-oriented	9,74	64,06%	7,19	47,93%
Originality	4,70	31,33%	3,81	25, 4%

The overall calculation of the average score of student entrepreneurial interest, which includes all indicators of entrepreneurial interest in the experimental class and control class, can be seen in the following table.

Table 14. Entrepreneurial interest in experiment and control class

Class	Average Score	Percentage	Category
Eksperiment	70,35	78,16%	High
Control	56,76	63,06%	Low

The calculation of the students' entrepreneurial interest questionnaire score following the learning process yielded an average score of 70.35, with a percentage of 78.16% in the experimental class. In the control group, the average score was 56.76, with a percentage of 63.06%. Students taught using project-based macromolecular modules are more interested in entrepreneurship than students not using project-based macromolecular modules

Based on the hypothesis test results in table 33, a significance value of 0.000 was obtained. The significance value of the results of this hypothesis test is smaller than the significance level of 0.05 (0.000<0.05). This shows that H_0 is rejected and H_1 is accepted, assuming that there is a difference in the level of entrepreneurial interest of students who use and those who do not use local natural resource-based modules in project-based learning on macromolecular materials.

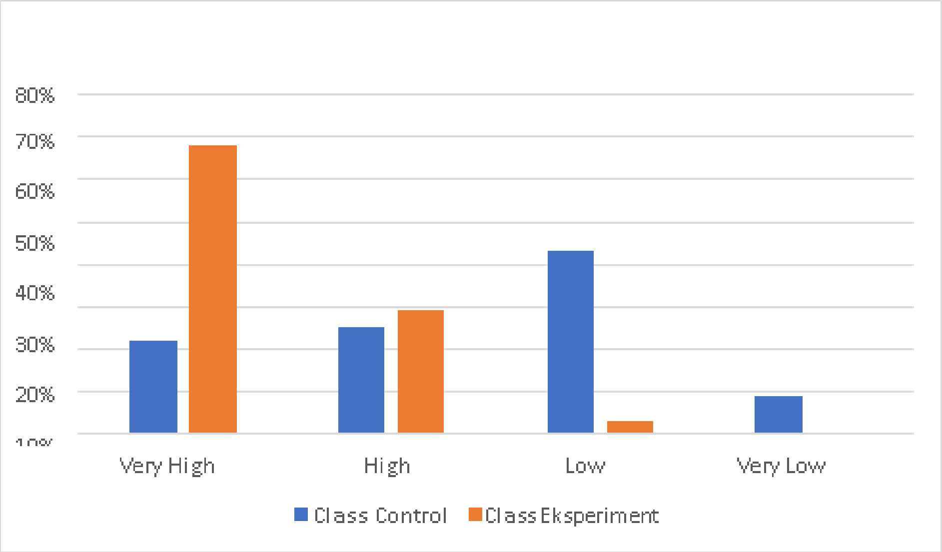


Figure 3. *Distribution of entrepreneurial interest of students*

Based on Figure 3, it can be seen that the percentage of distribution of entrepreneurial interest of students in the control class in the very low category is 9%, the low category is 43%, the high category is 25%, and the very high category is 22%. Meanwhile, the experimental class dominated the most significant percentage for achieving entrepreneurial interest in the high category at 68%, the high category at 28%, and the low category at 3%. The difference in entrepreneurial interest obtained shows that learning using local natural resource-based modules in project-based learning on macromolecular material influences students' entrepreneurial interest. The magnitude of the influence given by learning using local natural resource-based modules in project-based learning with the value shown by partial eta square. 0,438. This value shows a very high category, or it can be concluded that learning using local natural resource-based modules in project-based learning on macromolecular material influences entrepreneurial interest by 43.8%. It can be explained that the level of entrepreneurial interest of students based on the distribution in the control class and experimental class, the significance value of students with very high scores in the experimental class (67.42%) is better than the highest score in the control class (21.87%). This is relevant to research conducted by (Haq, 2022) that project-based learning can present abilities such as increasing interest in learning, entrepreneurial interest, entrepreneurial nature, understanding and learning outcomes, entrepreneurial understanding, leadership ability, risk-taking courage, problem-solving ability, increasing activeness, confidence, and increasing enthusiasm. Project-based learning can foster an entrepreneurial spirit, and the desire for entrepreneurship, and achieving entrepreneurial learning outcomes for students (Farida et al., 2017). In line with this statement, Abelenda et al. (2023) stated that applying the project-based learning model can develop students' entrepreneurial attitudes and motivation.

Conclusion

Based on the results that have been described, it can be concluded that the percentage of effective contribution of project-based modules in macromolecular learning to students' chemical literacy skills and entrepreneurial interests amounted to 47%, respectively, by 12.4% and 43.8%. The distribution of students' chemical literacy skills in the very high category in the experimental class was 35.48%, while the control class was 21.87%. The distribution of students' entrepreneurial interest in the very high category in the experimental class was 67.74%, while in the control class, it was 21.87%. Thus, modules that have been developed can increase students' chemical literacy and entrepreneurial interest.

Acknowledgements

The writer would like to thank LPDP, Indonesia Endowment Funds for Education for paying attention to supporting this research.

Declaration of Interest Statement

The authors declare that they have no conflict of interests.

References

Abelenda, A. M., Aiouache, F., & Moreno-Mediavilla, D. (2023). Adapted business model canvas template and primary market research for project-based learning on management of slurry. *Environmental Technology & Innovation*, *30*, 103106. https://doi.org/10.1016/j.eti.2023.103106

Agung, M. F., Adhuri, D. S., Ferse, S. C., Sualia, I., Andradi-Brown, D. A., Campbell, S. J., & Ahmadia, G. N. (2022). Marine conservation beyond MPAs: Towards the recognition of other effective area-based conservation measures (OECMs) in Indonesia. *Marine Policy*, *137*, 104939. https://doi.org/10.1016/j.marpol.2021.104939

Anggraini, P. D., & Wulandari, S. S. (2021). Analisis penggunaan model pembelajaran project based learning dalam peningkatan keaktifan siswa. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, *9*(2), 292-299. https://doi.org/10.26740/jpap.v9n2.p292-299

Arsyad, N. (2016). Model pengembangan pembelajaran menumbuhkembangkan kemampuan metakognitif. Makassar: Pustaka Refleksi

Badan Pusat statistik Indonesia,"*Tingkat Pengangguran Terbuka Berdasarkan Tingkat Pendidikan, 2022.*

Badan Pusat statistik Provinsi Maluku, "*Tingkat Pengangguran Terbuka Berdasarkan Tingkat Pendidikan, 2022.*

Dewi, C. A., & Mashami, R. A. (2019). The effect of chemo-entrepreneurship oriented inquiry module on improving students' creative thinking ability. *Journal of Turkish science education*, *16*(2), 253-263. https://doi.org/10.12973/tused.10279a

8. Farida, E et.al. 2017. Pengembangan Model Pembelajaran Kewirausahaan Berbasis Proyek untuk Menumbuhkan Semangat Wirausaha Mahasiswa Prodi Pendidikan Ekonomi IKIP PGRI Bojonegoro. JPEK. Vol 1(1). Hal : 8-13.

Haq, S. (2022). Model Pembelajaran Berbasis Proyek dalam ranah Kewirausahaan *CIVED*, *9*(2), 184-192. https://doi.org/10.24036/cived.v9i2.117804

Haatainen, O., & Aksela, M. (2021). Project-Based Learning in Integrated Science Education: Active Teachers' Perceptions and Practices. *LUMAT: International Journal on Math, Science and Technology Education*, *9*(1), 149-173. https://doi.org/10.31129/LUMAT.9.1.1392

Hidayah, H. N. (2020). Precondition Model for Field Work Practices Based on Project-Based Learning to Improve Vocational School Stundentsâ€™ Competence and Readiness in Entrepreneurship, Fashion Design Expertise Program. *Journal of Vocational and Career Education*, *5*(2). https://doi.org/10.15294/jvce.v5i2.29366

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. https://doi.org/10.1016/j.ijme.2019.03.007

Imansari, M., & Sumarni, W. (2018). Analisis Literasi Kimia Peserta Didik Melalui Pembelajaran Inkuiri Terbimbing Bermuatan Etnosains. Jurnal Inovasi Pendidikan Kimia, Volume 12, Nomor 2, Halaman 13-18. https://doi.org/10.15294/jipk.v12i2.15480

Jena, R. K. (2020). Measuring the impact of business management Student's attitude towards entrepreneurship education on entrepreneurial intention: A case study. *Computers in Human Behavior*, *107*, 106275. https://doi.org/10.1016/j.chb.2020.106275

Jumriani, J., Mutiani, M., Putra, M. A. H., Syaharuddin, S., & Abbas, E. W. (2021). The urgency of local wisdom content in social studies learning: Literature review. *The Innovation of Social Studies Journal*, *2*(2), 103-109. https://doi.org/10.20527/iis.v2i2.3076

Kohen, Z., Herscovitz, O., & Dori, Y. J. (2020). How to promote chemical literacy? On-line question posing and communicating with scientists. *Chemistry Education Research and Practice*, *21*(1), 250-266. https://doi.org/10.1039/C9RP00134D

Lestari, H., Hamidah, H., & Rahmawati, I. (2022). Gaya Kepemimpinan Entrepreneurship Kepala Sekolah terhadap Mutu Lulusan. *Jurnal Dirosah Islamiyah*, *4*(3), 413-421.191.

Lestari, M., & Guspatni, G. (2023). Validity of powerpoint-ispring learning media on carbohydrate materials in high school. *Jurnal Pijar Mipa*, *18*(2), 170-175. https://doi.org/10.29303/jpm.v18i2.4635

Listiningrum, H. D., Wisetsri, W., & Boussanlegue, T. C. H. A. B. L. E. (2020). Principal's entrepreneurship competence in improving teacher's entrepreneurial skill in high schools. *Journal of Social Work and Science Education*, *1*(1), 87-95 https://doi.org/10.52690/jswse.v1i1.20

Luthfiana, A. D., & Hidayah, R. (2022). E-Module of Chemistry Practicum Based on Cooperative Learning on Salt Hydrolysis Material to Improve Students' Scientific Literacy. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *10*(1), 36-47. https://doi.org/10.33394/j-ps.v10i1.4763

Masihu, J. M., & Augustyn, S. (2021). Pengembangan Bahan Ajar Ekosistem Berbasis Potensi Lokal Di Maluku:(Development of Local Potential-Based Ecosystem Teaching Materials in Maluku). *BIODIK*, *7*(3), 133-143. https://doi.org/10.22437/bio.v7i3.13250

Muntholib, M., Ibnu, S., Rahayu, S., Fajaroh, F., Kusairi, S., & Kuswandi, B. (2020). Chemical literacy: Performance of first year chemistry students on chemical kinetics. *Indonesian Journal of Chemistry*, *20*(2), 468-482. https://doi.org/10.22146/ijc.43651

Marjanah, M., Pandia, E., & Nursamsu, N. (2021). Development of Practicum Instruction Module Based on Project Based Learning (PjBL) Integrated with Science Process Skills and Scientific Literacy. *Jurnal Penelitian Pendidikan IPA*, *7*(SpecialIssue), 104-111. https://doi.org/10.29303/jppipa.v7iSpecialIssue.874

Nuraini, N., Asri, I. H., & Fajri, N. (2023). Development of Project Based Learning with STEAM Approach Model Integrated Science Literacy in Improving Student Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *9*(4), 1632-1640. https://doi.org/10.29303/jppipa.v9i4.2987

OECD. 2018. PISA Result in Focus. Paris: PISA-OECD Publishing

Putro, H. P. N., Rusmaniah, R., Mutiani, M., Jumriani, J., & Subiyakto, B. (2022). The relevance of social capital in efforts to develop entrepreneurship education. *Journal of Education and Learning (EduLearn)*, *16*(3), 412-417. https://doi.org/10.11591/edulearn.v16i3.20384

Pardede, E. (2023). Pengembangan Kewirausahaan Mahasiswa di Pendidikan Teknologi Kimia Industri (PTKI) Medan. *Jurnal Agroindustri, Agribisnis, dan Agroteknologi*, *2*(1), 1-6.

Purwanto, Ngalim. (2010). Prinsip-prinsip dan Teknik Evaluasi Pengajaran. Bandung: PT Remaja Rosdakarya.

Ramly, S. N. F., Ahmad, N. J., & Said, H. M. (2022). The development of innovation and chemical entrepreneurship module for pre-university students: An analysis phase of ADDIE model. *Journal of Natural Science and Integration*, *5*(1), 96-116. http://dx.doi.org/10.24014/jnsi.v4i2.11445

Ruhulessin, J. C. (2021). Social Capital of Victim Community in The Context of Land And Forest Acquisition Policy In Maluku Sea-Island Province. *Turkish Journal of Field Crops*, *26*(2), 8-21. https://doi.org/10.17557/tjfc.834532

Sang, D., & Lin, J. (2019). How does entrepreneurial education influence the entrepreneurial intention of college students: The moderating and mediating effects of entrepreneurial alertness. *International Journal of Emerging Technologies in Learning (Online)*, *14*(8), 139.

Siska, F., Supriatna, N., & Ratmaningsih, N. (2023, May). Exploration of Entrepreneurship Character in Minangkabau Livestock Toke as a Source for Social Studies Learning for Junior High School. In *4th International Conference on Progressive Education 2022 (ICOPE 2022)* (pp. 299-307). Atlantis Press. https://doi.org/10.2991/978-2-38476-060-2_28

Sudjana, N. (2016). Penilaian hasil proses belajar mengajar. Bandung: Remaja Rosdakarya Offset.

Sugiyono. (2010). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. CV Alfabeta.

Udeogalanya, V. (2022). Aligning digital literacy and student academic success: Lessons learned from COVID-19 pandemic. *International Journal of Higher Education Management*, *8*(2).

Yoo, S. H., Bae, S. M., Shin, B. M., & Shin, S. J. (2020). The effect of project-based learning modules on a community dental hygiene practicum in South Korea. *Journal of Dental Education*, *84*(4), 418-428. https://doi.org/10.1002/jdd.12047

Yulianti, R. N. E., Permanasari, A., & Heliawati, L. (2019). Pemanfaatan E-Book Konsep Asam Basa Dalam Pembelajaran Kimia Untuk Meningkatkan Literasi Kimia Siswa SMA Kelas XI. *JSEP (Journal of Science Education and Practice)*, *3*(1), 33-41. https://doi.org/10.33751/jsep.v3i1.1378

Appendix

1. Manova test results

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.997	8698.433[b]	2.000	60.000	.000	.997
	Wilks' Lambda	.003	8698.433[b]	2.000	60.000	.000	.997
	Hotelling's Trace	289.948	8698.433[b]	2.000	60.000	.000	.997
	Roy's Largest Root	289.948	8698.433[b]	2.000	60.000	.000	.997
kelas	Pillai's Trace	.470	26.622[b]	2.000	60.000	.000	.470
	Wilks' Lambda	.530	26.622[b]	2.000	60.000	.000	.470
	Hotelling's Trace	.887	26.622[b]	2.000	60.000	.000	.470
	Roy's Largest Root	.887	26.622[b]	2.000	60.000	.000	.470

a. Design: Intercept + kelas

b. Exact statistic

2. Test of Between-Subject Effect

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Literasi_Kimia	245.093[a]	1	245.093	8.659	.005	.124
	Minat_Kewirausahaan	1669.973[b]	1	1669.973	47.565	.000	.438
Intercept	Literasi_Kimia	335890.983	1	335890.983	11866.688	.000	.995
	Minat_Kewirausahaan	237441.402	1	237441.402	6762.888	.000	.991
kelas	Literasi_Kimia	245.093	1	245.093	8.659	.005	.124
	Minat_Kewirausahaan	1669.973	1	1669.973	47.565	.000	.438
Error	Literasi_Kimia	1726.627	61	28.305			
	Minat_Kewirausahaan	2141.677	61	35.109			
Total	Literasi_Kimia	337659.302	63				
	Minat_Kewirausahaan	240681.000	63				
Corrected Total	Literasi_Kimia	1971.721	62				
	Minat_Kewirausahaan	3811.651	62				

a. R Squared = ,124 (Adjusted R Squared = ,110)

b. R Squared = ,438 (Adjusted R Squared = ,429)